



ADDENDUM

Public Building Commission of Chicago | Richard J. Daley Center | 50 West Washington Street, Room 200 | Chicago, Illinois 60602 | (312) 744-3090 | pbcchicago.com

ADDENDUM NO.: 01
PROJECT NAME: Emergency Medical Services (EMS) Addition
PROJECT NO.: 07215
CONTRACT NO.: C1611
DATE OF ISSUE: July 12, 2024

NOTICE OF CHANGES, MODIFICATIONS, OR CLARIFICATIONS TO CONTRACT DOCUMENTS

The following changes, modifications, or clarifications are hereby incorporated and made an integral part of the Contract Documents. Unless clearly expressed otherwise by this Addendum, all terms and conditions defined in the original Contract Documents shall continue in full force and effect and shall have the same meaning in this Addendum. Issued Addenda represent responses/clarifications to various inquiries. Contractors shall be responsible for including all associated labor/material costs in its bid. Drawings/specifications corresponding to inquiry responses will be issued with the Issue for Construction Documents, upon issuance of building permit.

ITEM NO. 1: CHANGE TO KEY DATES

Change 1 Pre-Award Meeting Date and Location are **REVISED** to **Thursday, August 8, 2024**, at 11:00a.m. via Microsoft Teams (invitation to follow).

ITEM NO. 2: REVISIONS TO BOOK 1 – PBC INSTRUCTIONS TO BIDDERS

Change 1 **Book 1 – DELETE** Section II(A)(3) and **REPLACE** with the following:

Construction Budget for Base Work Only: \$26,500,000.00 to \$27,000,000.00 (EXCLUDING Allowances and Commission's Contract Contingency Funds).

Change 2 **Book 1 – DELETE** Section III(J)(3) and **REPLACE** with the following:

*Community Hiring Requirement. At least **15%** of the project labor must be performed by "Project Community Residents" as defined in Section II.A.6 and included on the "Project Community Area Map" in Exhibit #3. The aggregate hours of Work to be performed by the Contractor and Subcontractors under this Contract may be complied through residents who are trade or non-trade workers. These positions may include but are not limited to trade workers, field engineer, superintendent, project manager, security, data entry clerks, schedulers, traffic monitoring personnel, and site administrative support staff. In order to comply with the Community Hiring requirement, the Contractor must hold a minimum of (2) application intake sessions in the designated Project Community as depicted on Exhibit (3) and compile an applicant database.*

ITEM NO. 3: REVISIONS TO BOOK 2 – PBC STANDARD TERMS AND CONDITIONS

None.

ITEM NO. 4: REVISIONS TO BOOK 3 – TECHNICAL SPECIFICATIONS

Change 1 **Book 3 – Volume 1 – REVISED** – Table of Contents Specification Section 00 01 02

Change 2 **Book 3 – Volume 1 – REVISED** – Specification Section 01 10 00 – Summary: Revised lines 1.9C and 1.10F. Removed line 1.12N.

Change 3 **Book 3 – Volume 1 – REVISED** – Specification Section 01 50 10 – Commission Representative Field Office: Removed Book 1 and Book 2 samples.

Change 4 **Book 3 – Volume 1 – REVISED** – Moved Division 05-22 Specification Sections from Volume 2 into Volume 1.

Change 5 **Book 3 – Volume 2 – REVISED** - Moved Division 05-22 Specification Sections from Volume 2 into Volume 1.

Change 6 **Book 3 – Volume 2 – ADDED** – Specification Section 32 31 00 – Ornamental Metal Fencing.

Change 7 **Book 3 – Volume 2 – ADDED** – Specification Section 32 31 11 – Gate Operators.

ITEM NO. 5: REVISIONS TO DRAWINGS

- Change 1** **REVISED** Drawing No. G001
 - a. Updated index to reflect new and deleted drawings.
- Change 2** **REVISED** Drawing Nos. C010, C100, C200, C300, C500
 - a. Added plan note to identify area of work for new gate system.
- Change 3** **ADDED** Drawing Nos. C012, C102, C202, C302, C503, C909
- Change 4** **REVISED** Drawing No. L200
 - a. Included an additional tree species in plant schedule to note the replacement tree on sheet L301
- Change 5** **ADDED** Drawing Nos. L301, L302, L303, and L304
 - a. Added a layout for the new gate system, and relevant detail sheets
- Change 6** **REVISED** Drawing No. S101
 - a. Removed the north door and concrete stoop from the guard house.
- Change 7** **REVISED** Drawing No. S105
 - a. Added a partial plan for the retaining wall foundation near the Chicago Ave Gate. Plan in progress.
- Change 8** **REVISED** Drawing No. S404
 - a. Added a detail for the retaining wall near the Chicago Ave gate showing reinforcement and other information. Detail in progress.
- Change 9** **REVISED** Drawing Nos. A101, A121, A151, A403, A801
 - a. Revised layout and storage equipment for Weapons Storage Room. Removed exterior door.
- Change 10** **REVISED** Drawing No. A202
 - a. Removed reference to canopy work.
- Change 11** **REVISED** Drawing No. A320, A321, A322
 - a. Wall Sections: Revised Exterior Wall Type 4 (WT-4) note.
- Change 12** **REVISED** Drawing No. A680
 - a. Removed exterior door.
- Change 13** **REVISED** Drawing No. E002
 - a. Updated keynotes.
- Change 14** **REVISED** Drawing No. TS101
 - a. Updated plan to include scope for new gate system.

ITEM NO. 6: REQUESTS FOR INFORMATION

None.

This Addendum No. 1 and all attachments below can be found at the following Link:

[PBC Emergency Medical Services \(EMS\) Addition C1611](#) by clicking on: Addendum No. 1

This Addendum includes the following attached Specifications and/or Documents:

1. Book 3 – Volume 1 Technical Specifications
2. Book 3 – Volume 2 Technical Specifications

This Addendum includes the following attached Drawings:

1. G001 – ABBREVIATIONS, LEGENDS, & SHEET INDEX, dated 07/12/2024
2. C010 – OVERALL EXISTING CONDITIONS PLAN, dated 7/12/2024
3. C012 – EXISTING CONDITIONS, dated 7/12/2024
4. C100 – OVERALL DEMOLITION PLAN, dated 7/12/2024
5. C102 – DEMOLITION PLAN, dated 7/12/2024
6. C200 – OVERALL SITE PLAN, dated 7/12/2024
7. C202 – SITE PLAN, dated 7/12/2024
8. C300 – OVERALL GRADING PLAN, dated 7/12/2024
9. C302 – GRADING PLAN, dated 7/12/2024

10. C500 – OVERALL SOIL EROSION AND SEDIMENT CONTROL PLAN, dated 7/12/2024
11. C503 – SOIL EROSION AND SEDIMENT CONTROL PLAN, dated 7/12/2024
12. C909 – DETAILS, dated 7/12/2024
13. L200 – SITE DETAILS, dated 07/12/2024
14. L301 – SLIDING GATE PLAN, dated 07/12/2024
15. L302 – SLIDING GATE REQUIREMENTS, dated 07/12/2024
16. L303 – SLIDING GATE DETAILS, dated 07/12/2024
17. L304 – PEDESTRIAN GATE DETAILS, dated 07/12/2024
18. S101 – SECOND FLOOR FOUNDATION PLAN, dated 07/12/2024
19. S105 – PARTIAL PLANS, dated 07/12/2024
20. S404 – SECTIONS & DETAILS, dated 07/12/2024
21. A101 – SECOND FLOOR – REFERENCE FLOOR PLAN, dated 07/12/2024
22. A121 – SECOND FLOOR – CONSTRUCTION FLOOR PLAN, dated 07/12/2024
23. A151 – SECOND FLOOR – CEILING PLAN, dated 07/12/2024
24. A202 – EXTERIOR ELEVATIONS, dated 07/12/2024
25. A403 – ENLARGED FLOOR PLANS & ELEVATIONS, dated 07/12/2024
26. A680 – DOOR & CASED OPENING SCHEDULES, dated 07/12/2024
27. A801 – SECOND FLOOR – INTERIOR FINISHES PLAN, dated 07/12/2024
28. A320, A321, A322 – WALL SECTIONS, dated 07/12/2024
29. E002 – CAMPUS SITE PLAN, dated 07/12/2024
30. TS101 – TECHNOLOGY SITE PLAN, dated 07/12/2024

END OF ADDENDUM NO. 01

PUBLIC BUILDING COMMISSION OF CHICAGO

**BOOK 3 – VOLUME 1
TECHNICAL SPECIFICATIONS**

CONTRACT NO. C1611

**EMERGENCY MEDICAL SERVICES (EMS) ADDITION
701 N. KILBOURN AVENUE
CHICAGO, ILLINOIS 60651**

**NEW BUILDING ADDITION
PBC PROJECT #07215**

PUBLIC BUILDING COMMISSION OF CHICAGO



Mayor Brandon Johnson
Chairman

Ray Giderof
Acting Executive Director

Room 200
Richard J. Daley Center
50 West Washington Street
Chicago, Illinois 60602
312-744-3090
www.pbcchicago.com

ISSUED FOR BID ON JUNE 26, 2024

By
AECOM Services of Illinois, Inc.
303 E. Wacker Drive, Suite 1400
Chicago, IL 60601
312-373-7700

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 01	PROJECT MANUAL COVER PAGE	06/26/24
00 01 02	TABLE OF CONTENTS	07/12/24
00 01 11	SUPPLEMENTAL PROJECT INFORMATION.....	06/26/24

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	SUMMARY OF WORK.....	07/12/24
01 22 00	UNIT PRICES	06/26/24
01 23 00	ALTERNATES.....	06/26/24
01 25 00	SUBSTITUTION PROCEDURES	06/26/24
01 25 00.01	SUBSTITUTION REQUEST FORM	06/26/24
01 26 00	CONTRACT MODIFICATION PROCEDURES.....	06/26/24
01 26 13	REQUESTS FOR INTERPRETATION	06/26/24
01 29 00	PAYMENT PROCEDURES	06/26/24
01 31 00	PROJECT MANAGEMENT AND COORDINATION	06/26/24
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION	06/26/24
01 32 16	CONSTRUCTION PROJECT SCHEDULE.....	06/26/24
01 32 33	PHOTOGRAPHIC DOCUMENTATION	06/26/24
01 33 00	SUBMITTAL PROCEDURES	06/26/24
01 40 00	QUALITY REQUIREMENTS	06/26/24
01 42 20	REFERENCES.....	06/26/24
01 50 00	TEMPORARY FACILITIES AND CONTROLS.....	06/26/24
01 50 10	COMMISSION REPRESENTATIVE FIELD OFFICE	06/26/24
01 56 11	GENERAL DUST, FUME AND ODOR CONTROL	06/26/24
01 56 39	TEMPORARY TREE AND PLANT PROTECTION	06/26/24
01 57 13	LEED TEMPORARY EROSION AND SEDIMENT CONTROL	06/26/24
01 60 00	PRODUCT REQUIREMENTS	06/26/24
01 73 00	EXECUTION	06/26/24
01 73 29	CUTTING AND PATCHING.....	06/26/24
01 74 19	LEED CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	06/26/24
01 77 00	CLOSEOUT PROCEDURES.....	06/26/24
01 78 23	OPERATION AND MAINTENANCE DATA.....	06/26/24
01 78 39	PROJECT RECORD DOCUMENTS	06/26/24
01 79 00	DEMONSTRATION AND TRAINING.....	06/26/24
01 81 13	LEED SUSTAINABLE DESIGN REQUIREMENTS	06/26/24
01 81 13A	LEED PROJECT CHECKLIST	06/26/24
01 81 13B	LEED MATERIALS.....	06/26/24
01 91 13	GENERAL COMMISSIONING REQUIREMENTS.....	06/26/24

DIVISION 02 - EXISTING CONDITIONS

02 41 19	SELECTIVE DEMOLITION.....	06/26/24
----------	---------------------------	----------

DIVISION 03 – CONCRETE

03 30 00	CAST-IN-PLACE CONCRETE	06/26/24
----------	------------------------------	----------

DIVISION 04 - MASONRY

04 22 00	CONCRETE UNIT MASONRY	06/26/24
----------	-----------------------------	----------

DIVISION 05 – METALS

05 12 00	STRUCTURAL STEEL FRAMING.....	06/26/24
05 31 00	STEEL DECK.....	06/26/24
05 40 00	COLD FORMED METAL FRAMING.....	06/26/24
05 50 00	METAL FABRICATIONS.....	06/26/24
05 51 00	MODULAR ROOFTOP STAIRS.....	06/26/24
05 51 13	METAL PAN STAIRS.....	06/26/24
05 52 13	PIPE AND TUBE RAILINGS.....	06/26/24

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 53	MISCELLANEOUS ROUGH CARPENTRY.....	06/26/24
06 16 00	SHEATHING.....	06/26/24
06 41 16	PLASTIC LAMINATE-CLAD ARCHITECTURAL CABINETS.....	06/26/24

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 05 43	RAIN SCREEN ATTACHMENT SYSTEMS.....	06/26/24
07 11 13	BITUMINOUS DAMPPROOFING.....	06/26/24
07 21 00	THERMAL INSULATION.....	06/26/24
07 21 19	FOAMED-IN-PLACE INSULATION.....	06/26/24
07 21 29	ACOUSTIC SPRAY ON SYSTEM.....	06/26/24
07 27 15	SELF-ADHERING WATER-RESISTIVE AIR BARRIER MEMBRANE.....	06/26/24
07 42 13.13	FORMED METAL WALL PANELS.....	06/26/24
07 54 23	THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING.....	06/26/24
07 60 00	SHEET METAL FLASHING AND TRIM.....	06/26/24
07 72 00	ROOF ACCESSORIES.....	06/26/24
07 81 00	APPLIED FIRE PROTECTION.....	06/26/24
07 84 13	PENTRATION FIRESTOPPING.....	06/26/24
07 84 43	JOINT FIRESTOPPING.....	06/26/24
07 92 00	JOINT SEALANTS.....	06/26/24
07 92 19	ACOUSTICAL JOINT SEALANT.....	06/26/24
07 95 13.16	EXPANSION JOINT COVER ASSEMBLIES.....	06/26/24

DIVISION 08 - OPENINGS

08 11 13	HOLLOW METAL DOORS AND FRAMES.....	06/26/24
08 14 16	FLUSH WOOD DOORS.....	06/26/24
08 31 13	ACCESS DOOR AND FRAMES.....	06/26/24
08 33 23	OVERHEAD COILING DOORS.....	06/26/24
08 41 13	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.....	06/26/24
08 44 13	GLAZED ALUMINIUM CURTAIN WALLS.....	06/26/24
08 71 00	DOOR HARDWARE.....	06/26/24
08 80 00	GLAZING.....	06/26/24
08 91 19	FIXED LOUVERS.....	06/26/24

DIVISION 09 - FINISHES

09 21 16.23	GYPNUM BOARD SHAFT WALL ASSEMBLIES.....	06/26/24
09 22 16	NON-STRUCTURAL METAL FRAMING.....	06/26/24
09 29 00	GYPNUM BOARD.....	06/26/24
09 30 13	CERAMIC TILING.....	06/26/24
09 65 13	RESILIENT BASE AND ACCESSORIES.....	06/26/24
09 67 23	RESINOUS FLOORING.....	06/26/24
09 68 13	TILE CARPETING.....	06/26/24

09 91 23 INTERIOR PAINTING 06/26/24
09 96 11 HIGH-PERFORMANCE COATINGS 06/26/24
09 96 53 SILICONE ELASTOMERIC COATINGS..... 06/26/24

DIVISION 10 – SPECIALTIES

10 14 23.16 ROOM IDENTIFICATION PANEL SIGNAGE 06/26/24
10 21 13.17 PHENOLIC-CORE TOILET COMPARTMENTS 06/26/24
10 22 39 FOLDING PANEL PARTITIONS 06/26/24
10 26 00 WALL AND DOOR PROTECTION 06/26/24
10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES 06/26/24
10 44 16 FIRE EXTINGUISHERS 06/26/24
10 51 13 METAL LOCKERS 06/26/24

DIVISION 12 - FURNISHINGS

12 24 13 ROLLER WINDOW SHADES 06/26/24
12 36 61.16 SOLID SURFACING COUNTERTOPS..... 06/26/24
12 50 00 FURNITURE PACKAGE 06/26/24

DIVISION 13 - SPECIAL CONSTRUCTION

NOT APPLICABLE 06/26/24

DIVISION 14 - CONVEYING EQUIPMENT

14 21 23.16 MACHINE ROOMLESS ELECTRIC TRACTION PASSENGER ELEVATOR 06/26/24

Facility Services Subgroup

DIVISION 21 - FIRE SUPPRESSION

21 05 17 SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING 06/26/24
21 05 23 GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING 06/26/24
21 05 53 IDENTIFICATION FOR FIRE SUPPRESSION PIPING 06/26/24
21 11 00 FACILITY FIRE SUPPRESSION WATER SERVICE PIPING 06/26/24
21 13 13 WET-PIPE SPRINKLER SYSTEMS 06/26/24

DIVISION 22 – PLUMBING

22 05 01 COMMON WORK RESULTS FOR PLUMBING 06/26/24
22 05 07 EXCAVATION AND BACKFILL 06/26/24
22 05 13 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT 06/26/24
22 05 19 METERS AND GAUGES FOR PLUMBING PIPING 06/26/24
22 05 23 GENERAL-DUTY VALVES FOR PLUMBING PIPING..... 06/26/24
22 05 29 HANGERS AND SUPPORTS FOR PLUMBING AND PIPING EQUIPMENT 06/26/24
22 05 48 VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT 06/26/24
22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT 06/26/24
22 05 61 PREPERATION OF PLUMBING SYSTEMS 06/26/24
22 05 93 PLUMBING SYSTEMS TESTING, ADJUSTING, AND BALANCING 06/26/24
22 07 00 PLUMBING PIPING INSULATION 06/26/24
22 08 00 COMMISSIONING FOR PLUMBING 06/26/24
22 11 16 DOMESTIC WATER PIPING 06/26/24
22 13 16 BUILDING SANITARY STORM DRAINAGE 06/26/24
22 13 31 ELEVATOR SUMP PUMP 06/26/24
22 20 00 FACITILY NATURAL GAS SYSTEM 06/26/24
22 33 00 DOMESTIC WATER HEATERS 06/26/24

22 40 00 PLUMBING FIXTURES 06/26/24

DIVISION 23 – MECHANICAL

23 05 00 GENERAL MECHANICAL REQUIREMENTS 06/26/24
 23 05 14 VARIABLE FREQUENCY DRIVES 06/26/24
 23 05 19 METERS AND GUAGES FOR HVAC PIPING..... 06/26/24
 23 05 23 GENERAL–DUTY VALVES FOR HVAC PIPING..... 06/26/24
 23 05 29 HANGERS, SLEEVES, AND SUPPORTS..... 06/26/24
 23 05 48 VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT 06/26/24
 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT 06/26/24
 23 05 93 MECHANICAL SYSTEMS TESTING, ADJUSTING, AND BALANCING 06/26/24
 23 07 00 HVAC INSULATION 06/26/24
 23 08 00 COMMISSIONING FOR HVAC 06/26/24
 23 09 00 CONTROLS AND INSTRUMENTATION 06/26/24
 23 21 13 HYDRONIC PIPING 06/26/24
 23 21 23 HYDRONIC PUMPS..... 06/26/24
 23 23 00 REFRIGERANT PIPING..... 06/26/24
 23 25 00 HVAC WATER TREATMENT 06/26/24
 23 30 00 DUCTWORK AND ACCESORIES..... 06/26/24
 23 34 00 EXHAUST AND VENTILATING FANS 06/26/24
 23 36 16 TERMINAL BOXES – DDC CONTROL 06/26/24
 23 52 16 CONDENSING BOILERS..... 06/26/24
 23 64 26.13 AIR COOLED ROTARY SCREW WATER CHILLER 06/26/24
 23 73 43.19 OUTDOOR CUSTOM AIR HANDLING UNIT 06/26/24
 23 81 26 SPLIT SYSTEM AIR CONDITIONERS..... 06/26/24
 23 82 36 FINNED TUBE RADIATION HEATERS..... 06/26/24
 23 82 39.13 CABINET UNIT HEATERS 06/26/24

DIVISION 24 - RESERVED

NOT APPLICABLE 06/26/24

DIVISION 25 - INTEGRATED AUTOMATION

NOT APPLICABLE 06/26/24

DIVISION 26 - ELECTRICAL

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES ... 06/26/24
 26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES 06/26/24
 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 29 HANGERS AND SUPPORT FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS..... 06/26/24
 26 05 44 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING 06/26/24
 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 73.13 SHORT-CIRCUIT STUDIES..... 06/26/24
 26 05 73.16 COORDINATION STUDIES 06/26/24
 26 05 73.19 ARC-FLASH HAZARD ANALYSIS 06/26/24
 26 08 00 COMMISSIONING FOR ELECTRICAL 06/26/24
 26 09 13 ELECTRICAL POWER MONITORING..... 06/26/24
 26 09 43 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM 06/26/24
 26 22 13 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS..... 06/26/24
 26 24 13 SWITCHBOARDS 06/26/24

26 24 16 PANELBOARDS 06/26/24
 26 27 13 ELECTRICITY METERING 06/26/24
 26 27 26 WIRING DEVICES 06/26/24
 26 28 13 FUSES 06/26/24
 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS 06/26/24
 26 29 13.03 MANUEL AND MAGNETIC MOTOR CONTROLLERS 06/26/24
 26 33 23.11 CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING 06/26/24
 26 51 19 LED INTERIOR LIGHTING 06/26/24
 26 52 13 EMERGENCY AND EXIT LIGHTING 06/26/24

DIVISION 27 - COMMUNICATIONS

27 00 01 COMMON WORK RESULTS FOR COMMUNICATIONS 06/26/24
 27 00 02 QUALITY ASSURANCE FOR COMMUNICATIONS 06/26/24
 27 00 03 OWNER'S STANDARDS DOCUMENT 06/26/24
 27 01 00 OPERATION AND MAINTENANCE OF COMMUNICATIONS 06/26/24
 27 05 01 BASIC MATERIALS & METHODS 06/26/24
 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS 06/26/24
 27 05 28 PATHWAYS FOR COMMUNICATIONS 06/26/24
 27 05 36 CABLE TRAYS FOR COMMUNICATIONS 06/26/24
 27 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS... 06/26/24
 27 05 50 FIRESTOPPING FOR COMMUNICATIONS 06/26/24
 27 05 53 IDENTIFICATION FOR COMMUNICATIONS 06/26/24
 27 08 10 VERIFICATION TESTING OF STRUCTURED CABLING 06/26/24
 27 11 10 WALL LININGS FOR COMMUNICATION ROOMS 06/26/24
 27 11 16 CABINETS, RACKS, FRAMES AND ENCLOSURES 06/26/24
 27 11 23 CABLE MANAGEMENT AND LADDER RACK 06/26/24
 27 11 26 RACK MOUNTED POWER PROTECTION AND POWER STRIPS 06/26/24
 27 13 13 COPPER BACKBONE CABLING 06/26/24
 27 13 23 FIBER OPTIC BACKBONE CABLING 06/26/24
 27 15 13 COPPER HORIZONTAL CABLING 06/26/24
 27 15 43 FACEPLATES AND CONNECTORS 06/26/24
 27 41 00 AUDIO AND VIDEO SYSTEMS 06/26/24
 27 41 01 AUDIO AND VIDEO SYSTEMS CABLING 06/26/24
 27 41 03 AUDIO AND VIDEO SYSTEMS SOFTWARE DEVELOPMENT 06/26/24

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 00 01 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY 06/26/24
 28 00 02 QUALITY ASSURANCE FOR ELECTRONIC SAFETY AND SECURITY 06/26/24
 28 00 03 OWNER 06/26/24
 28 01 00 OPERATION AND MAINTENANCE OF COMMUNICATIONS 06/26/24
 28 05 01 BASIC MATERIALS 06/26/24
 28 13 01 SECURITY ACCESS CONTROL SYSTEM 06/26/24
 28 13 02 SIMULATION TRAINING VIDEO RECORDING SYSTEM 06/26/24
 28 31 11 MULTIPLEX FIRE ALARM SYSTEM 06/26/24
 28 55 00 ENTRANCE SECURITY INTERCOM 06/26/24

Site and Infrastructure Subgroup

DIVISION 30 - RESERVED

NOT APPLICABLE 06/26/24

DIVISION 31 - EARTHWORK

31 10 00 SITE CLEARING 06/26/24
31 13 00 LANDSCAPE REMOVAL PRUNING 06/26/24
31 22 00 GRADING 06/26/24
31 23 16 EXCAVATION 06/26/24
31 23 17 EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES 06/26/24
31 23 18.13 SOIL, FILL, BACKFILL, CU STRUCTURAL SOIL AND CONSTRUCTION AND
DEMOLITION DEBRIS REMOVAL 06/26/24
31 23 18.14 CCDD AND UNCONTAMINATED SOIL DISPOSAL 06/26/24
31 23 23.01 FILL 06/26/24
31 23 23.25 ACCEPTANCE OF BACKFILL, TOPSOIL, CU STRUCTURAL SOIL 06/26/24
31 63 29 DRILLED CONCRETE SHAFTS 06/26/24

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING 06/26/24
32 13 13 CONCRETE PAVING 06/26/24
32 31 00 ORNAMENTAL METAL FENCING 07/12/24
32 31 11 GATE OPERATORS 07/12/24
32 31 20 METAL FENCE SCREENING 06/26/24
32 92 01 SOD AND SEED 06/26/24
32 93 11 LANDSCAPE PLANTING 06/26/24

DIVISION 33 - UTILITIES

33 10 13 WATER SERVICE 06/26/24
33 41 00 SEWERAGE AND DRAINAGE 06/26/24

END OF TABLE OF CONTENTS

SECTION 00 01 11 - SUPPLEMENTAL PROJECT INFORMATION**PART 1 - GENERAL****1.01 EXISTING CONDITIONS**

- A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders and is referenced as an attachment to the Project Manual, including:
 - 1. EMS Addition Geotechnical report.
 - 2. Phase I Geophysical Survey
 - 3. Phase I Environmental Reports: Phase 1, Phase 2
 - 4. Phase I Traffic Study
- B. The Contractor is responsible for coordination of information within the Supplemental Project Information with the applicable scope of work for this Project.
- C. The Client and the Architect/Engineer of Record do not guarantee the accuracy or validity of the data, nor do they assume any responsibility for the Contractor's interpretation of the data.
- D. Verification of data and existing conditions is the Contractor's responsibilities. At Contractor's option, perform additional investigations at own expense.

1.02 CLASH COORDINATION

- A. Before the start of building construction, the contractor and subcontractors shall provide clash detection coordination with provided LOD100 Revit models utilizing clash detection software (i.e. Navisworks) to identify potential areas of conflict. General contractor to coordinate with AOR with RFIs to identify resolution to conflicts.

1.03 GEOTECHNICAL REPORT(S)

- A. The following are the geotechnical reports prepared for the project site and are as follows:
 - 1. By Flood Testing Laboratories; dated February 20, 2024; titled "Joint Public Safety Training Campus – EMS Addition Geotech Report".
 - 2. By Geo Services; dated June 27, 2019, titled "Structure Foundation Boring Log"

1.04 GEOPHYSICAL SURVEY

- A. The following are the geophysical survey prepared for the Phase I project and are as follows:
 - 1. By American Surveying & Engineering, P.C.,; titled "Geophysical Survey"

1.05 ENVIRONMENTAL REPORT(S)

- A. The following are the environmental reports prepared for the Phase I project and are as follows:
 - 1. By Amec, Foster, Wheeler; dated December 6, 2017; titled "Phase I Environmental Site Assessment"

2. By Amec, Foster, Wheeler; dated January 12, 2018; titled “Phase II Environmental Site Assessment”

1.06 TRAFFIC STUDY

- B. The following are the traffic study report prepared for the Phase I project and are as follows:
 1. By AECOM; dated June 11, 2020; titled “Joint Public Safety Training Campus (JPSTC) Traffic Impact Study”

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 00 01 11



1945 EAST 87TH STREET
CHICAGO, IL 60617-2946
o. 773.721.2200
info@floodlabs.com

20 February 2024

JOINT PUBLIC SAFETY TRAINING CAMPUS JPSTC – EMS ADDITION GEOTECH REPORT FINAL GEOTECHNICAL INVESTIGATION REPORT

Prepared for:

Ms. Jenna Joo
AECOM
303 W Wacker Drive, Suite 1400
Chicago, IL 60610

Prepared by:

Flood Testing Laboratories
1945 E 87th St., Chicago, IL

20 February 2024

Re: Preliminary Geotechnical Investigation Report
JPSTC – EMS Addition
4443 W Chicago Avenue, Chicago, IL

Ms. Joo:

Enclosed are the results of the Geotechnical Investigation performed in October 2023 at the above project site. As we understand, an addition will be constructed for the existing JPSTC building. 3 borings were performed to depths ranging from 65' to 67' below grade, and this boring information is supplemented with 3 borings done by others, previously performed on the site to depth of 50ft for the construction of the existing building. The investigation included Pressuremeter testing (PMT) and Vane Shear Testing (VST) for the design of a deep foundation system. Caisson loads were obtained from the design team and used to confirm adequate bearing and differential settlement.

Geotechnical recommendations for foundation types, depths, and construction are provided. The straight shaft and belled caissons shown on the attached Structural Drawings comply with the results of this investigation and the geotechnical aspects of the Chicago Building Code. An allowable capacity of 40,000 psf can be used for the design of deep elements bearing at an elevation of -6 ft CCD. Caissons along the existing structure shall bear at an elevation of +5 ft CCD to match the elevation of existing caisson elements for the existing structure and use an allowable capacity of 12,000 psf.

Yours Very Truly,



Walt Flood IV, M.S., P.E.
Vice President



Walter H. Flood, P.E.
Principal Engineer



with bubbled edits 25 March 2024

20 February 2024

Table of Contents

I. Location	5
II. Summary of Borings	6
III. Laboratory Testing	7
IV. Site Conditions	7
V. Soil Profile	8
VI. Expansive Soil or Fill on Site	8
VII. Ground Water	8
VIII. Foundations.....	9
Deep Foundations	9
Deep Foundations: Settlement and Group Effect	11
Uplift Capacity	11
Squeeze Analysis for Caissons	12
IX. Seismic Design.....	13
X. Slabs on Grade and Pavements.....	13
XI. Placement and Compaction of Fill material	13
XII. Potential Effect of Excavation on existing Structures and Utilities	14
XIV. General Qualifications	16
XV. References	16
Boring Logs and Profile Cut	21
Pressuremeter and Vane Shear Testing	33
Boring Location Plan	43
Borings from Others	46

20 February 2024

Table of Figures

Figure 1: Site Location	5
Figure 2: Existing Caisson elevations.....	10
Figure 3: Vane Shear of clays, in-situ.....	12
Figure 4: Shear Strength of Clays	34
Figure 5: Squeeze Analysis.....	36
Figure 6: Approximate Boring Locations	44

Table of Tables

Table 1: Summary of Boring Investigations.....	6
Table 2: Summary of Soil Profile Bearing.....	9
Table 3: Equivalent fluid pressures	15
Table 4: Vane Shear Tests.....	34
Table 5: PMT Tables.....	37

20 February 2024

I. Location

The Project is located at the property address of 4443 W Chicago Avenue in Chicago, Illinois. The site is located south of W Chicago Avenue between Kilbourn Avenue to the west, N Pulaski to the far east. As of writing this report, the immediate site is undeveloped and has much of the vegetation removed. The site will be an addition to the existing building to the north, completed in 2020.

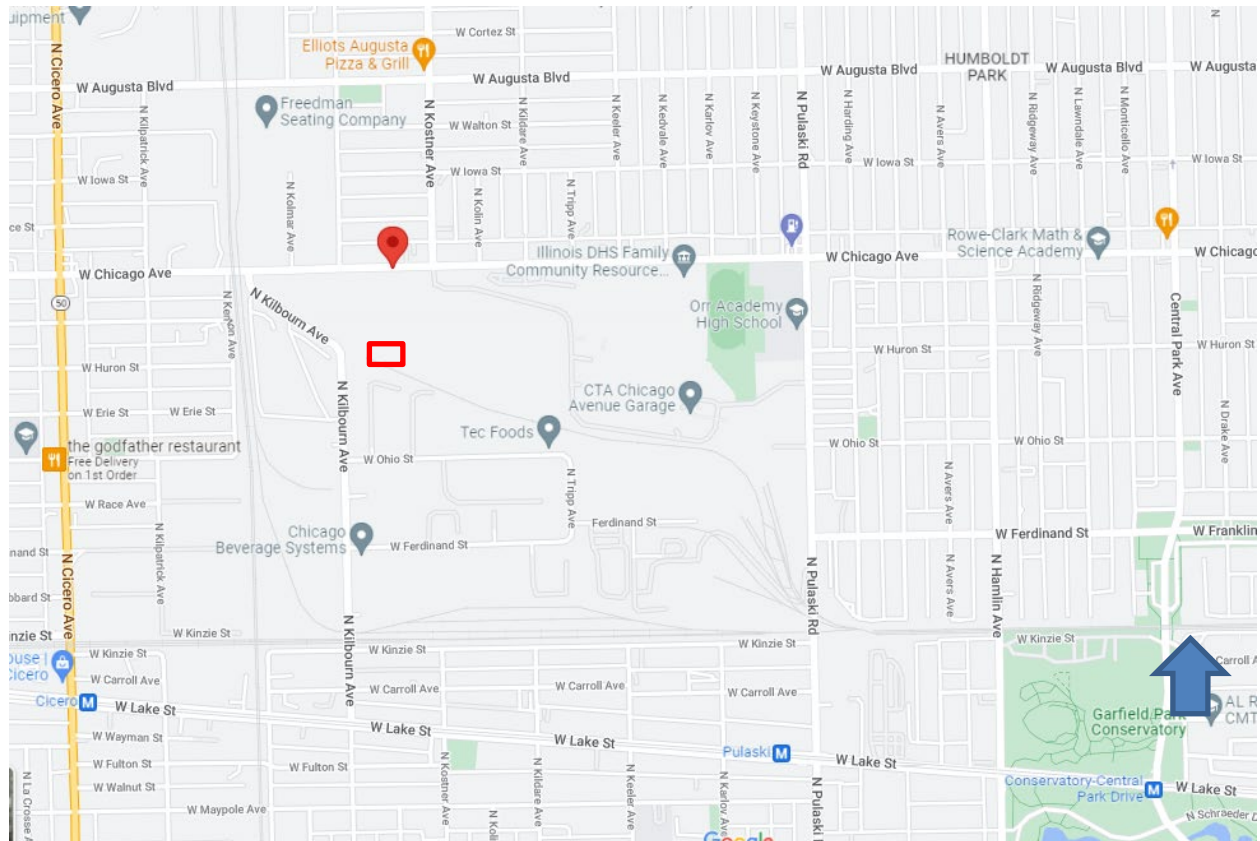


Figure 1: Site Location

20 February 2024

II. Summary of Borings

The subsurface investigation for this exploration consisted of 3 borings, performed in October 2023. Boring locations were discussed with the design team AECOM. In addition, AECOM has requested that FTL utilize 3 (three) borings from their previously performed investigation (GSI report dated 10/05/2020) in order to provide soil information to meet OUC/DOB requirements for the proposed structure improvements.

Flighted hollow stem augers were used at the surface; once sufficient embedment (approximately 10 to 15ft) into the surficial soils was accomplished, drillers switched to a rotary wash method. No investigation was performed for infiltration or the ability of the soils to meet IEPA CCDD requirements for disposal, and environmental observations are outside the scope of this investigation. Soil samples were taken by means of split spoon sampling procedures in general accordance with ASTM D-1586 specifications with an auto-hammer. Sampling was at two and one-half foot intervals for the first ten feet and every five feet thereafter. SPT N-values in this report have not been adjusted - samples were taken with autohammer equipment with a measured efficiency of 82%. A summary of the borings performed are shown in the following table.

Borings were marked out in the field with permission by the onsite contractor, Berglund Construction. Elevations are marked on the logs and boring locations are approximated in the back of the appendices in the Boring Location Plan.

Boring	Depth (ft)	Surface Elevation (CCD, ft)	Performed By	PMT Testing Performed	Date Performed
B-01	65.0	+38.6	FTL	Attempted	10/13/23
B-02	65.0	+37.6	FTL	Yes	10/12/23
B-03	67.0	+38.1	FTL	Yes	10/11/23
SB-10	30.0	+35.1	GSI	No	06/27/19
SB-11	30.0	+33.7	GSI	No	06/27/19
SB-41	30.0	+34.8	GSI	No	08/10/20

Table 1: Summary of Boring Investigations

All samples were identified and sealed in the field and returned to our laboratory for further identification and testing. During the field operation, the drilling crew maintained a log of

20 February 2024

drilling procedures and subsurface conditions including changes in soil stratigraphy and ground water levels. The boring holes were grouted after completion.

III. Laboratory Testing

The laboratory testing program consisted of hand penetrometer tests on portions of the cohesive soils recovered from the borings. Water content tests were also performed on representative portions of the material obtained. The results of all laboratory tests are indicated on the enclosed boring logs. Detailed water contents for each borehole can be found within the corresponding boring logs.

The retrieved soil samples were examined in our laboratory and classified on the basis of texture and plasticity in accordance with the Unified Soil Classification System (ASTM D2487). The soil descriptions on the boring logs are in conformance with this system and estimated group symbol according to this system is included in parenthesis following each soil description in the boring logs. Stratification lines, as indicated on the boring logs, are in some cases estimated *in-situ*. The transition between soil types may be gradual.

IV. Site Conditions

The surface elevation on the boring logs represents the existing ground surface at the time of the investigation, referenced to the topographic survey performed several weeks prior to boring operations. In general, the site was flat and level. The majority of the property consisted of demolished landscaping and granular fill. Directly to the north, a caisson-supported structure was present; however, the surrounding sites to the east are currently in development.

No evidence of other structures such as foundation walls or basement slabs were encountered within the boring areas; however, it is common to encounter previous development during construction and suspected fills were present to a depth of 8.5'. Potholing should be performed prior to foundation installation to avoid costly obstruction time during caisson installation.

20 February 2024

V. Soil Profile

A description of the soil stratigraphy findings follows, but for more detailed information, refer to the boring logs attached to this report.

The surface was generally composed of granular fill. Varying thickness of stone fills were encountered across the site to a depth of 6ft to 8.5ft. Generally, once fill materials stop, brown, medium dense silty sands were encountered to an approximate depth of 13 to 18ft, overlying gray stiff to very stiff silty clays. These stiff to very stiff clay soils generally are encountered to depth of 18ft to 28ft, where soils transitioned to harder/denser silty and clayey materials. These silty clays and/or clayey silts continue to where weathered bedrock was encountered between -64ft to -65' below grade, depending upon location on the site. It should be noted that B-1 encountered sand, gravel and rock fragments from a depth of 53.5ft to 65.0ft before encountering weathered bedrock. Further, a sand layer was identified in B-2 from a depth of 43.5 to 48.5ft below grade.

In general, the borings from the GSI investigation yielded similar results with the respective closest borings from this investigation, though those borings showed greater variability in clay and silt strata.

VI. Expansive Soil or Fill on Site

No expansive soils were identified in the geotechnical investigation.

VII. Ground Water

Ground water levels were estimated based on the soil characteristics and previous experience in the area. The borings did not encounter sustained ground water within the depth range of 15ft, before switching to mud rotary techniques. However, based on the color change of gray to brown, the long-term groundwater level is estimated at approximately 12ft to 15ft (+25ft CCD) below the surface. This generally agreed with other reports performed for the JPSTC project. This elevation aligns closely with the top of clay in two of the borings – in these and similar locations the presence of perched groundwater

20 February 2024

in the overlaying sandy soils is likely. Please note that water will move quickly through the granular natural soils and granular fills. Traditional pumping operations will likely be sufficient to maintain a dry working area for shallow excavations if no basement or deep excavations are expected for the site. For excavations deeper than +26 ft CCD, this will likely not be true and larger scale de-watering efforts will need to be considered. As always, fluctuations in ground water levels will likely occur depending on fluctuations in precipitation, evaporation, and surface run-off.

VIII. Foundations

Based on Structural Drawings dated 5 February 2024, a caisson deep foundation solution has been selected for the support of the new structure. Both belled and straight-shaft caissons are anticipated. The following table includes a summary of the general soil profile that can be used for modeling purposes; however, each of the following sections should be referenced for specifics and details. As we understand, shallow foundations are not planned to be needed or included in this project.

Elevation (CCD,ft)	Class	Description	Su (psf)	Consist/ Density	Net Allowable (psf) ¹	Lateral Bearing Pressure (psf) ²	Lateral Sliding Coeff.	Lateral Sliding Cohes. (psf)
To +30	7	Gran. Fill	NA	Medium	500	4.0 z	0.35	-
+30 to +24	4	Sand	NA	Medium	2,000	12.0 z	0.35	-
+24 to +13	5	Silty Clay	2,000	Stiff	4,000	107	-	130
+13 to +7.5	5	Silty Clay	4,500	Hard	4,000	107	-	130
+7.5 to +0	3	Hardpan	5,000	Hard	12,000	107	-	130
+0 to -27	3	Hardpan Silt	NA	V Dense	40,000	8.0 z	0.35	-

1) Considering spread footing or deep foundation for

2) Based on 3.5 diameter shaft

Table 2: Summary of Soil Profile Bearing

Deep Foundations

Deep foundations could be used to support concentrated loads. Pressuremeter testing (PMT) was performed in the hard gray clayey silts (B-02 and B-03) and attempted in the sand, gravel, and weathered rock (B-01) at elevations from 39ft to 55ft below grade in order to perform a caisson design. A summary of pressuremeter results can be found in the appendix. A caisson design was performed, and caissons may be designed with an

20 February 2024

allowable bearing capacity of 40,000 psf bearing at -6 ft CCD (42 ft below grade). Bell and shaft sizes from 3' to 15' were confirmed with this value. No evidence of water-bearing silts or unstable granular materials were encountered during drilling but input from local caisson contractors, especially those having participated in the installation of deep foundations for JPSTC Phases 1 and 2 may be helpful in considering potential constructability issues at this elevation and location.

Along lines 18.1 and 18.2, where caissons are within 15 ft of existing deep foundation structures, new elements will need to match the elevation of the existing. From as-built documents, the existing foundations were built with a bottom elevation of +4 to +5 ft CCD with a design bearing of 12,000psf. Pressuremeter tests were too deep to be used for inclusion in a bearing elevation of +5 ft CCD; because of this, allowable bearing capacity of caissons will default to the code-permitted value from Table 1806.2(2).

(E) CAISSON LOCATION	MARK	DIAMETER	BOTTOM EL
I-17.6	(E) DS48	4'-0"	76.72' = +4.32' CCD
I-17.6	(E) DS48	4'-0"	76.46' = +4.06' CCD
H-17.6	(E) DS48	4'-0"	77.48' = +5.08' CCD
G-17.6	(E) DS48	4'-0"	77.29' = +4.89' CCD
F-17.6	(E) DS48	4'-0"	76.56' = +4.16' CCD
E-17.6	(E) DS60	5'-0"	77.15' = +4.75' CCD

Figure 2: Existing Caisson elevations

It is recommended that caisson bells be inspected in order to avoid oversizing of holes; the City of Chicago requires oversizing of caisson bells by 15% to a maximum of 12" when no downhole inspection is performed. FTL would be happy to provide a proposal to perform these and other inspection and material testing services.

Minimum shaft diameters of 2.5' are recommended and caisson bells should have a base angle of at least 60 degrees from the horizontal. Caisson settlement will be limited to less than 1" total, with less than 0.5" differential settlement, though this does not include elastic shortening. Dramatically different loading may result in changes to the allowable capacity and settlement. Allowable capacities may be increased by 1/3 for transient live loads such as wind.

A horizontal modulus of subgrade reaction, k_h , can be used for lateral analysis of caissons. The moduli are representative for horizontal deflections at the top of the shaft of approximately 1/4 to 1/2 inch. Resistance in the top 3 feet of the shaft is typically ignored if the soil will be subjected to freeze-thaw cycling or changes in moisture content from

20 February 2024

weather. Additionally, a height of B (caisson diameter) is also ignored above the top of the caisson bell. For granular materials, such as the deep granular fills, the modulus values increase linearly with depth (z). Conservative values for a simplified soil profile are presented below as ksf/ft. A relationship of $67S_u/D^{0.5}$ is used for cohesive soils, and $n_h(z)/D^{0.5}$ is used for cohesionless soils.

It is recommended that temporary casing and/or permanent liners be installed for the caissons due to the granular materials as indicated in the logs; it is recommended they be embedded sufficiently into the clay soils to ensure that the granular soils will not compromise caisson integrity. In general, the clay soils were encountered near a depth of 13.5ft, with some areas deeper up to 18.5ft based on the logs. However, B-02 encountered sandy soils at a depth of 43.5ft; caissons are designed to bear several feet above this elevation, but care must be taken not to penetrate further in this area to avoid potential destabilization of the foundation bottom. Of further note, the north caissons along the existing structure will be within 5' of the existing deep foundation structure. For this reason, we require that the caissons within 15' of the existing structure utilize permanent casings to prevent squeeze of the open caisson excavation or lateral movement of the existing structures during the removal of typical temporary casings. It is also important that new caissons bear at the same elevation as neighboring caissons so that loads are not imparted onto the existing structure.

Deep Foundations: Settlement and Group Effect

In general, caissons should be spaced 3X the (larger of the closest) bell diameter in order to alleviate concerns for group effects. Several caissons unfortunately do not meet this criteria and are denoted on Structural drawing S100DS with an asterisk. Settlement of individual elements has been analyzed and results in total settlement less than 0.20". Due to the extreme stiffness of the bearing strata, the enlarged area of the caissons further decrease the settlement when analyzed as a group. Specific cases can be further explored where necessary. As mentioned above, total settlement will be kept to less than 1.0" with no more than 0.5" differential.

Uplift Capacity

As shown on Structural Drawing S201, 0 uplift capacity is needed and Uplift loading is only due to transient wind and seismic events.

20 February 2024

Squeeze Analysis for Caissons

Vane shear and potential squeeze of the clays has been considered for shaft sizes of 2.5 to 5.0 ft. The shear strength of the soils and moisture contents appear to indicate that squeeze is generally unlikely for this range in shaft diameters. Clay soils on this site are exceptionally strong, with only one in-situ vane shear test being completed; all other clays encountered were too strong to test. Squeeze is dependent upon the strength of the materials encountered, the size of the excavation, and the length of time the materials are exposed. No caisson should remain open overnight. If squeeze becomes apparent, longer casing should be pushed through the problematic zone to prevent additional squeeze and settlement of the surrounding area. It is still recommended that the first several caissons drilled should be used as test cases to observe for squeeze and evaluate with actual onsite conditions; it is possible that weaker clays may exist on the site in locations where borings were not performed. Additional squeeze can be caused by the influence of surrounding structures. In this case, as mentioned above, the caissons and the existing structure must be protected within 15' of existing caissons with permanent casing. Additional discussion on this topic is included in the "Potential effect of excavations on existing structures" section of this report.

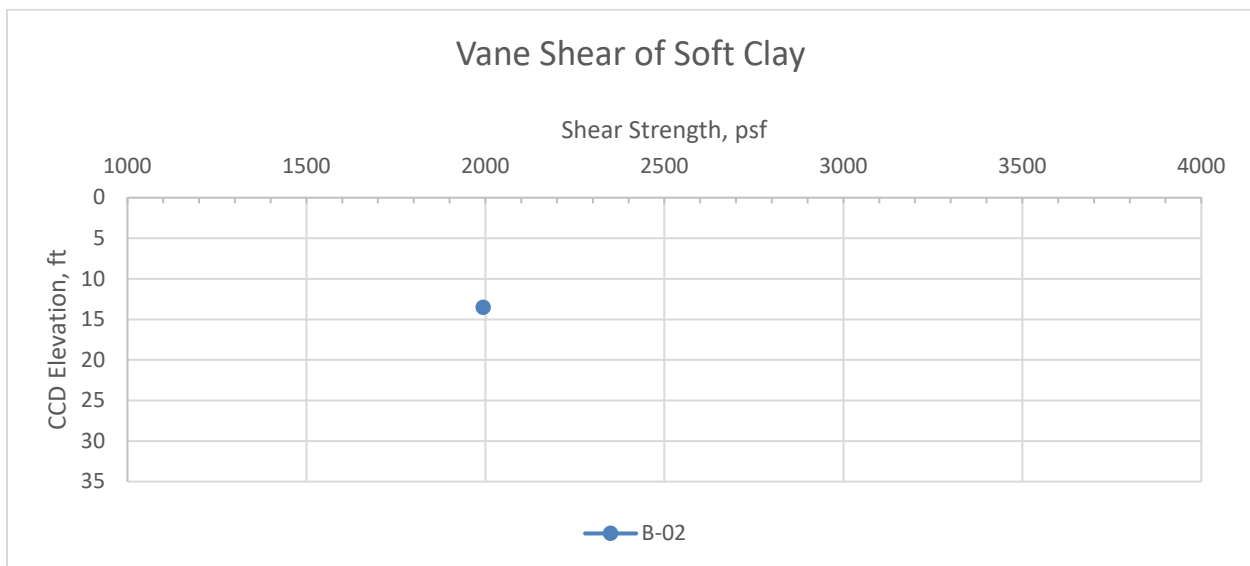


Figure 3: Vane Shear of clays, in-situ

20 February 2024

The table in the appendix shows the results of this analysis. Potential squeeze was analyzed using an empirically modified overburden pressure to s_u ratio for temporary casing from Budiman, Keifer, and Baker, 2005, ASCE Geotechnical Special Publication 132, Advances in Deep Foundations (Budiman, 2005).

IX. Seismic Design

Based on our shear strength and SPT data, the site has a Seismic Site Class of C. The proposed structure has been designed with a SDC of A. As such, a liquefaction analysis has not been completed.

X. Slabs on Grade and Pavements

The sandy silts and clays encountered are suitable for support of slabs on grade and pavement; however, organic materials and topsoil are not permitted. If encountered during excavation it must be removed and replaced with competent compacted material. The fill material is also acceptable for backfill and support of slabs, if necessary.

The subsoil should be compacted and then proofrolled using a heavy vehicle such as loaded dump truck with an axle weight exceeding 15,000 lbs. or a roller exceeding 12 tons. Soft areas or voids encountered should be removed and replaced with a granular material compacted in accordance with section XI: Placement and Compaction of Fill Material. Concrete placed onto compacted stone subgrade would utilize a friction coefficient of 0.40. Use of a vapor barrier below the slab would reduce the coefficient to 0.20.

XI. Placement and Compaction of Fill material

The on-site materials are suitable for backfill; however, it should be noted that these materials have a very narrow moisture range for acceptable compaction results. The silts will likely not be able to be used unless the material is mixed with another material. Any fill debris larger than a half brick will need to be removed or reduced in size by crushing. Any fill operations should be monitored full time by a qualified soil technician. Any organic material encountered is unsuitable and must be removed.

20 February 2024

If a granular backfill material is needed, closed-graded materials such as CA-6 may be utilized. Gap-graded materials such as CA-7 are also acceptable. However, where gap-graded fills will be in contact with sand, a layer of fabric must be used between them to prevent migration of fines into the open-graded backfill materials. Regardless of the type of material used it still must be placed and compacted in lifts. There is no such thing as “self-compacting” fill. Alternatively, to eliminate backfilling in lifts, a lean concrete fill could be used.

All fill should be placed in maximum loose lifts of 8” to 12” and compacted to a minimum 95% of ASTM D-1557 below footings, 90% below the slabs and paving, and 85% in the lawn and landscaped areas. Proper compaction of fill material can be confirmed by means of ASTM D-6938. Where thick fill areas are present, such as in historic basements, 95% compaction may be necessary in order to prevent large long-term settlements, even though a footing may not be present over the area. Proofrolling should be substituted for non-moisture sensitive gap-graded materials. Unless required otherwise in specifications or elsewhere, compaction of fill materials must be checked at least once per lift and at a rate of once per 150 ft along trenches or foundations. As always, fill materials must not be frozen and may never be placed on a frozen subgrade. Undercuts, when performed for footings, must be extended laterally 6 inches on each side for every 12 inches in depth. For example, a 12” undercut for a 48” wide footing would result in a prepared foundation area 60” in width.

XII. Potential Effect of Excavation on existing Structures and Utilities

Where the miscellaneous fill or granular material is present, excavations will likely need to be cut to a 1.5:1 slope to maintain stability for depth less than 8ft; however, under the influence of wet weather even gentler slopes may be required. For shallow excavations 4’ in depth or less, the City of Chicago allows a 1:1 cut. Good materials will degrade with exposure to weather – excavations should be open only as long as necessary to minimize impact and prevent costly, needless cutting and replacement.

Large and extensive excavations are not expected if no basement is being considered below the structure. Pressures for lateral loading of elevator pits and other subsurface

20 February 2024

structures can be determined from the following chart. Approximately ¼” of movement is required to mobilize the full active pressures, and over 2” of movement is required to mobilize the passive pressures. Because of this, full passive pressures should rarely be used in design, as they will rarely be fully mobilized. Surcharge loading would utilize the at rest pressure applied uniformly throughout the height of the structure.

Material	Equivalent Fluid pressure, pcf		
	Active (Ka)	Passive (Kp)	At Rest (Ko)
Onsite urban fills ($\gamma=120$)	40 (.36)	305 (2.77)	60 (.53)
Natural Silty Sands ($\gamma=120$)	40 (.36)	305 (2.77)	60 (.53)
Natural Clay ($\gamma=130$)	74 (.57)	225 (1.76)	95 (.72)
CA-6 Stone ($\gamma=130$)	29 (.22)	500 (3.85)	55 (.42)
CA-7 Stone ($\gamma=105$)	28 (.27)	375 (3.57)	45 (.43)
Modulus of Sub. reaction (urb. fill)	$K_s=150$ psi/inch		

Table 3: Equivalent fluid pressures

A permanent structure adjoins the site to the north and could be impacted by construction in close proximity. Caution must be exercised with excavation in this area. S100DS-F and S201 drawings dated 3/16/21 from the construction of the adjacent structure were reviewed in preparing this report. In many cases, existing caissons will be within 10ft of new structures. Open dialogue will be needed between the entire project team to best address the northern building and any possible utilities or unknown/unmarked underground structures and the optimal approach to construction based on actual site conditions. In order to most avoid detrimentally impacting the existing structures, permanent casings as discussed in the Deep Foundation section will be necessary and caisson excavation depths will need to match those of the existing structures. If suitable bearing materials are not present at that elevation, the Geotechnical Engineer of Record should be notified.

If deemed necessary, the project team may receive a Damage Monitoring Letter from the City of Chicago, possibly requiring inclinometers, settlement indicators, or vibration monitors to protect adjacent structures and utilities. If so, we would be happy to review the letter and provide a proposal to provide those services.

Design and details of any ERS must be performed by a Registered Structural Engineer in the State of Illinois. This report provides information to ease the design assessment but in no shape, part or form this section should be considered as Earth Retention System

20 February 2024

design. Completed ERS and EX drawings will need to be submitted for review in order to confirm soils assumptions and for use in the analysis of slopes and adjacent structures required for permit submittal.

XIV. General Qualifications

The recommendations presented within this report are based upon the small-diameter soil borings performed at the site. Soils, bedrock depth, and natural deposits are variable in nature and some strata or variances may not have been detected in our investigation. All the elevations are approximate and generally rounded to the nearest 6", and actual elevations may vary.

XV. References

- American Society of Civil Engineers. (2010). Minimum Design Loads for Buildings and Other Structures. Reston, VA, USA: American Society of Civil Engineers.
- Briaud, J. L. (1992). *The Pressuremeter*. College Station, TX: Taylor & Francis/Balkema.
- Briaud, J. L. (2013). *Geotechnical Engineering: Unsaturated and Saturated Soils*. Hoboken, NJ: John Wiley & Sons, Inc.
- Budiman, K. B. (2005). Potential Squeeze of Open Drilled Shafts in Soft Clay. *ASCE GSP 132: Advances in Deep Foundations*.
- Coduto, D. P. (1998). *Geotechnical Engineering: Principles and Practices*. Upper Saddle River, NJ: Prentice-Hall.
- Coduto, D. P., Kitch, W. A., & Ronald-Yeung, M.-c. (2014). *Foundation Design, Principles and Practictices*. Pomona, CA, USA: Pearson.
- Craig, R. (1997). *Soil Mechanics*. London, UK: E & FN Spon.
- Naval Facilities Engineering Command (NAVFAC). (1986). *Soil Mechanics, Foundations and Earth Structures*. Alexandria, VA: US Navy, Vulcan Hammer reprint.



Calculation: Allowable Bearing of Deep Foundation.

The allowable bearing for the deep foundations consisting of caisson will be evaluated using the bearing capacity equation by Briaud, "The Pressuremeter".

PMT values are shown on the profiles and the PMT table

$$q_{all} = (K) (P_i - P_o) / (FS)$$

where: K = PMT bearing capacity factor = 1.4 (typical for Chicago clays)

P_i = PMT limit pressure

P_o = PMT at rest pressure

FS = Factor of safety = 2.5 for a caisson

The geometric mean will be used to determine the value of P_i within 1.5B of the caisson.

Caisson bells are founded at -6ft CCD and bedrock approximately around -27ft CCD. Caisson bearing surfaces range in diameter from 3ft to 4ft in diameter. The PMT results show the lowest values at -12 ft CCD, so the lowest q_{all} will be with the largest bell of 4 ft diameter. Thus, 1.5B reaches from -6 ft CCD to -12 ft CCD.

$$P_i = (156.6 * 140.8 * 106.5)^{(1/3)} \text{ ksf} = 132.9 \text{ ksf}$$

P_o = Largest P_o value within influence depth = 3.8 ksf

$$q_{all} = (1.4) (132.9 \text{ ksf} - 3.8 \text{ ksf}) / (2.5) = 72.3 \text{ ksf} \gg 40,000 \text{ psf}$$

The allowable value of this report is ok at 40,000 psf for caissons bearing at -6 ft CCD. Keep recommendation from report.



Calculation: Caisson Settlement and Differential Settlement

Settlement has been calculated using the approach method by Louis Menard by using pressuremeter data, using a RocTest Texam Model E with Type N probes, from borings all the borings collected at the site. As previously shown in the bearing calculation, we will consider the PMT values from a depth of -6 feet CCD. The following Caisson Schedule can be found in the Structural Plans page S201.

TYPE - NOTE 6	SHAFT DIAMETER	BELL DIAMETER	VERTICAL BARS	TIES	TOP OF SHAFT ELEVATION VARIES - SEE PLAN	BOTTOM OF SHAFT ELEVATION	ALLOWABLE SOIL BEARING PRESSURE	UPLIFT - NOTE 7	REMARKS
DS36A	3'-0"	N/A	(8) #8	#4 @ 12" OC	105'-8" = CCD 33.10' 108'-10" = CCD 36.43' 109'-8" = CCD 37.10'	TO -8.0' CCD	40,000 PSF	0	NOTE 1 & 2
DS36B	3'-0"	N/A	(8) #8	#4 @ 12" OC	105'-8" = CCD 33.10' 108'-10" = CCD 36.43'	TO +5.0' CCD	12,000 PSF	0	NOTES 1 & 5
DS36C	3'-0"	N/A	(8) #8	#4 @ 12" OC	108'-10" = CCD 36.43' 112'-0" = CCD 39.80'	TO -8.0' CCD	40,000 PSF	0	NOTES 1 & 3
DS42A	3'-0"	3'-8"	(8) #8	#4 @ 12" OC	107'-8" = CCD 35.10' 108'-10" = CCD 36.43' 112'-0" = CCD 39.80'	TO -8.0' CCD	40,000 PSF	0	NOTES 1, 2, & 4
DS42B	3'-0"	3'-8"	(8) #8	#4 @ 12" OC	107'-8" = CCD 35.10' 108'-10" = CCD 36.43' 109'-8" = CCD 37.10' 112'-0" = CCD 39.80'	TO -8.0' CCD	40,000 PSF	0	NOTES 1, 3, & 4
DS42C	3'-0"	3'-8"	(8) #8	#4 @ 12" OC	108'-10" = CCD 36.43'	TO +5.0' CCD	12,000 PSF	0	NOTES 1, 4, & 5
DS48A	3'-0"	4'-0"	(8) #8	#4 @ 12" OC	107'-8" = CCD 35.10' 108'-10" = CCD 36.43' 109'-8" = CCD 37.10' 112'-0" = CCD 39.80'	TO -8.0' CCD	40,000 PSF	0	NOTES 1, 2, & 4
DS48B	3'-0"	4'-0"	(8) #8	#4 @ 12" OC	105'-8" = CCD 33.10' 108'-10" = CCD 36.43'	TO +5.0' CCD	12,000 PSF	0	NOTES 1, 4, & 5

CCD DATUM ELEVATION 27.60' = 100'-0"

Figure 1 – Caisson Schedule from S201

Using the provided loads from the SE for applied pressure (based on caisson end bearing area), our calculation will be using the Menard equation for settlement. See bearing calculation at the beginning of this package. The highest loaded caisson has a 48" diameter bell, at WestMat I3-18.4 with an applied load of 436.2 kips.

$$q_{app} = P/A = 436.2 / \pi (4^2 / 4) = 34.7 \text{ ksf}$$

$$S(\text{total}) = \frac{(1.33)(q_{app})}{(3)(E_d)} [(\lambda d)B/2]^\alpha + \frac{(\alpha)(q_{app})}{(4.5)(E_c)} (\lambda c)(B/2)$$



We will look at the scenario where B (diameter) of 4ft wide will be used, with actual loads . We will be using the following parameters:

Load (ksf)	Pressuremeter Modul		Mendard Shap		Width (ft)	Menard Comp Factor
	Ec	Ed	λc	λd		
q _{app}	Ec	Ed	λc	λd	B	α
34.7	2,400.0	2,271.0	1.1	1.1	4	0.5

Table 1 – Settlement parameters summary

Where E is the layer thickness equal to approximately 0.5B

- Ec = E1 = 2,400.0 ksf = 2,400.0
- E2 = 2,193.1 ksf = no test, use lower value of E3
- E3 = 2,193.1 ksf = 2,653.8 + 1,732.4 / 2
- E4= No test ksf = No PMT's in this range
- E5= No test ksf = No PMT's in this range
- E345= 2,193.1 ksf = average of E3, E4 and E5

Ed =

$$\frac{3.2}{(1/E1) + (1/0.85E2) + (1/E345)} = \frac{3.2}{0.0004 + 0.0005 + 0.0005}$$

= 2,271.0 ksf

S(total)

$$= \frac{(1.33)(q_{app})}{(3)(Ed)} [(\lambda d)B/2]^{\alpha} + \frac{(\alpha)(q_{app})(\lambda c)(B/2)}{(4.5)(Ec)}$$

$$= \frac{46.15}{6,813} \cdot 1.483 + \frac{(17.35)(1.1)}{10,800}$$

Client: AECOM

Project: JPSTC EMS Addition

Date: 20 February 2024

Prepared By: WF4

Checked By: WF3



$$= 0.0100 + 0.0018$$

$$= 0.0118 \text{ ft}$$

$$= 0.14 \text{ inches}$$

So, approximately 0.14 inches settlement for 4ft diameter bell with 34.7 ksf applied load. Doing the same methodology for the other belled diameters, we have the following summary for settlement, considering using **max** loading.



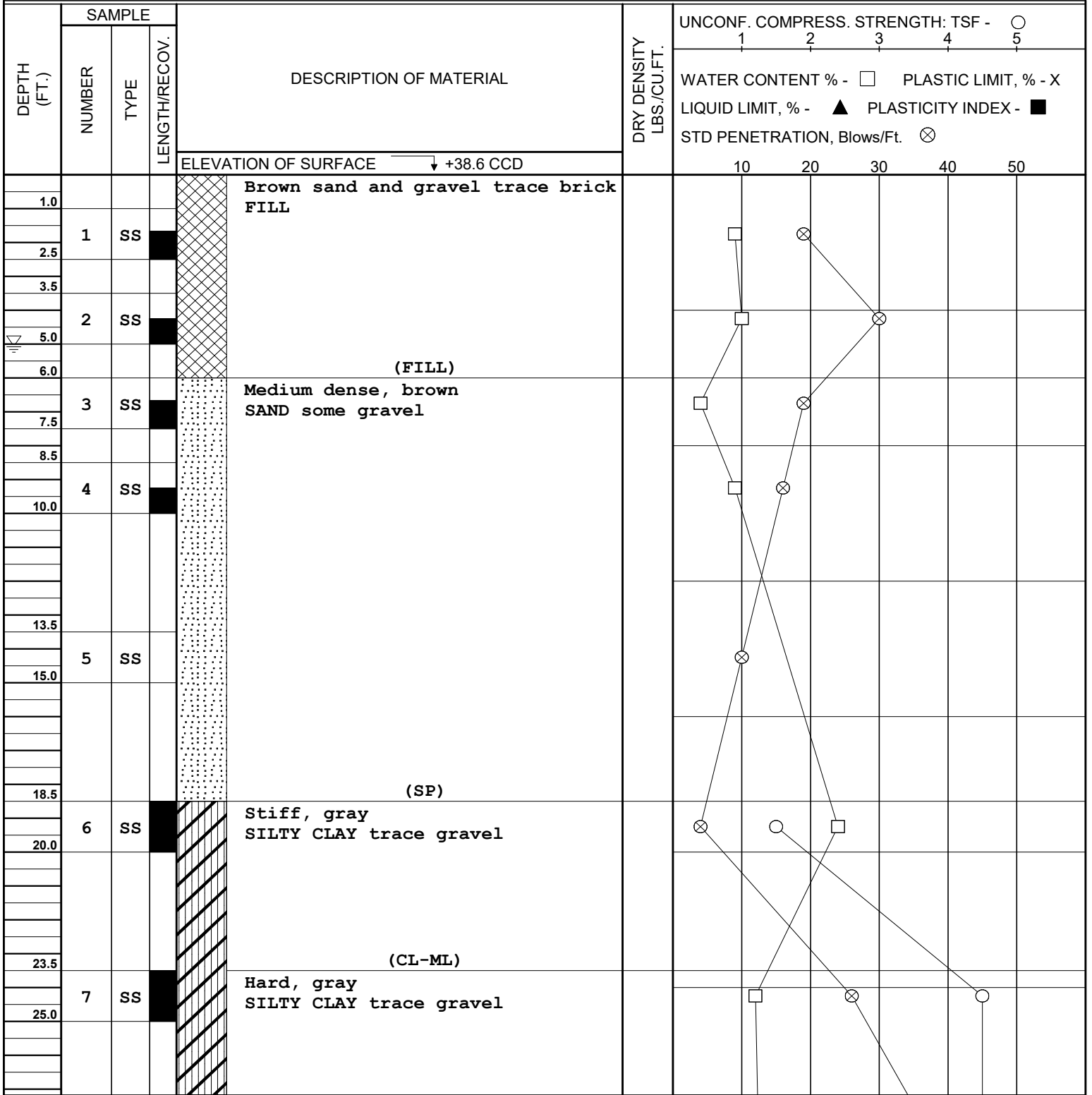
1945 EAST 87TH STREET
CHICAGO, IL 60617-2946
o. 773.721.2200
info@foodlabs.com

20 February 2024

Boring Logs and Profile Cut

PROJECT: JPSTC - EMS Addition

CLIENT: AECOM

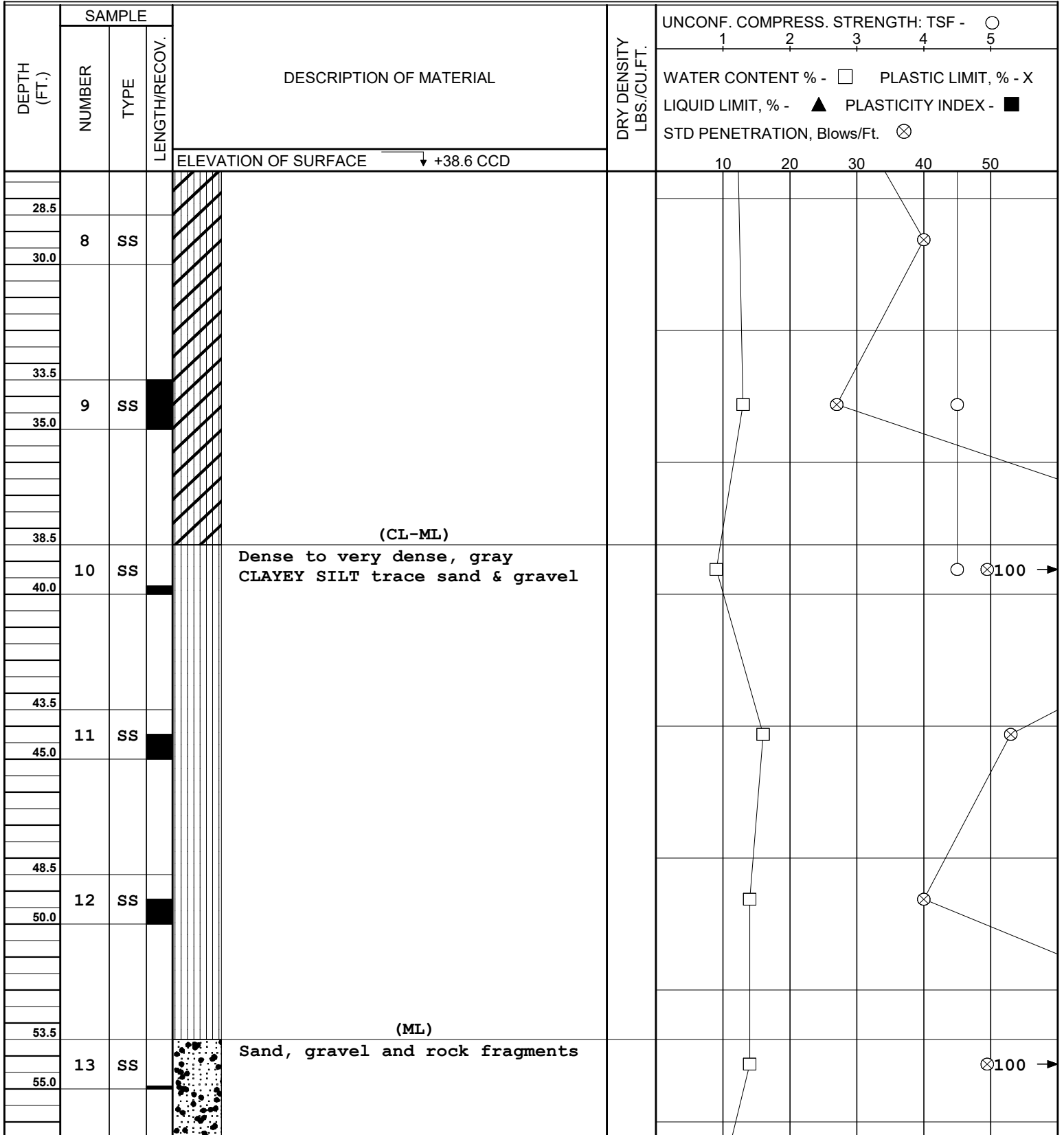


WATER LEVEL: 5.0 FT. AT ATD HRS.
FT. AT HRS.

BORING STARTED: 12 October 2023
BORING COMPLETED: 13 October 2023

PROJECT: JPSTC - EMS Addition

CLIENT: AECOM



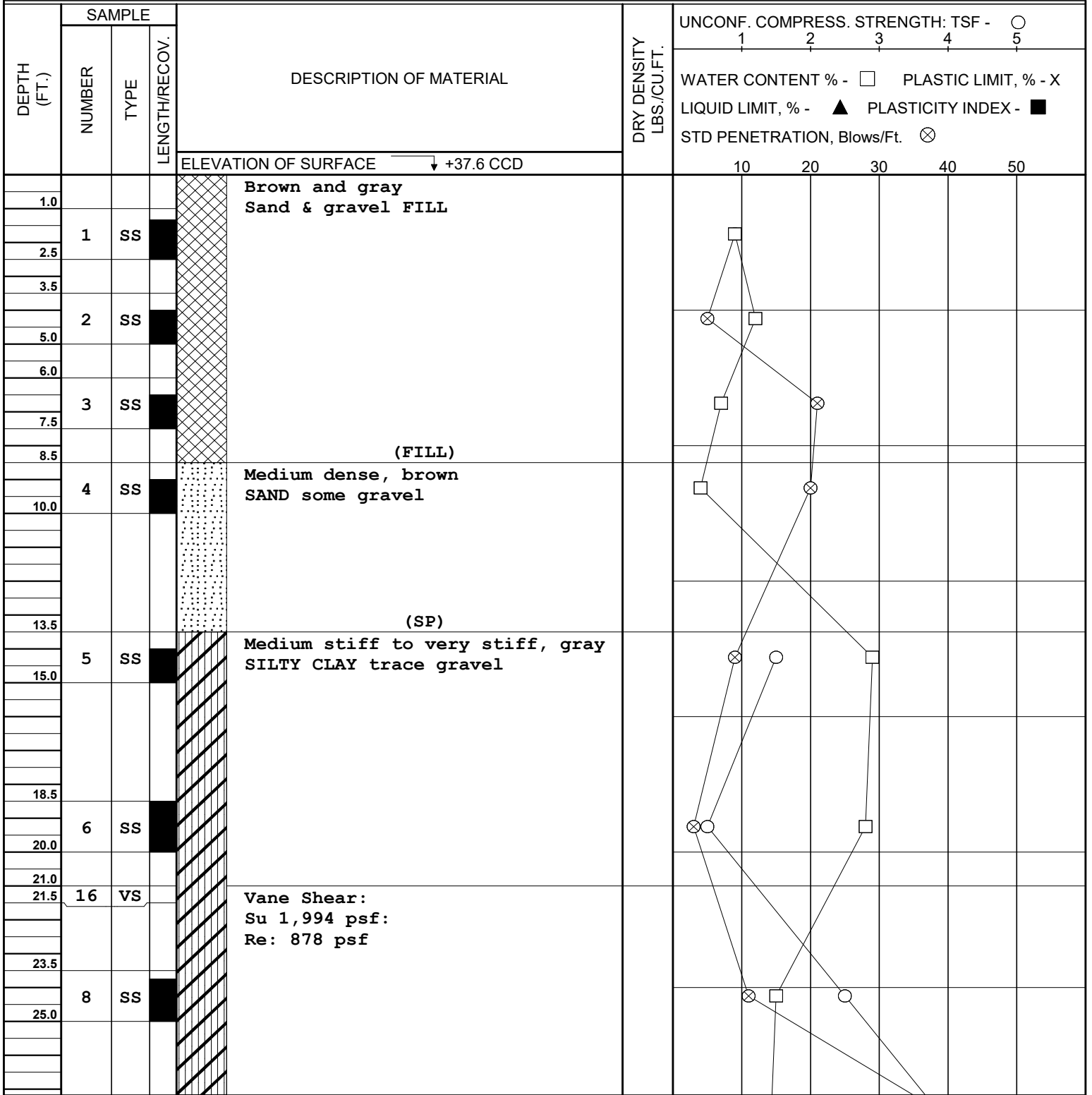
PROJECT: JPSTC - EMS Addition

CLIENT: AECOM

DEPTH (FT.)	SAMPLE			DESCRIPTION OF MATERIAL	DRY DENSITY LBS./CU.FT.	UNCONF. COMPRESS. STRENGTH: TSF - ○								
	NUMBER	TYPE	LENGTH/RECOV.			1	2	3	4	5				
				ELEVATION OF SURFACE ↓ +38.6 CCD										
58.5														
60.0	14	SS												
63.5														
65.0	15	SS												
				(GP-SP)										
				End of Boring										

PROJECT: JPSTC - EMS Addition

CLIENT: AECOM



WATER LEVEL:

FT. AT HRS.

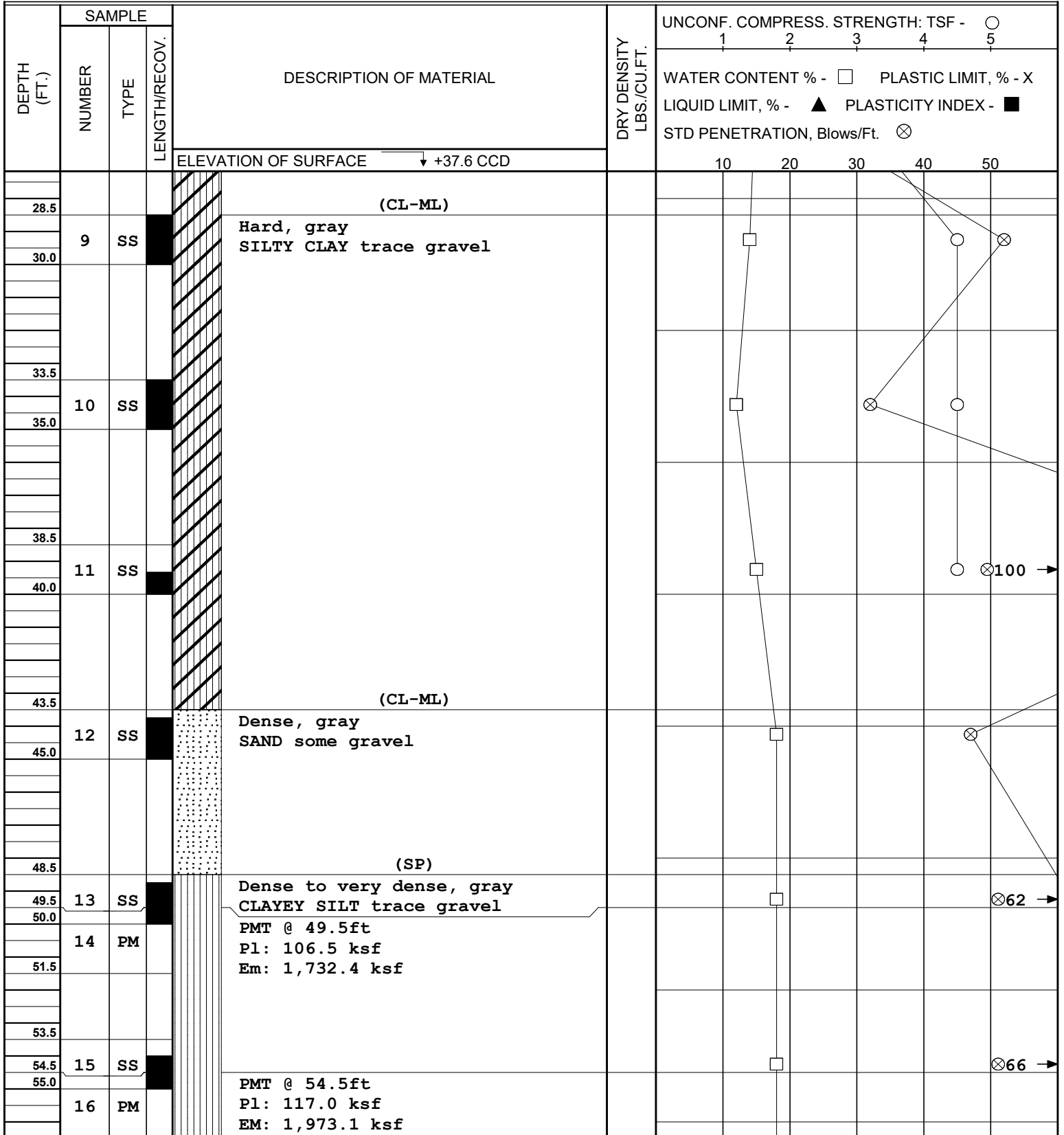
BORING STARTED: 12 October 2023

FT. AT HRS.

BORING COMPLETED: 12 October 2023

PROJECT: JPSTC - EMS Addition

CLIENT: AECOM



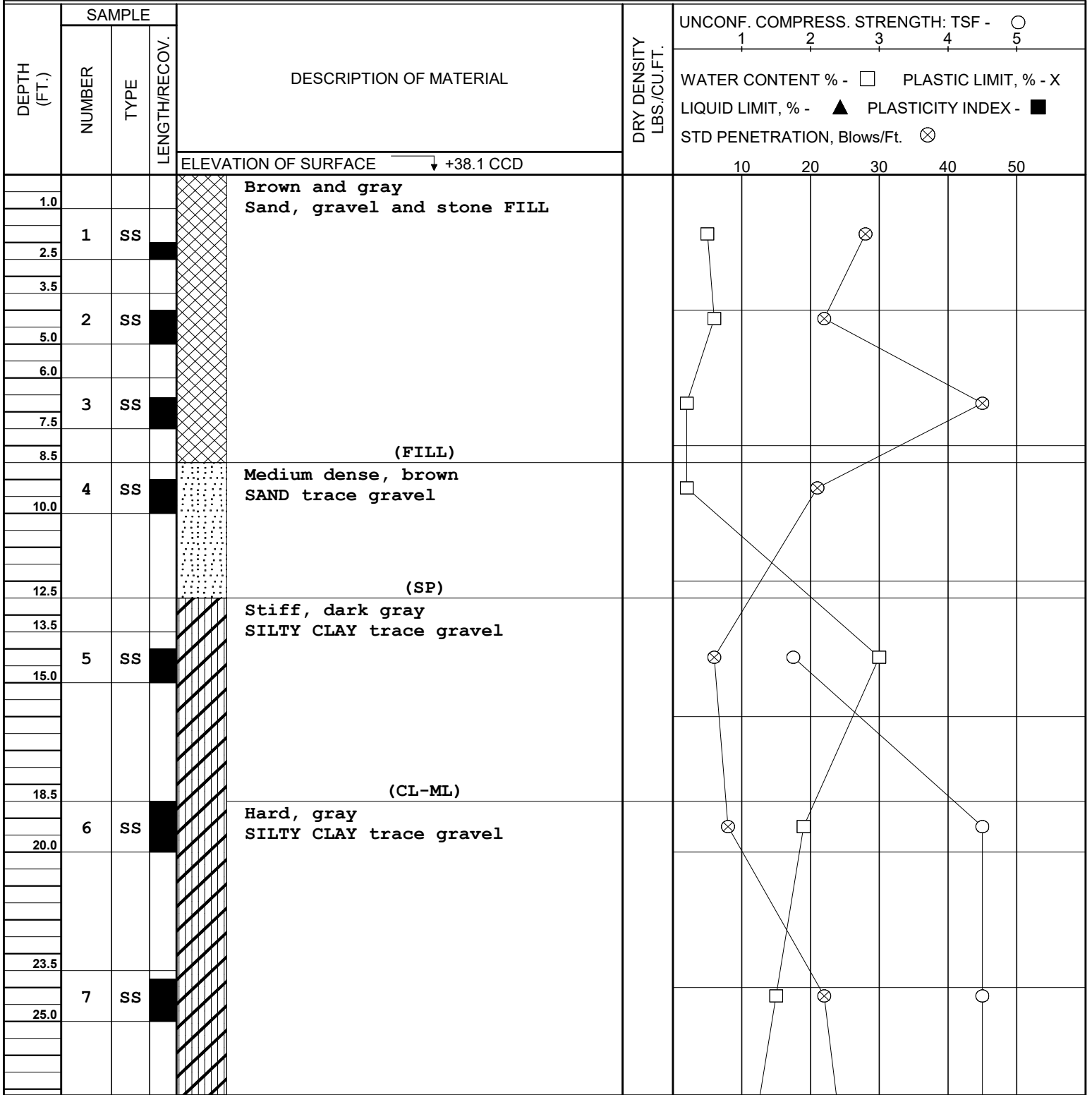
PROJECT: JPSTC - EMS Addition

CLIENT: AECOM

DEPTH (FT.)	SAMPLE		DESCRIPTION OF MATERIAL	DRY DENSITY LBS./CU.FT.	UNCONF. COMPRESS. STRENGTH: TSF - ○					
	NUMBER	TYPE			LENGTH/RECOV.	1	2	3	4	5
			ELEVATION OF SURFACE ↓ +37.6 CCD							
56.5										
58.5										
60.0	17	SS								
63.5										
65.0	18	SS	(ML)							
			End of Boring							

PROJECT: JPSTC - EMS Addition

CLIENT: AECOM



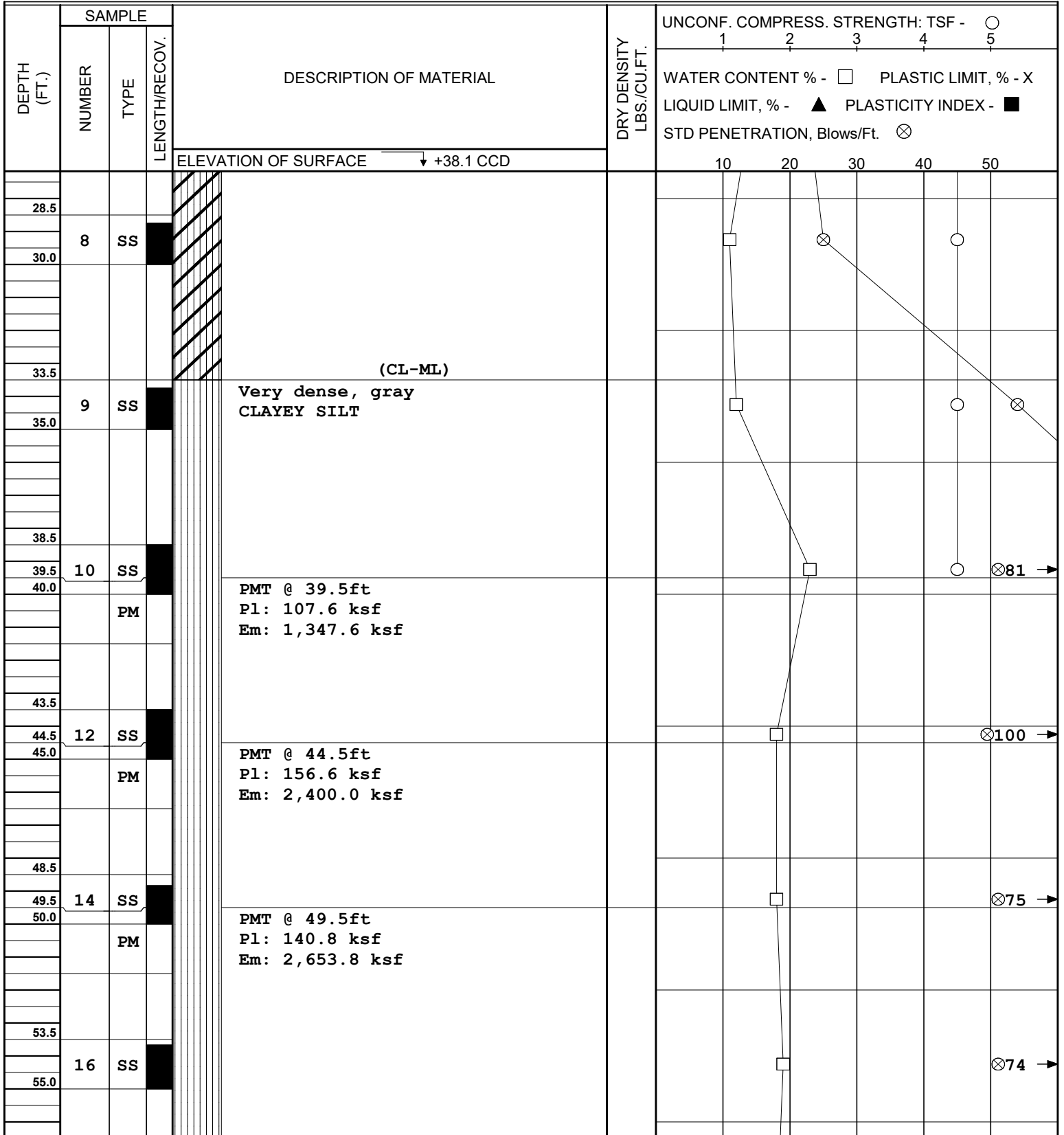
WATER LEVEL:

FT. AT HRS.
FT. AT HRS.

BORING STARTED: 11 October 2023
BORING COMPLETED: 11 October 2023

PROJECT: JPSTC - EMS Addition

CLIENT: AECOM



PROJECT: JPSTC - EMS Addition







CLIENT: AECOM

DEPTH (FT.)	SAMPLE		DESCRIPTION OF MATERIAL	DRY DENSITY LBS./CU.FT.	UNCONF. COMPRESS. STRENGTH: TSF - ○					
	NUMBER	TYPE			LENGTH/RECOV.	1	2	3	4	5
			ELEVATION OF SURFACE ↓ +38.1 CCD							
58.5										
60.0	17	SS								⊗84 →
63.5										
64.5	18	SS	(ML)							⊗100 →
65.0			Fractured Rock							
67.0			(ROCK)							
			End of Boring - Potential Bedrock							




KEY TO SYMBOLS

Symbol Description

Strata symbols

	Fill
	Poorly graded sand
	Silty low plasticity clay
	Silt
	Poorly graded gravel and sand
	Basalt (or generic rock)

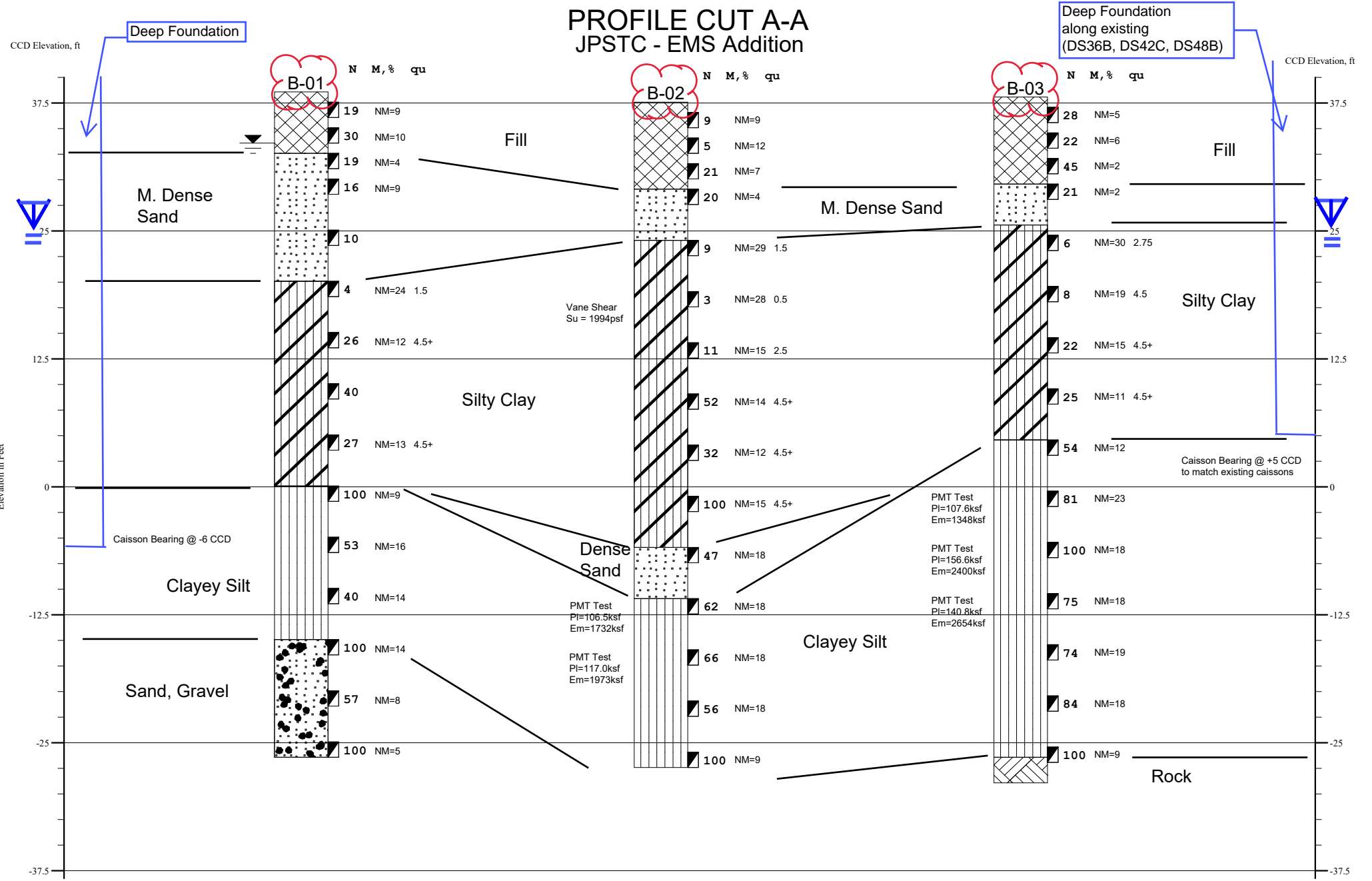
Misc. Symbols

	Water table during drilling
	N-Value
	Water Content

Notes:

1. Exploratory borings were drilled on 11 October 2023 using a 4-inch diameter continuous flight power auger.
2. Boring locations were estimated from existing features and elevations reference ground elevation on the date of drilling.
3. These logs are subject to the limitations, conclusions, and recommendations in this report.
4. Results of tests conducted on samples recovered are reported on the logs.

PROFILE CUT A-A JPSTC - EMS Addition



- Fill
- Poorly graded sand
- Silty low plasticity clay
- Silt
- Poorly graded gravel and sand
- Basalt (or generic rock)



1945 EAST 87TH STREET
CHICAGO, IL 60617-2946
o. 773.721.2200
info@foodlabs.com

20 February 2024

Pressuremeter and Vane Shear Testing

20 February 2024

Squeeze Analysis, Vane Shear tests

Boring	Depth	Elevation (-CCD)	Wc	Total Overburden	Su	Remold	Sensitivity	Limit value to avoid squeeze (D=2.5')	Limit value to avoid squeeze (D=3.0')	Limit value to avoid squeeze (D=3.5')	Limit value to avoid squeeze (D=4.0')	Limit value to avoid squeeze (D=5.0')	Total overburden/Su	Will squeeze occur?
B-02	21	13.5	43	2520	1994	878	2.27	7.10	6.75	6.50	6.31	6.05	1.26	No

Table 4: Vane Shear Tests



1945 EAST 87TH STREET
CHICAGO, IL 60617-2946
PHONE (773) 721-2200
EMAIL: info@floodlabs.com

A Certified Woman Owned Business Enterprise

27 February 2024

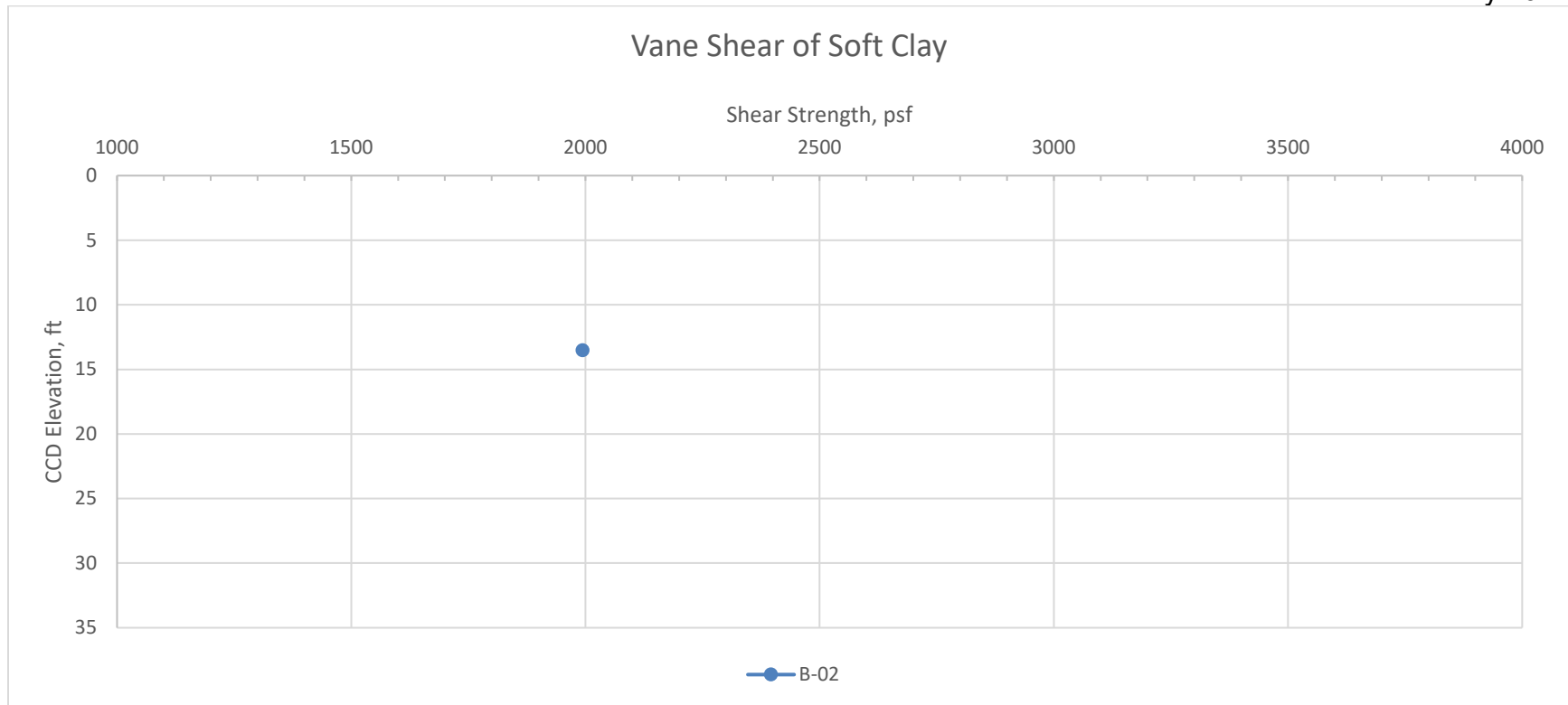


Figure 4: Shear Strength of Clays

27 February 2024

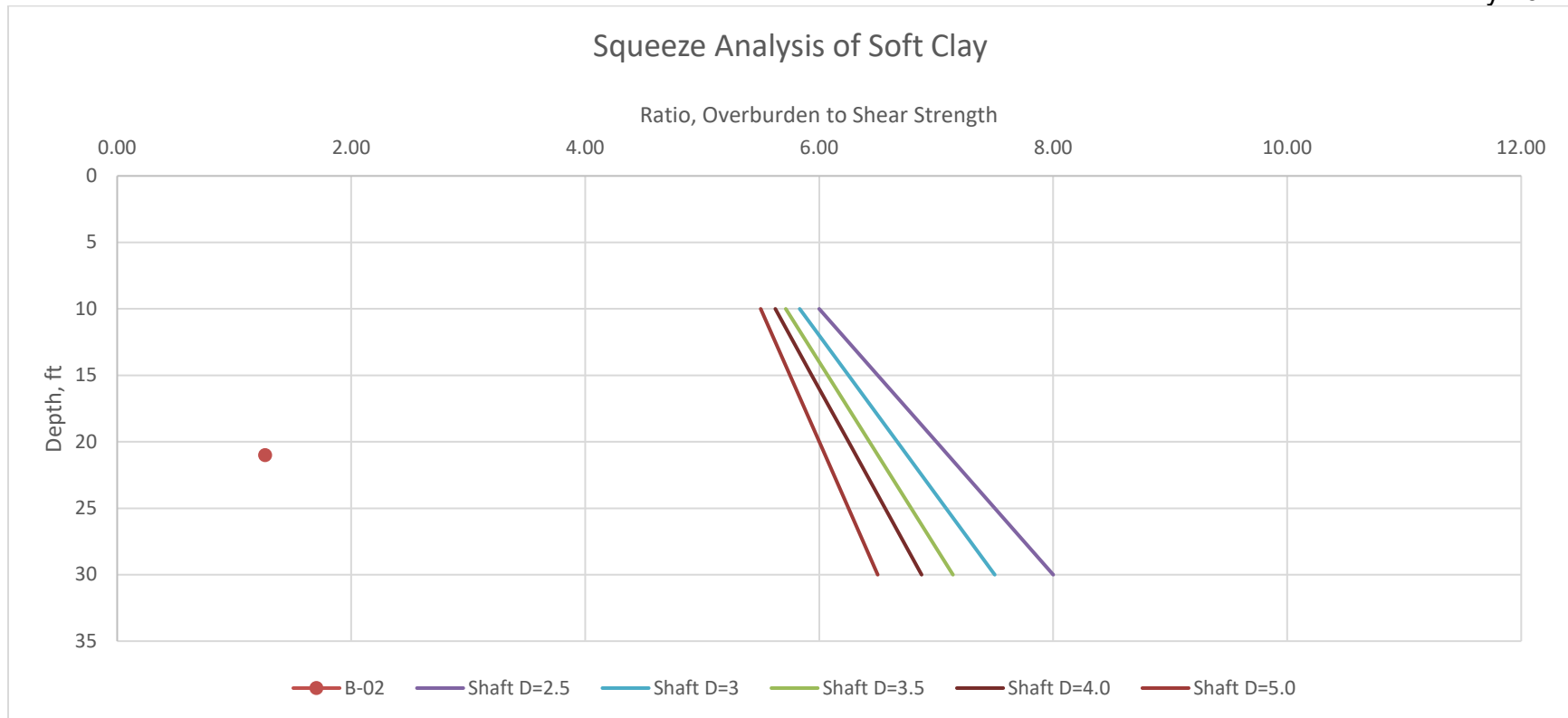


Figure 5: Squeeze Analysis



1945 EAST 87TH STREET
 CHICAGO, IL 60617-2946
 PHONE (773) 721-2200
 EMAIL: info@floodlabs.com

A Certified Woman Owned Business Enterprise

27 February 2024

Project	AECOM JPSTC														
Operator	AB														
Checked By	WHF IV														
Test Date	10/12/23														

Pressuremeter Test Summary															
Boring	Test Depth	CCD	USCS	N	Moisture	Po (psf)	Pf (psf)	PI (psf)	Em (psf)	Er (psf)	Em/Er	Em/PI	Ed/N	PI/Pf	
B-02	49.5	-11.9	ML	62	18	3,843	86,675	106,516	1,732,375	8,414,814	0.21	16.3	27942	1.2	
B-02	54.5	-16.9	ML	66	18	4,135	92,732	117,022	1,973,106	11,181,086	0.18	16.9	29896	1.3	
Average						3,989	89,703	111,769	1,852,740	9,797,950	0.19	16.6	28,919	1.2	

Project	AECOM JPSTC														
Operator	AB														
Checked By	WHF IV														
Test Date	10/11/2023														

Pressuremeter Test Summary															
Boring	Test Depth	CCD	USCS	N	Moisture	Po (psf)	Pf (psf)	PI (psf)	Em (psf)	Er (psf)	Em/Er	Em/PI	Ed/N	PI/Pf	
B-03	39.5	-1.4	ML	81	23	3,133	54,302	107,644	1,347,642	13,560,302	0.10	12.5	16638	2.0	
B-03	44.5	-6.4	ML	92	18	3,425	109,649	156,642	2,400,035	11,810,454	0.20	15.3	26087	1.4	
B-03	49.5	-11.4	ML	75	18	3,613	98,997	140,789	2,653,794	10,057,001	0.26	18.8	35384	1.4	
Average						3,390	87,650	135,025	2,133,824	11,809,252	0.19	15.6	26036	1.6	

Table 5: PMT Tables



1945 E 87th St
 Chicago, IL 60617
 o. 773.721.2200
 info@floodlabs.com

Pressuremeter Stress Test Data

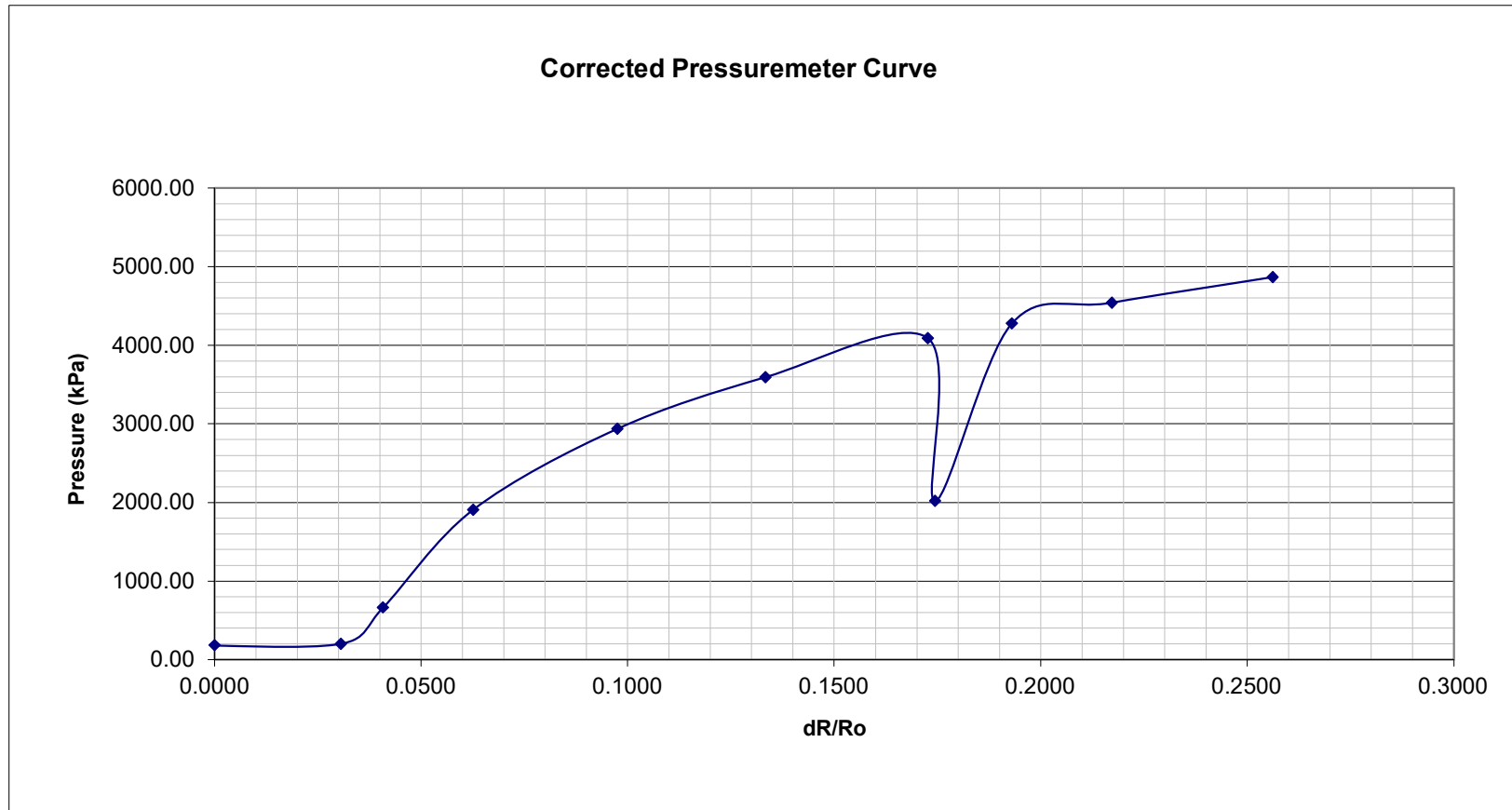
AECOM JPSTC

Date Drilled: 12-Oct-23

Boring ID: B-02
 Depth: 49.5 ft
 Material: Clayey SILT

Calculated Po: 3843 psf
 Calculated Pf: 86675 psf
 SPT blow count: 19-29-33

Calculated PI: 106516 psf
 Calculated Em: 1732375 psf
 Calculated Er: 8414814 psf





1945 E 87th St
 Chicago, IL 60617
 o. 773.721.2200
 info@floodlabs.com

Pressuremeter Stress Test Data

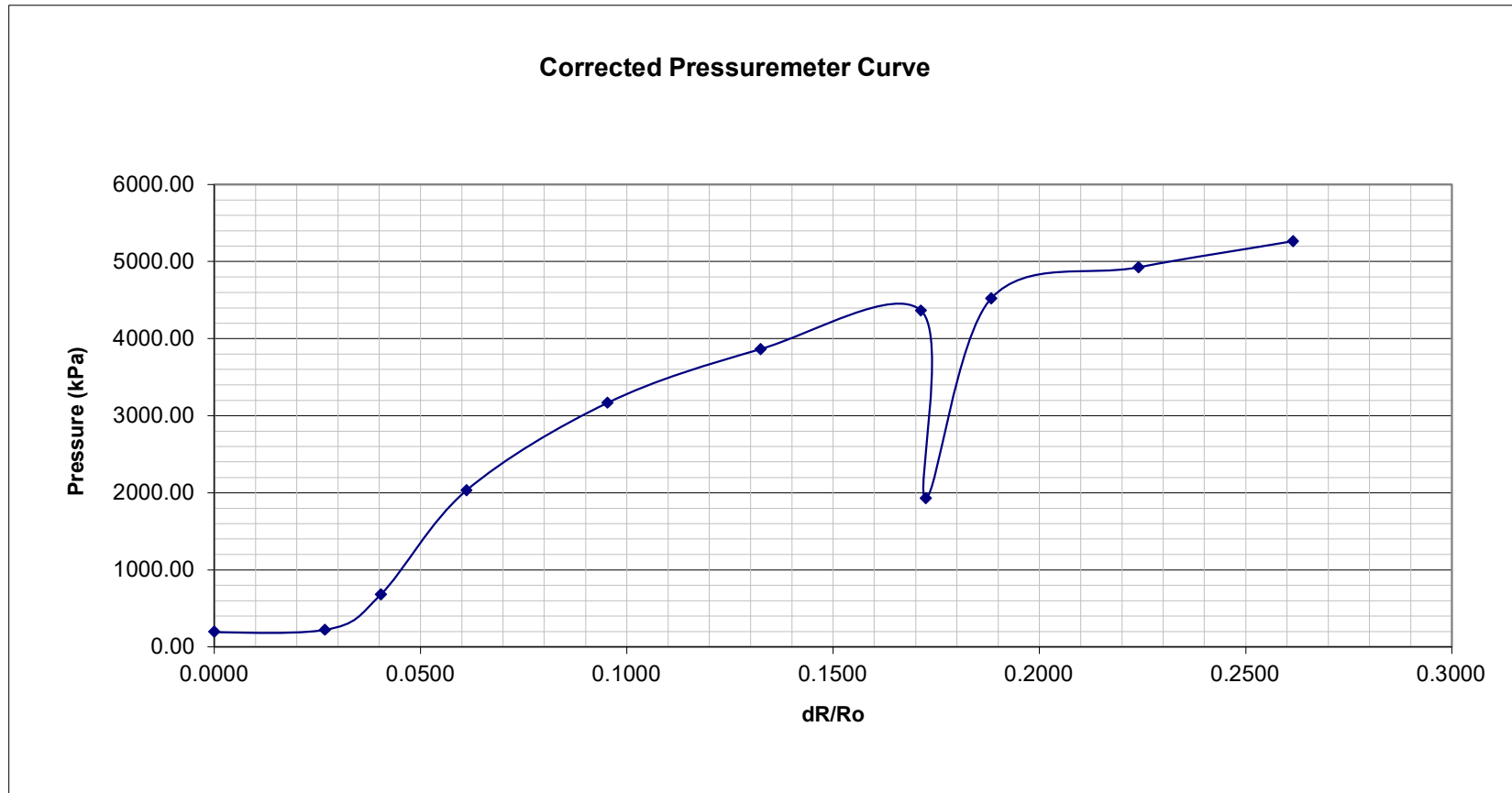
AECOM JPSTC

Date Drilled: 12-Oct-23

Boring ID: B-02
 Depth: 54.5 ft
 Material: Clayey SILT

Calculated Po: 4135 psf
 Calculated Pf: 92732 psf
 SPT blow count: 19-30-36

Calculated PI: 117022 psf
 Calculated Em: 1973106 psf
 Calculated Er: 11181086 psf





1945 E 87th St
 Chicago, IL 60617
 o. 773.721.2200
 info@floodlabs.com

Pressuremeter Stress Test Data

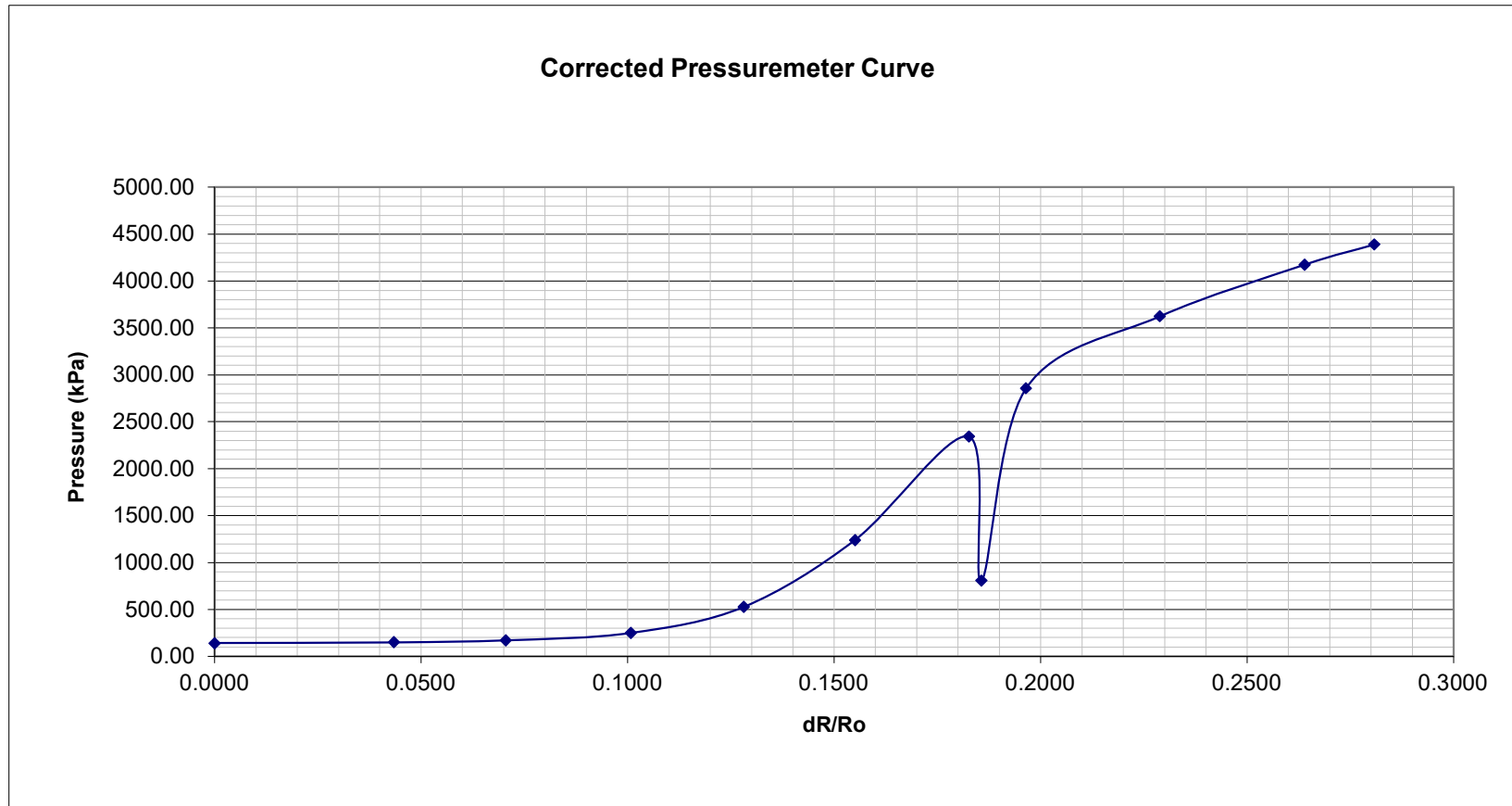
AECOM JPSTC

Date Drilled: 11-Oct-23

Boring ID: B-03
 Depth: 39.5 ft
 Material: Clayey SILT

Calculated Po: 3133 psf
 Calculated Pf: 54302 psf
 SPT blow count: 20-35-46

Calculated PI: 107644 psf
 Calculated Em: 1347642 psf
 Calculated Er: 13560302 psf





1945 E 87th St
 Chicago, IL 60617
 o. 773.721.2200
 info@floodlabs.com

Pressuremeter Stress Test Data

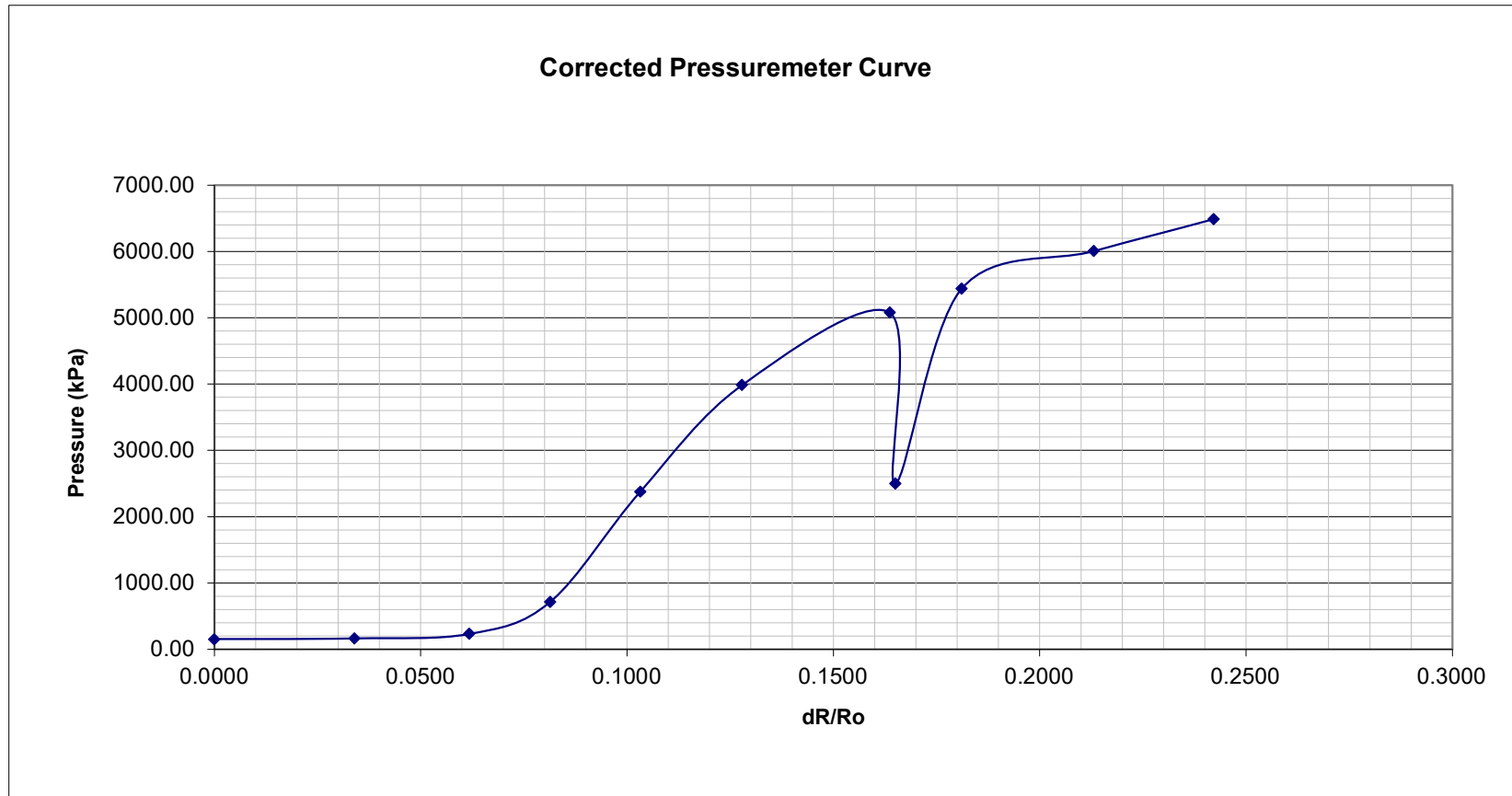
AECOM JPSTC

Date Drilled: 11-Oct-23

Boring ID: B-03
 Depth: 44.5 ft
 Material: Clayey SILT

Calculated Po: 3425 psf
 Calculated Pf: 109649 psf
 SPT blow count: 35-42-50

Calculated PI: 156642 psf
 Calculated Em: 240035 psf
 Calculated Er: 11810454 psf





1945 E 87th St
 Chicago, IL 60617
 o. 773.721.2200
 info@floodlabs.com

Pressuremeter Stress Test Data

AECOM JPSTC

Date Drilled: 11-Oct-23

Boring ID: B-03

Depth: 49.5 ft

Material: Clayey SILT

Calculated Po: 3613 psf

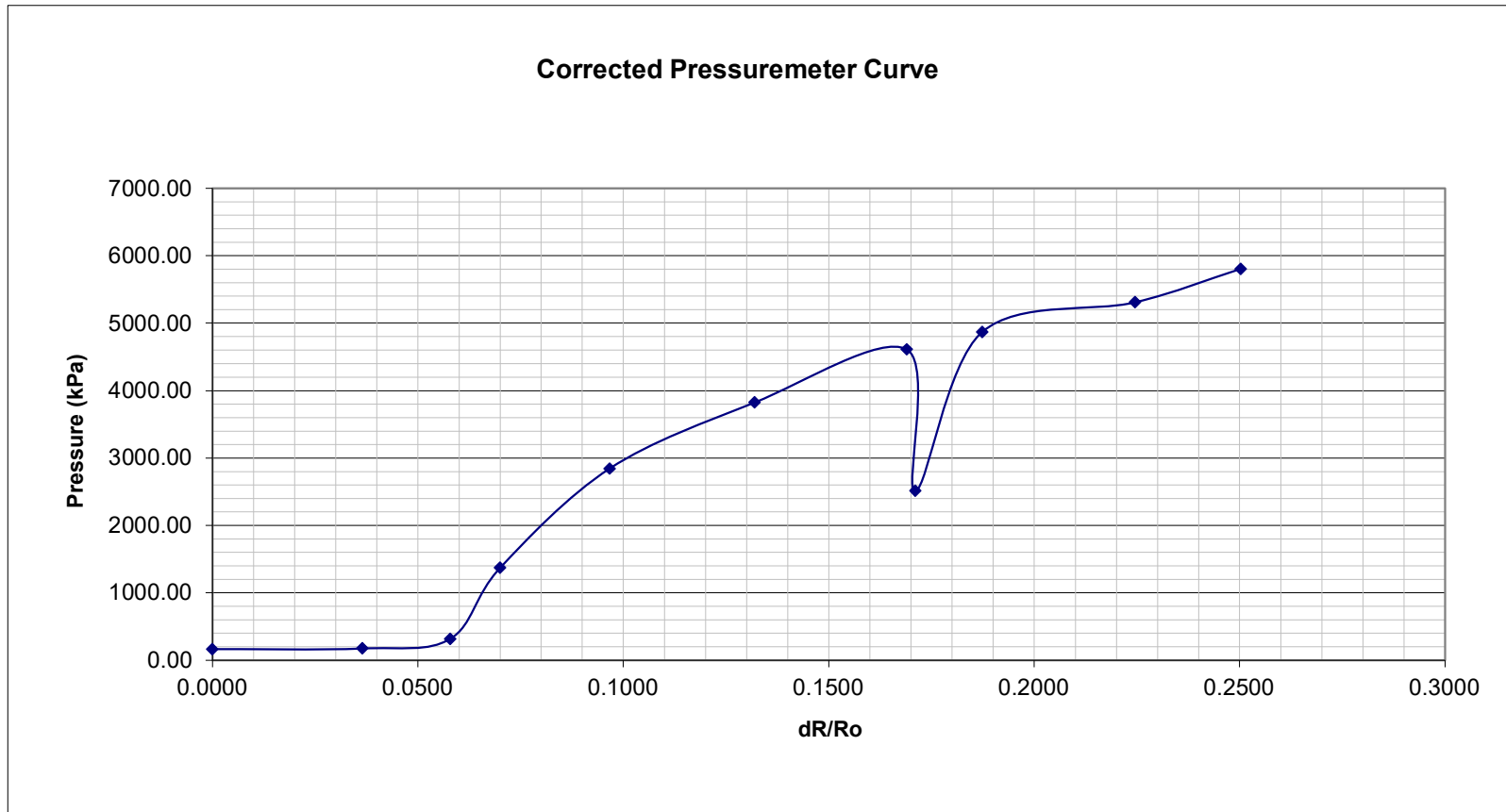
Calculated Pf: 98997 psf

SPT blow count: 28-35-40

Calculated PI: 140789 psf

Calculated Em: 2653794 psf

Calculated Er: 10057001 psf





1945 EAST 87TH STREET
CHICAGO, IL 60617-2946
PHONE (773) 721-2200
EMAIL: info@floodlabs.com

27 February 2024

Boring Location Plan

27 February 2024

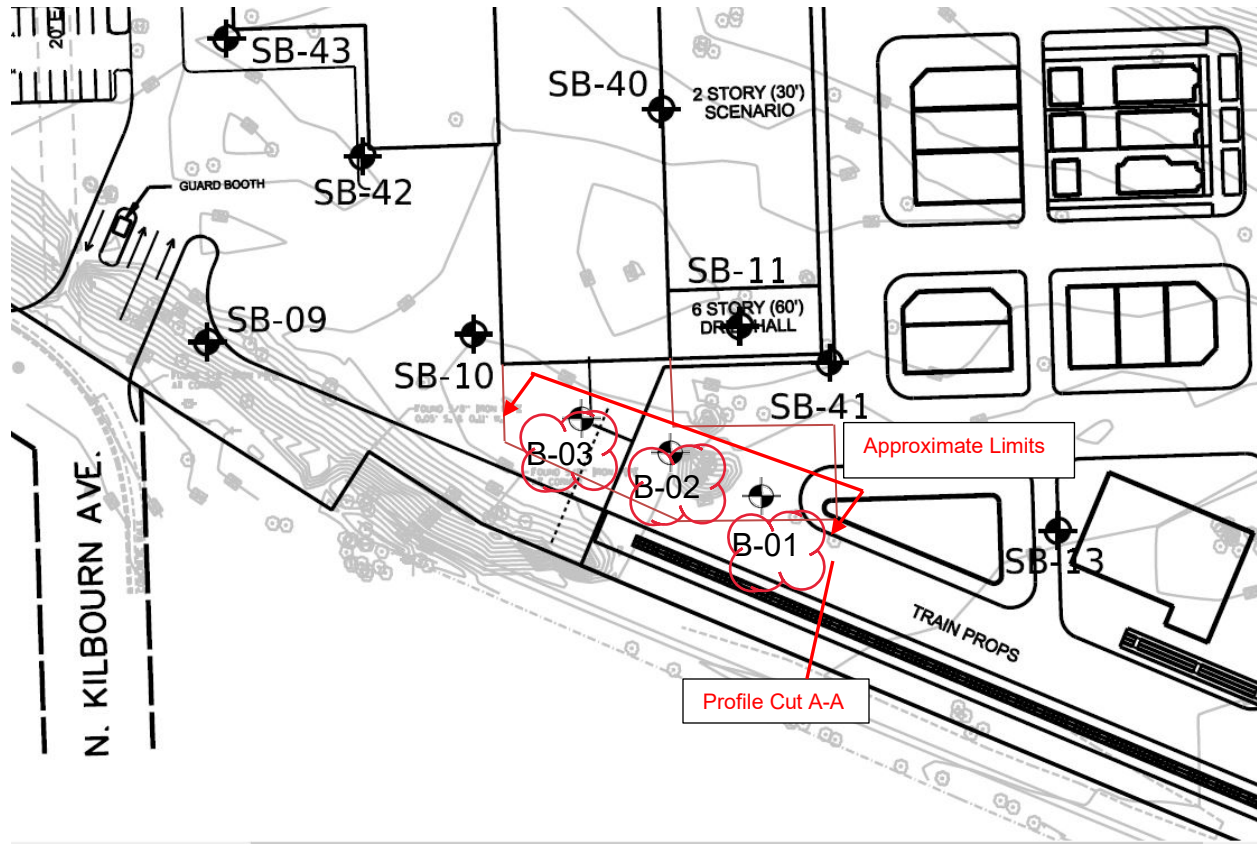
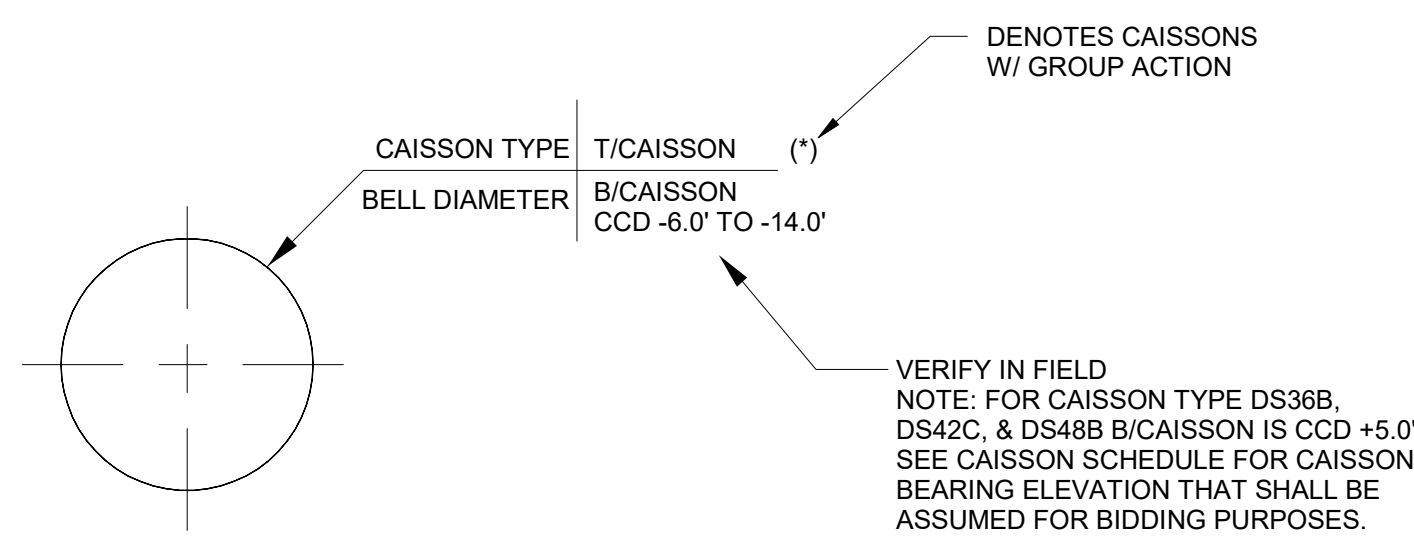
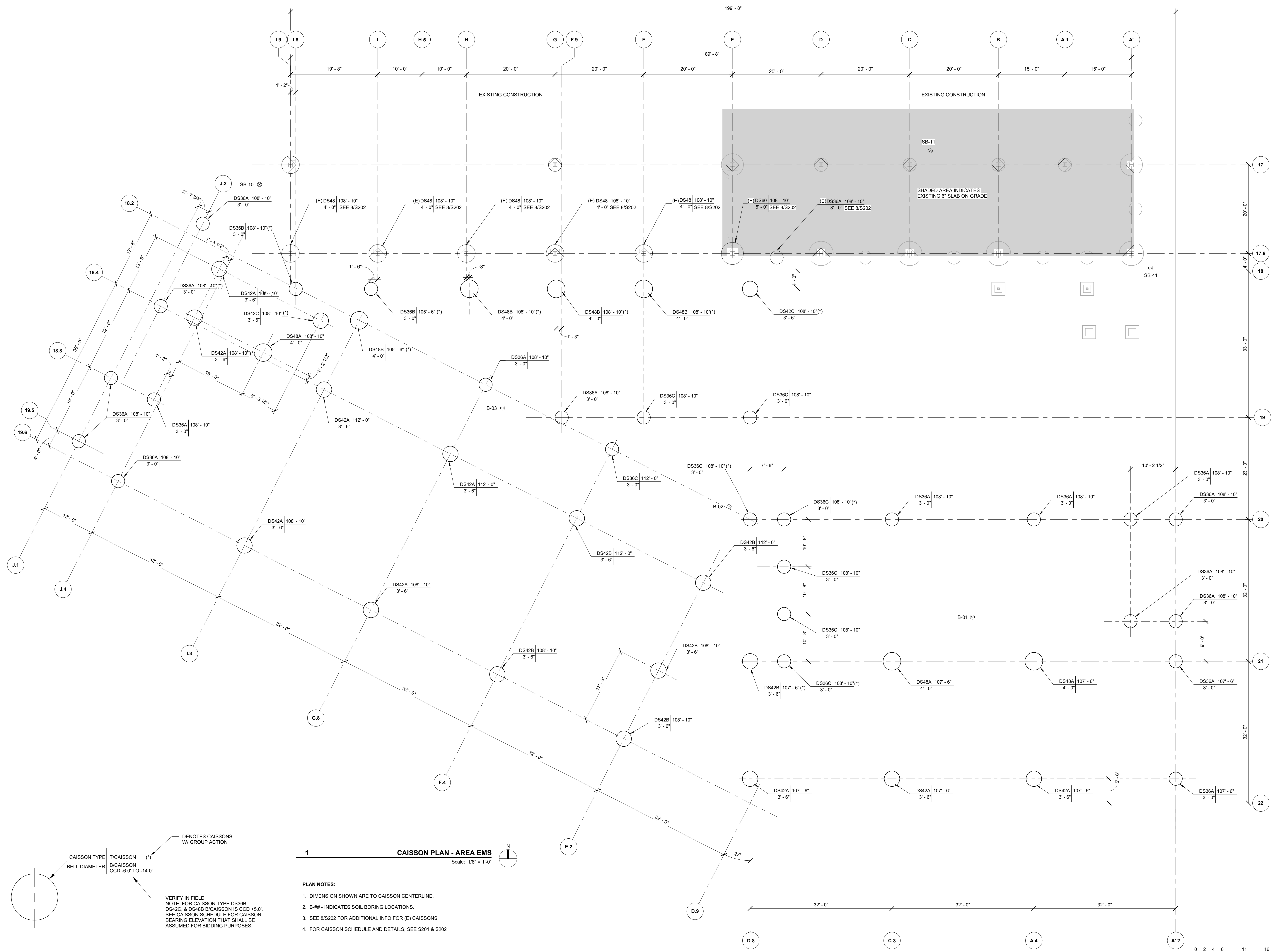


Figure 6: Approximate Boring Locations



CAISSON PLAN - AREA EMS
Scale: 1/8" = 1'-0"

- PLAN NOTES:**
1. DIMENSION SHOWN ARE TO CAISSON CENTERLINE.
 2. B-## - INDICATES SOIL BORING LOCATIONS.
 3. SEE 8/S202 FOR ADDITIONAL INFO FOR (E) CAISSONS
 4. FOR CAISSON SCHEDULE AND DETAILS, SEE S201 & S202

TYPICAL CAISSON LEGEND

CCD ELEVATION 27.60' = 100'-0"
1/8"=1'-0"

CAISSONS (VERTICAL PENETRATION) ONLY PERMIT.
OTHER INFORMATION IS FOR REFERENCE ONLY.



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
AECOM
ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-375-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-820-9188

INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

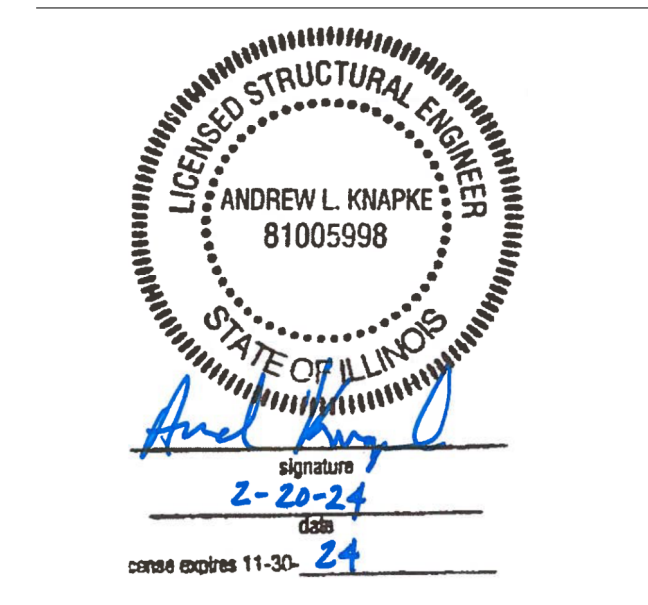
JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

PROJECT STATUS

CAISSON PACKAGE
02/20/2024

REGISTRATION



ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	02/20/2024	CAISSON PACKAGE
2	12/22/2023	DESIGN DEVELOPMENT
1	12/22/2023	50% CAISSON SET
I/R	DATE	DESCRIPTION

PROJECT NUMBER
PBC: #07215 AECOM: 60710711

SHEET TITLE
CAISSON DIMENSION PLAN

SHEET NUMBER
S100DS

This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or disseminated by third parties, except as agreed by AECOM and its client as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility and denies any liability whatsoever to any party that modifies this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



1945 EAST 87TH STREET
CHICAGO, IL 60617-2946
PHONE (773) 721-2200
EMAIL: info@floodlabs.com

27 February 2024

Borings from Others



STRUCTURE FOUNDATION BORING LOG

PAGE 1 of 2

DATE 6/27/2019

LOGGED BY RT

GSI JOB No. 19059

Project: Geotechnical Investigation For Joint Public Safety Training Campus (JPSTC)

Location: 4301 W. Chicago Avenue, Chicago, Illinois

County: Cook Drilling Method: Hollow Stem Auger/Rotary Hammer Type: CME Automatic

Client: AECOM

BORING No.: SB-10

Northing: 1904409.0

Easting: 1146471.3

Ground Surface Elev. +35.1 CCD

D E P T H	B L O W S	U C S Qu	M O I S T	Surface Water Elev. <u>n/a</u>	D E P T H	B L O W S	U C S Qu	M O I S T
				Stream Bed Elev. <u>n/a</u>				
				Groundwater Elevation:				
				First Encounter <u>Dry to -10.0'</u> ▼				
				Upon Completion <u>n/a</u> ▼				
				After _____ Hrs. _____ ▼				
(ft)	(/6")	(tsf)	(%)		(ft)	(/6")	(tsf)	(%)

TOPSOIL—black								
	AS		29	SILT—gray—medium dense (ML)				
	10							
	8							
	6		7					
POORLY GRADED SAND & GRAVEL— brown—very loose to medium dense (GP) Fill								
	6					16		
	5			LEAN CLAY with Sand—gray— hard (CL)		24		
	-5	5	5		-25	40	4.5+P	11
	8							
	9							
	10		4					
	3					13		
	2					20		
	-10	2	10		-30	23	4.5+P	13
	3							
	4							
SILTY CLAY—brown & gray—stiff (CL)								
	3		103	SILT—gray—very dense (ML)		35		
	4				50/9"			
	-15	4	1.6B		-35			18
	8							
	10					36		
SILT—gray—medium dense (ML)						41		
	-20	12	14	SILTY SAND—gray—very dense (SM)		-40	48	14

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B—Bulge, S—Shear, P—Penetrometer) ST—Shelby Tube Sample VS—Vane Shear Test
 The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
 NR—No Recovery NP—Nonplastic



STRUCTURE FOUNDATION BORING LOG

PAGE 2 of 2

DATE 6/27/2019

LOGGED BY RT

GSI JOB No. 19059

Project: Geotechnical Investigation For Joint Public Safety Training Campus (JPSTC)

Location: 4301 W. Chicago Avenue, Chicago, Illinois

County: Cook Drilling Method: Hollow Stem Auger/Rotary Hammer Type: CME Automatic

Client: AECOM

BORING No.: SB-10

Northing: 1904409.0

Easting: 1146471.3

Ground Surface Elev. +35.1 CCD

D E P T H	B L O W S	U C S Qu	M O I S T	Surface Water Elev. <u>n/a</u>	D E P T H	B L O W S	U C S Qu	M O I S T
(ft)	(/6")	(tsf)	(%)	Stream Bed Elev. <u>n/a</u>	(ft)	(/6")	(tsf)	(%)
				Groundwater Elevation:				
				First Encounter <u>Dry to -10.0'</u> ▼				
				Upon Completion <u>n/a</u> ▼				
				After _____ Hrs. _____ ▼				

SILTY SAND—gray—very dense (SM)	—	—	—		—	—	—	—
SANDY SILT—gray—very dense (ML)	43							
	50/2"							
	-45		13		-65			
	32							
End Of Boring @ -50.0' Hollow Stem Augers To -10.0' Rotary Drilling To Completion 10.0' Of 4.0"Ø Casing Used CME Automatic Hammer	40							
	-50/2"		17		-70			
	-55				-75			
	-60				-80			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B—Bulge, S—Shear, P—Penetrometer) ST—Shelby Tube Sample VS—Vane Shear Test
 The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
 NR—No Recovery NP—Nonplastic



STRUCTURE FOUNDATION BORING LOG

PAGE 1 of 2

DATE 6/27/2019

LOGGED BY RT

GSI JOB No. 19059

Project: Geotechnical Investigation For Joint Public Safety Training Campus (JPSTC)

Location: 4301 W. Chicago Avenue, Chicago, Illinois

County: Cook Drilling Method: Hollow Stem Auger/Rotary Hammer Type: CME Automatic

Client: AECOM

BORING No.: SB-11

Northing: 1904413.9

Easting: 1146633.3

Ground Surface Elev. +35.7 CCD

D E P T H	B L O W S	U C S Qu	M O I S T	Surface Water Elev. <u>n/a</u>	D E P T H	B L O W S	U C S Qu	M O I S T
				Stream Bed Elev. <u>n/a</u>				
				Groundwater Elevation:				
				First Encounter <u>Dry to -10.0'</u> ▼				
				Upon Completion <u>n/a</u> ▼				
				After _____ Hrs. _____ ▼				
(ft)	(/6")	(tsf)	(%)		(ft)	(/6")	(tsf)	(%)

TOPSOIL—black								
	AS		28	SILTY SAND—dark gray— medium dense (SM)				
	7							
	7							
POORLY GRADED SAND & GRAVEL— brown—medium dense (GP) Apparent Fill	7		5					
	5			CLAYEY SILT—gray—dense (ML)				
	5				13			118
	-5	8	5		16			
becoming dark brown @ -5.5'	-5	8	5		-25	24	1.8B	15
	4							
	5							
	6		8					
	4			LEAN CLAY with Sand—gray— hard (CL)		15		
	6				17			
	-10	7	12		-30	22	4.5+P	14
	3							
SILTY CLAY—brown & gray— very stiff (CL)	3			CLAYEY SILT—gray—very dense (ML)		49		
	5				50/1"			
	-15	6	2.5P		-35		4.5+P	17
	5							
	11				38			
SILTY SAND—dark gray— medium dense (SM)	5			SILT—gray—very dense (ML)		41		
	11				41			
	-20	7	14		-40	50/1"		21

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B—Bulge, S—Shear, P—Penetrometer) ST—Shelby Tube Sample VS—Vane Shear Test
 The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
 NR—No Recovery NP—Nonplastic



STRUCTURE FOUNDATION BORING LOG

PAGE 1 of 2

DATE 8/10/2020

LOGGED BY RT

GSI JOB No. 19059

Project: Geotechnical Investigation For Joint Public Safety Training Campus (JPSTC)

Location: 4301 W. Chicago Avenue, Chicago, Illinois

County: Cook Drilling Method: Hollow Stem Auger/Rotary Hammer Type: CME Automatic

Client: AECOM

BORING No.: SB-41

Northing: 1904391.796

Easting: 1146687.975

Ground Surface Elev. +34.8 CCD

DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)	Surface Water Elev.	DEPTH H (ft)	BLOW S (/6")	UCS Qu (tsf)	MOIST T (%)
				Stream Bed Elev.				
				<u>n/a</u>				
				<u>n/a</u>				
				First Encounter				
				Upon Completion				
				After _____ Hrs.				
12.0" TOPSOIL-black			13					
	AS			SILTY SAND & GRAVEL-gray-medium dense (GM)				
POORLY GRADED SAND-brown-medium dense (SP) Fill	4							
	5							
	6		1					
POORLY GRADED SAND & GRAVEL-gray-loose to medium dense (GP) Fill	4			SILTY CLAY with Sand-gray-very stiff (CL)		14		117
	7					12		
	-5	8	3			-25	17	3.2B 15
becoming brown @ -5.5'	4							
	6							
	6		3					
	3					12		121
	3		10			16		
	-10	4	2.5P			-30	50/4"	4.4B 13
SILTY CLAY-brown & gray-stiff to very stiff (CL)								
	3							
	4							
	5	2.5P	23					
becoming gray @ -13.0'				SILTY CLAY-gray-very stiff (CL-ML)				
	2					20		
	2					50/5"		
	-15	2	1.25P			-35	4.5P	17
SILTY SAND & GRAVEL-gray-medium dense (GM)				SILTY GRAVEL & FRACTURED ROCK-gray-very dense (GM)				
	5					50/4"		
	6							
	-20	7	15			-40		12

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer) ST=Shelby Tube Sample VS=Vane Shear Test
 The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206) The Unit Dry Weight (pcf) is noted in italics above moist (%)
 NR-No Recovery NP=Nonplastic



AMERICAN
SURVEYING & ENGINEERING, P.C.

**GEOPHYSICAL SURVEY
JOINT PUBLIC SAFETY TRAINING CAMPUS
CHICAGO, ILLINOIS**

PROJECT REPORT



AMERICAN SURVEYING & ENGINEERING, PC

OCTOBER 12, 2020

TABLE OF CONTENTS

1. Executive Summary	3
2. Introduction	4
3. Instrumentation	7
4. Data Collection	7
5. Processing	8
6. Conclusions	16
7. Appendix	18

Figures

1. Figure 1 Exhibit of Site	4
2. Figure 2 Site Condition Photo	5
3. Figure 3 Site Condition Photo	6
4. Figure 4 Typical Radargram	8
5. Figure 5 Radargram of Buried Tank and Drums	8
6. Figure 6 – 9 Project Radargrams	9 – 10
7. Figure 10 GPR Soil Suitability Map	11
8. Figure 11 Typical Color Contour Map Scale	13
9. Figure 12 Area 1 Color Contour Map	14
10. Figure 13 Area 3 Color Contour Map	15

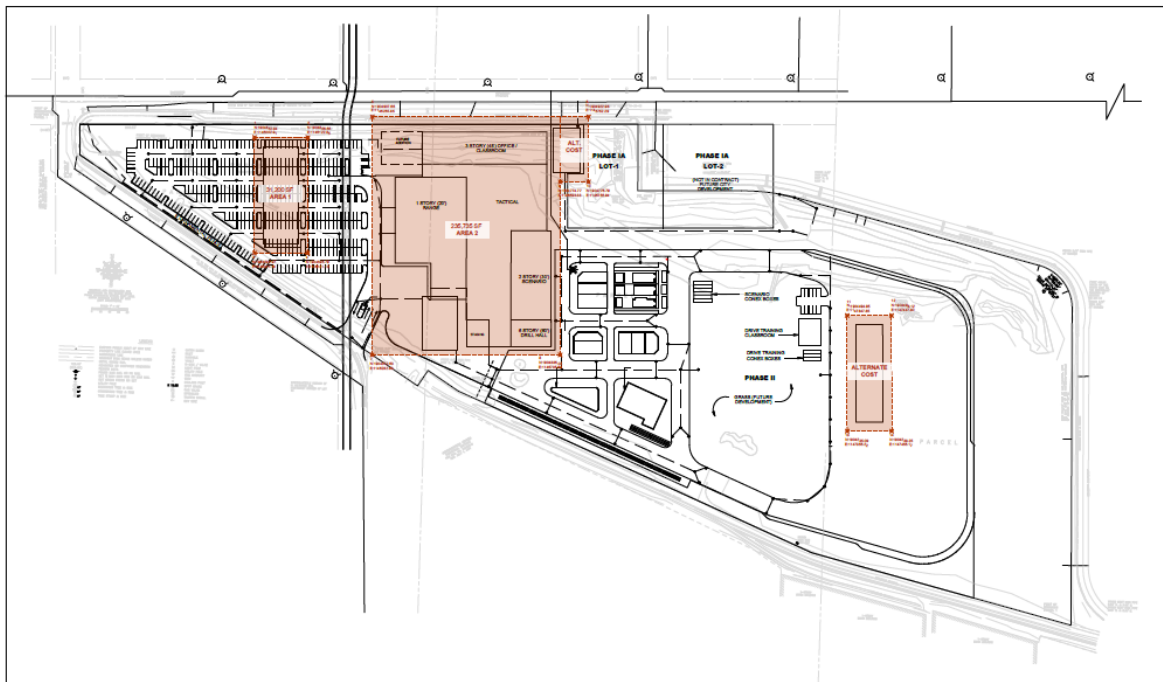
Contact

American Surveying & Engineering, P.C. Coventine Fidis 815-288-6231 841 N. Galena Ave. Dixon, IL

EXECUTIVE SUMMARY

American Surveying & Engineering (ASE) was commissioned by AECOM to perform certain professional services for the proposed Joint Public Safety Training Campus (JPSTC) located at 4301 W. Chicago Ave., Chicago, Illinois. The requested scope of work included performing an ALTA Survey, Topographic Survey and a Geophysical Survey consisting of Electromagnetic (EM) detection (QL B), Ground Penetrating Radar (GPR) and Magnetometer Survey (MAG). The 30-acre site at 4301 W. Chicago Ave., was used as a railroad yard or industrial site with RR sidings from around 1900 through the late 1980s. It is in an industrial and commercial area in West Garfield Park.

This report addresses the Geophysical portion of the scope of work. The below exhibit details the areas where GPR and MAG surveys were performed.



The Site was subsequently razed of all surface features at some point in the 1980s or later. Varying years of aerial photography were examined to assist in the surveillance of potential remnants, articles or targets that might prove disruptive to construction of the proposed facility. The areas requested for the geophysical surveys consisted of proposed areas where buildings would be built.

The area as it existed at the time of the proposed survey was severely overgrown with trees and brush. No work could be conducted in that condition. Clearing and mowing was necessary for the work to be performed. The GPR work was substantially not informative. There were numerous small returns, but depth was limited due to poor soil conditions. No identifiable targets of interest were discovered in the survey area.

The MAG survey was performed and located hundreds of anomalies of small magnitude. As might be expected the anomalies followed the general alignment of previous RR sidings at the site.

INTRODUCTION

The Geophysical surveys were performed in three distinct areas throughout the 30-acre site, from the West to the East Area 1, Area 2 and Area 3. The three areas were visually inspected after the clearing and mowing. The GPR and MAG surveys were performed as two separate surveys over the three separate survey areas. The Exhibit attached shows the approximate limits of the three areas in red.



Figure 1 – Google Earth exhibit of Survey Site

The areas, while cleared, were left in a rough condition with piles of debris, holes where tree stumps and roots were removed and other debris that impaired the collection of data. However, the surveys were carried out at a slower pace and with difficulty. GPR, in particular, requires a smoother ground surface to maintain a close proximity to the ground surface with the antenna.

The size of the three areas are approximately 260' by 120' for Area 1, 525' by 490' for Area 2 and 260' by 100' for Area 3. The areas requested for the geophysical surveys consisted of proposed areas where buildings would be built. Therefore the focus of the Geophysical Survey was to locate objects (targets) that might hamper construction of a building such as Railroad Rails, buried tanks (UST) or drums and other large objects.

There are several monitoring wells on the site. We do not know the origin of the Monitoring Wells nor the purpose. Searching numerous online sources provided no information. The client was unable to furnish any information that would allow us to obtain what might be critical information with respect to the location of underground storage tanks (UST) that may have existed and was the focus of the monitoring wells.



Figure 2 - Photo of site conditions after clearing and mowing



Figure 3 - Photo of site conditions after clearing and mowing

INSTRUMENTATION

The following equipment was used on this project: Trimble R10 GPS unit, GSSI UtilityScan (GPR) unit and a Ferex Foerester 4.032 magnetometer (mag). The FEREX is a vertical gradient fluxgate magnetometer that measures the deformation of the earth's magnetic field evoked by ferromagnetic objects. Magnetometers are suitable for the detection of ferromagnetic metals like iron, steel, or nickel. Normally the detection depth of magnetometers is larger compared to active EMI detectors, but it varies and depends on the object's mass and its magnetic properties. The Ferex magnetometer has an accuracy of +/-2% nanotesla (nT). The Ferex has a sensitivity of -10,000 nT to +10,000 nT . The Ferex will measure and display all results in nT .

Our GSSI Utility Scan GPR unit operates at 350 MHZ with a 1 HZ cycling rate. The GPR produces a visual indication of underground facilities. Unlike other survey methods, signals corresponding to ground penetrating radar (GPR) depend on a multitude of physical properties. The most important physical property to GPR is the dielectric permittivity ($\epsilon\epsilon$), as it greatly influences the velocity, attenuation, reflection, refraction and transmission of radio waves. Dielectric permittivity is considered the diagnostic physical property for GPR. In addition to the dielectric permittivity, the propagation of radio waves through the Earth may depend significantly on the electrical conductivity ($\sigma\sigma$); provided the electrical conductivity of the Earth is sufficiently large. Radio waves will also reflect off of very conductive objects buried in the Earth.

FIELD DATA COLLECTION

The three areas were surveyed to establish the exterior boundaries of the sites and grids were laid out to act as transects or track lines for the collection of both the GPR and the MAG. The grid interval is different for GPR than it is for MAG data collection. Grids were staked in the field. MAG data was collected at ten ft. (10') intervals while GPR was collected at five ft. (5') intervals.

GPR data collection

Field collection for the GPR survey began on September 2nd, 2020 by laying out a five-foot grid along the survey areas. A five-foot grid was staked out for the GPR as suggested by the user manual and personal experience to achieve best results. Poor soil conditions at the site limited the GPR data acquisition to less than a 6-foot depth. Site conditions prevented a perfect grid from being followed. Remaining holes, debris piles, and vegetation had to be avoided so the grid was adjusted accordingly. Rain on September 8th, 9th, and 10th further reduced the depth to only two-and a half foot in many areas. The GPR survey was completed on September 10th, 2020. Only a few small anomalies were observed primarily around the area of the old railroad tracks. Given the shallow depth the GPR unit was able to acquire, the results of the survey are inconclusive.

MAG data collection

MAG data collection began on September 9th, 2020 with the Ferex Magnetometer. Each of the three areas was laid out with parallel transecting lines every ten feet. As suggested by the user manual and personal experience for best results. The survey areas were reviewed for external magnetic interference and noted. The operator also ensured that magnetic influences under our control were removed from the site and the operator is "magnetically clean." Zippers, watches, eyeglass frames, boot grommets, keys, and mechanical pencils can all contain steel or iron. The Magnetometer was compensated daily in a neutral area to correct for daily diurnal changes. The Magnetometer data collection was completed September 15th, 2020.

PROCESSING

GPR processing

The data measured by the GPR system is the amplitude of the signal as a function of its two-way travel time. However, interpretation can be made easier if the information can be represented in terms of depth. Because of this, an apparent depth axis is frequently added to the right-hand side of the radargram (profile). GPR does not measure depths. Rather, it measures time with a very precise clock. The depth is dependent on the speed of the signal through the medium in which it is travelling, the propagation velocity. The signal travels through air at the speed of light, roughly 0.30 meter per nano second. As shown in the figure below.

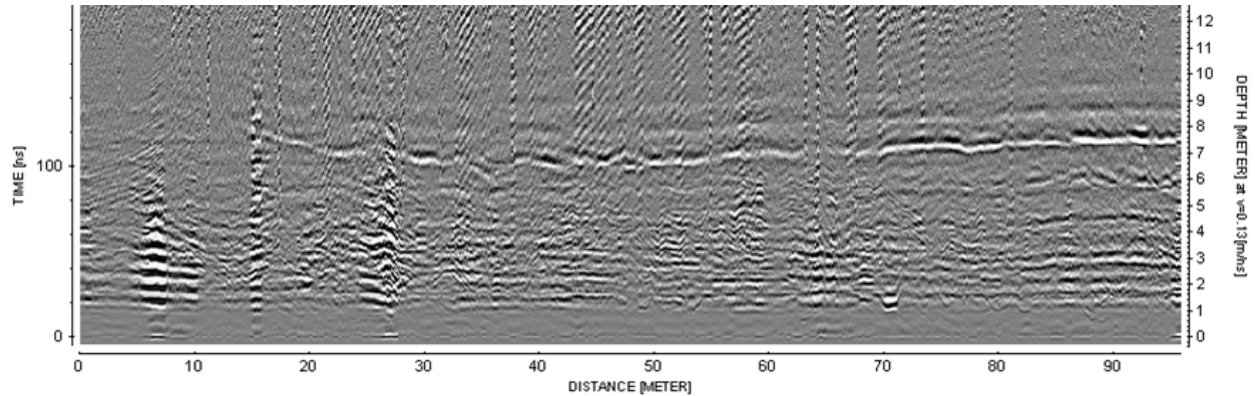


Figure 4 - Typical radargram showing depth by time converted to distance, not from this project

The radargrams are all processed then viewed for artifacts (targets) of interest. Normally pipes, tanks and other manmade objects appear as hyperbolas in the data, as shown below.

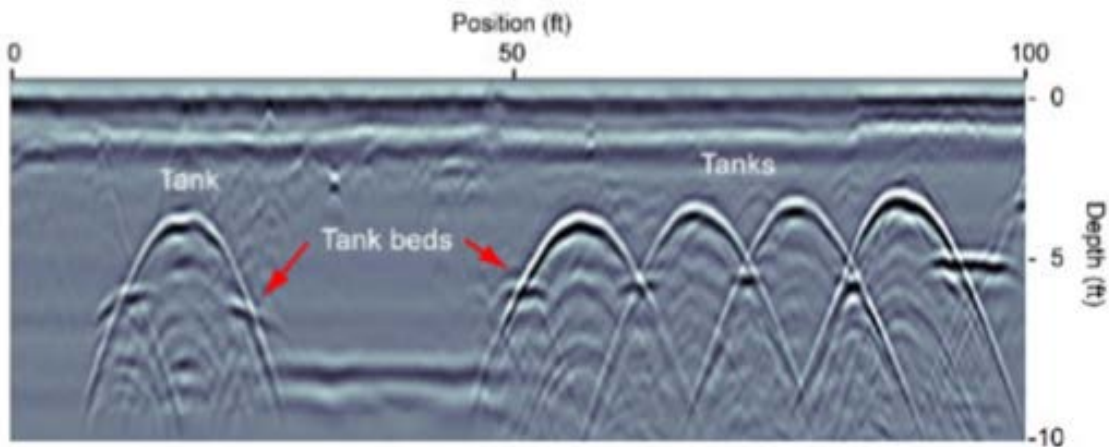


Figure 5 – Radargram of buried tanks, not from this project

Sample Radargrams from this project follow below.

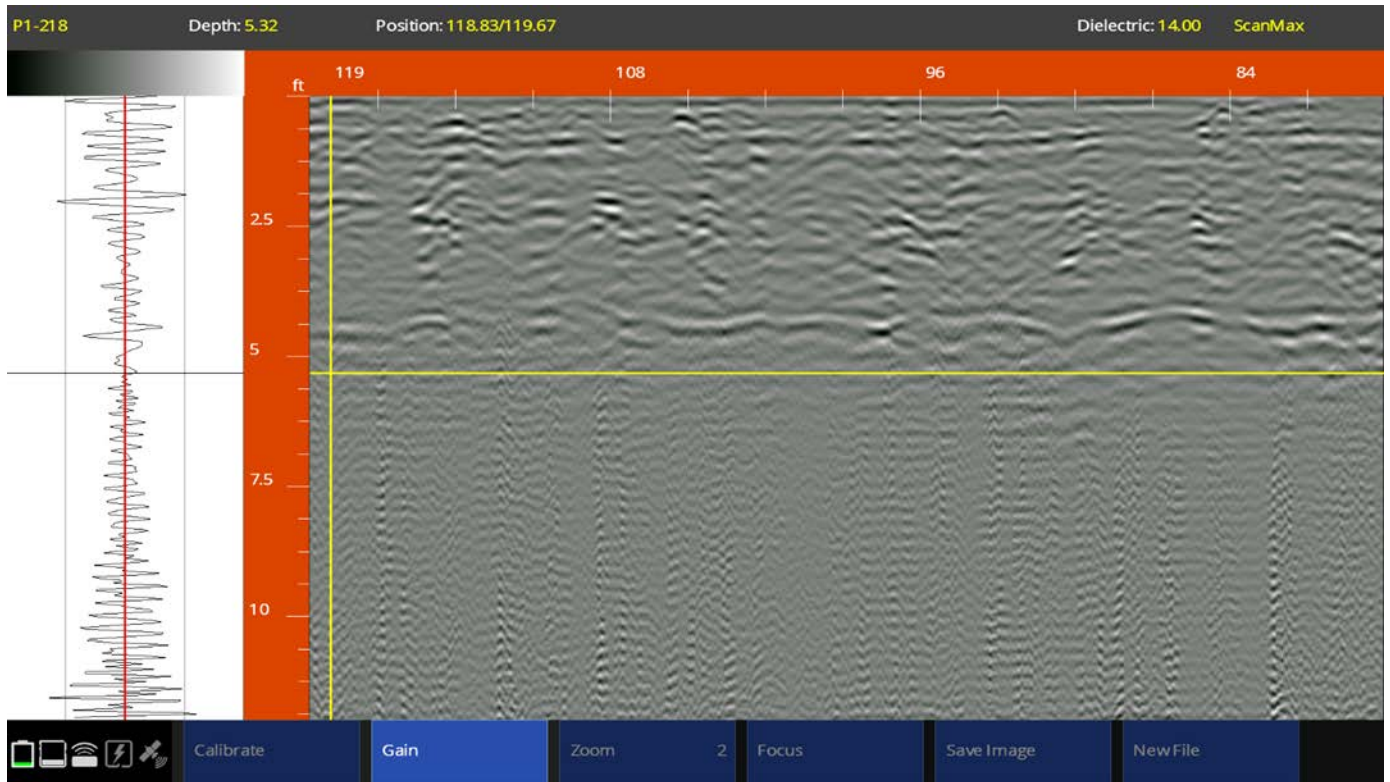


Figure 6 – Radargram from this project to a depth of 5.3 ft. Below that is noise

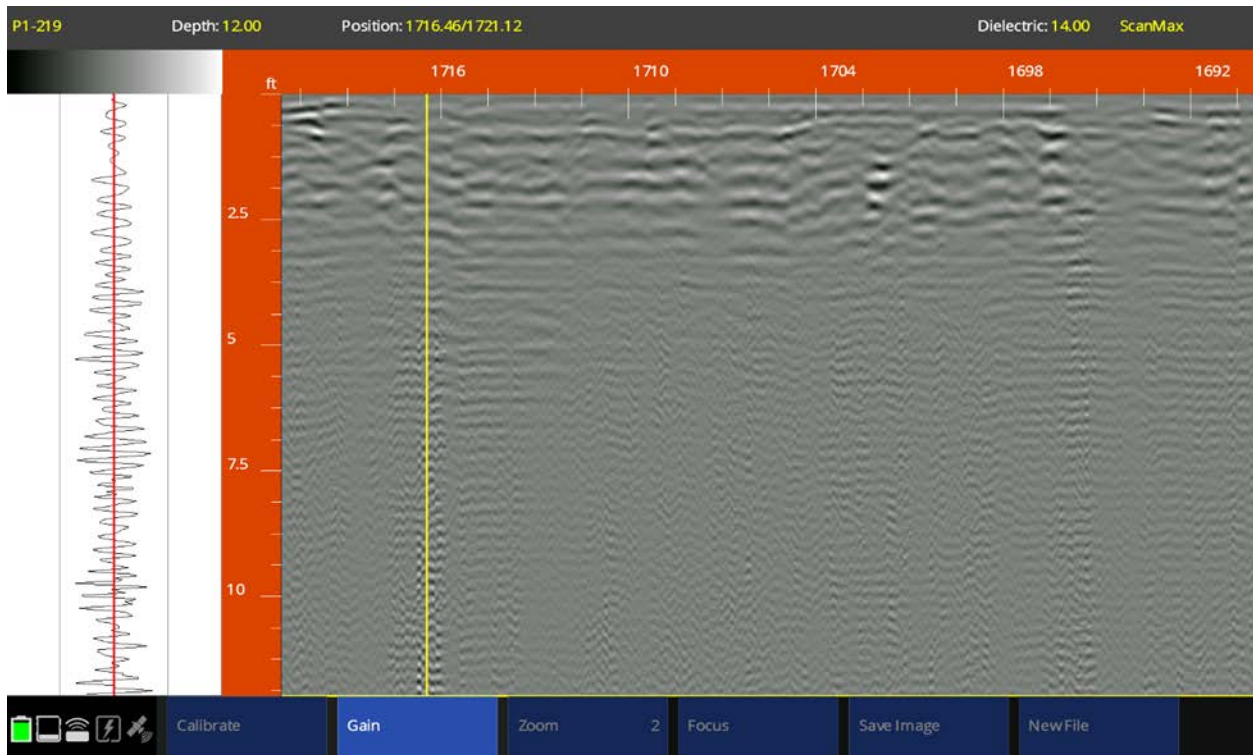


Figure 7 – Radargram from this project showing depth to 2.5 ft. Below that is noise

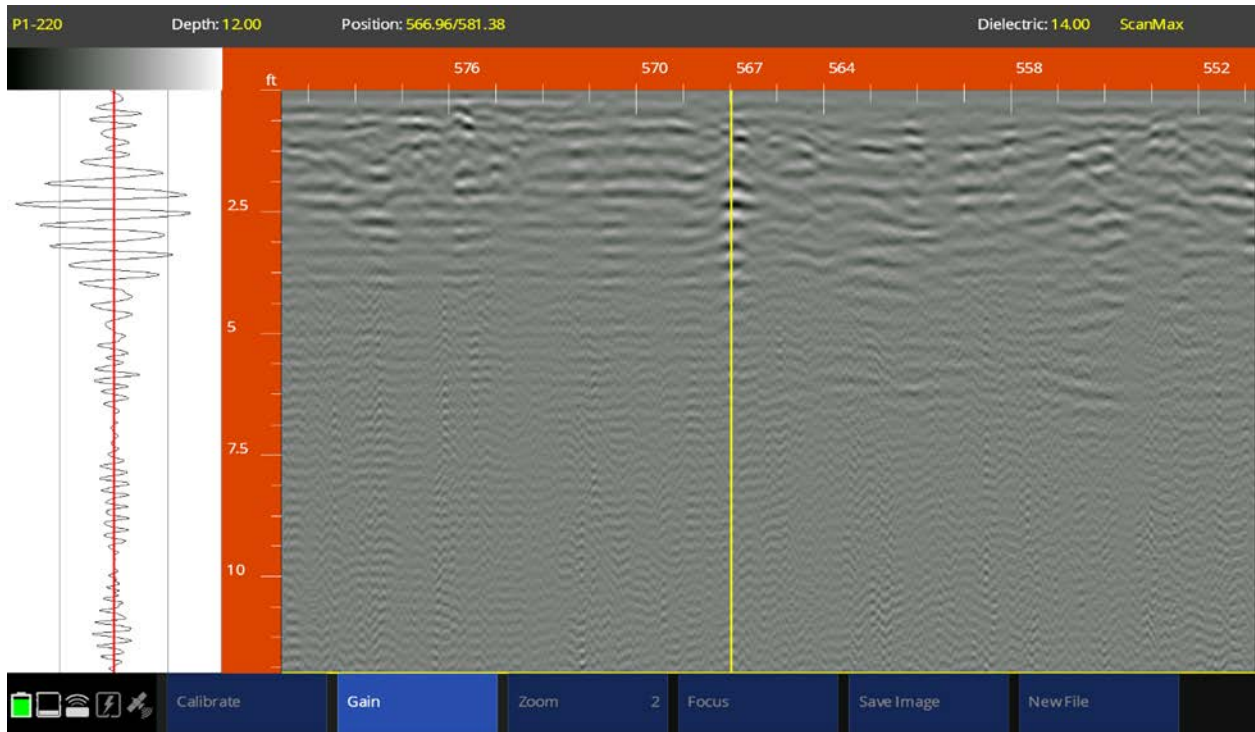


Figure 8 - Radargram from this project showing depth to 4 ft. Below that is noise

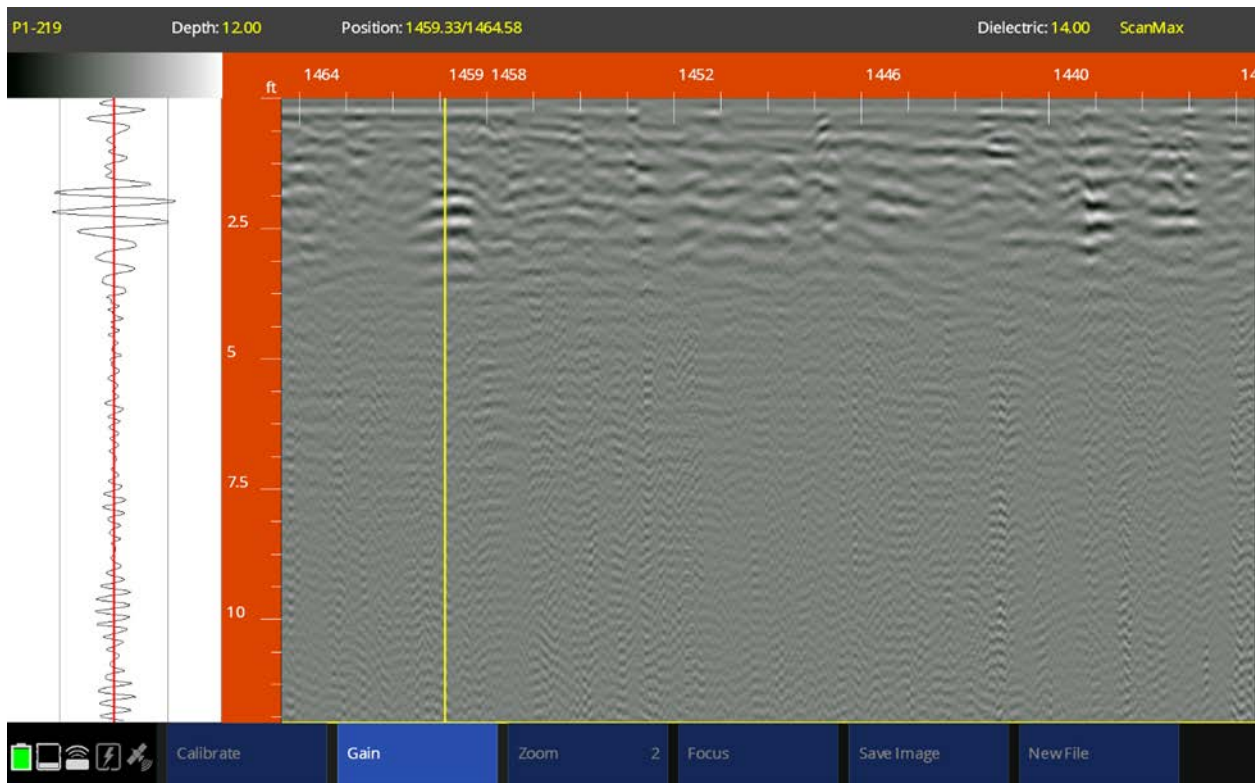


Figure 9 - Radargram from this project showing depth to 3.5 ft. Below that is noise

Careful examination of the radargrams both real time in the field and during processing revealed no tell-tale hyperbolas or other shapes indicative of the targets that we were commissioned to locate. It is clear that there are many small artifacts underground as evidenced by the radargrams, but most are clearly geologic in nature not anthropogenic. It is also clear that small artifacts are abundantly present given the industrial nature of the site. The office processing and review was completed on October 9th, 2020. Radan 7 is the preferred software for processing the GPR data.

The lack of GPR depth throughout the site is due in most part to the subsoils prevalent in this part of Illinois. See Figure 10 below.



Figure 10 – GPR Soil Suitability Map for Illinois. Very Low GPR Index for the project area. Poor likelihood of satisfactory results is prevalent in this area

Magnetometer (MAG) Processing

Data recorded during the field acquisition phase were processed in Geosoft Oasis Montaj Geophysics software. The data was carefully checked and is free from significant interference such as RF (radio frequencies) that would impair the quality of the signals. Field strength is the magnitude of the geomagnetic field, and therefore is a scalar quantity; it is commonly referred to as the 'total field.' The total field is the most commonly and easily measured quantity in surface magnetic surveys. The readings recorded for MAG are measured on a grid. The readings are then assembled into the area for the site survey and recorded in amplitude (also magnitude) of the readings. The technical name for this measure is flux density. The unit of the measurement is nanotesla (nT). The grid of readings is not easy to interpret as a line of readings but make sense when joined with others. The best way to portray the readings are customarily done in contours. There are other means of portraying the results, such as wire frames (3D), color contours, and greyscale contours. For this project we have selected color contours since they are more easily read by the end user. They can also be overlaid on other drawings with less confusion in line work.

Readings that are high indicate artifacts that are ferrous in nature and likely represent a manmade target. As can be seen the survey located hundreds of anomalies of small magnitude. For the most part the readings of greater magnitude follow the areas where railroad sidings were located. When this data is overlain on the topographic map that becomes abundantly clear.

Magnetometers have been used for decades to perform magnetic surveys. Both geologic and anthropogenic features are surveyed. Nearby metal objects may cause interference. Some items, such as automobiles, are obvious, but some subtle interference will be recognized only by the experienced magnetics operator and in careful design of the magnetic survey.

The full presentation of the MAG Color Contour Maps will be presented in full size sheets superimposed over the topographic survey for clarity.

This sample scale of magnitude measured in nanoteslas (nT) is representative of the spread of values for the particular survey area. The scale will vary for each site.

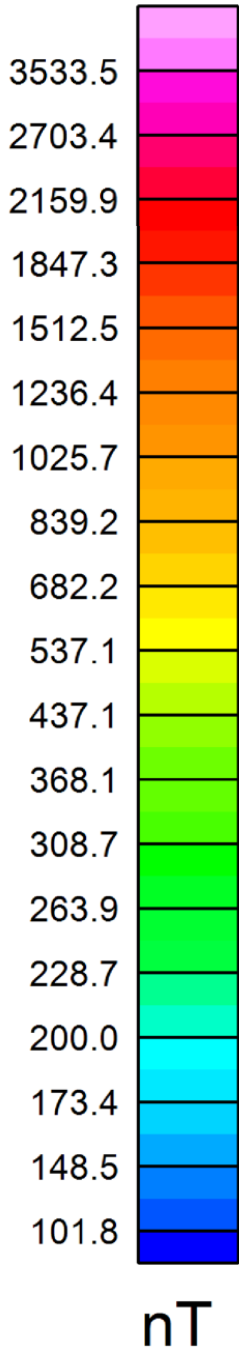


Figure 11 – Sample scale for Area 1 showing Magnitude of magnetic readings in nanoteslas (nT)

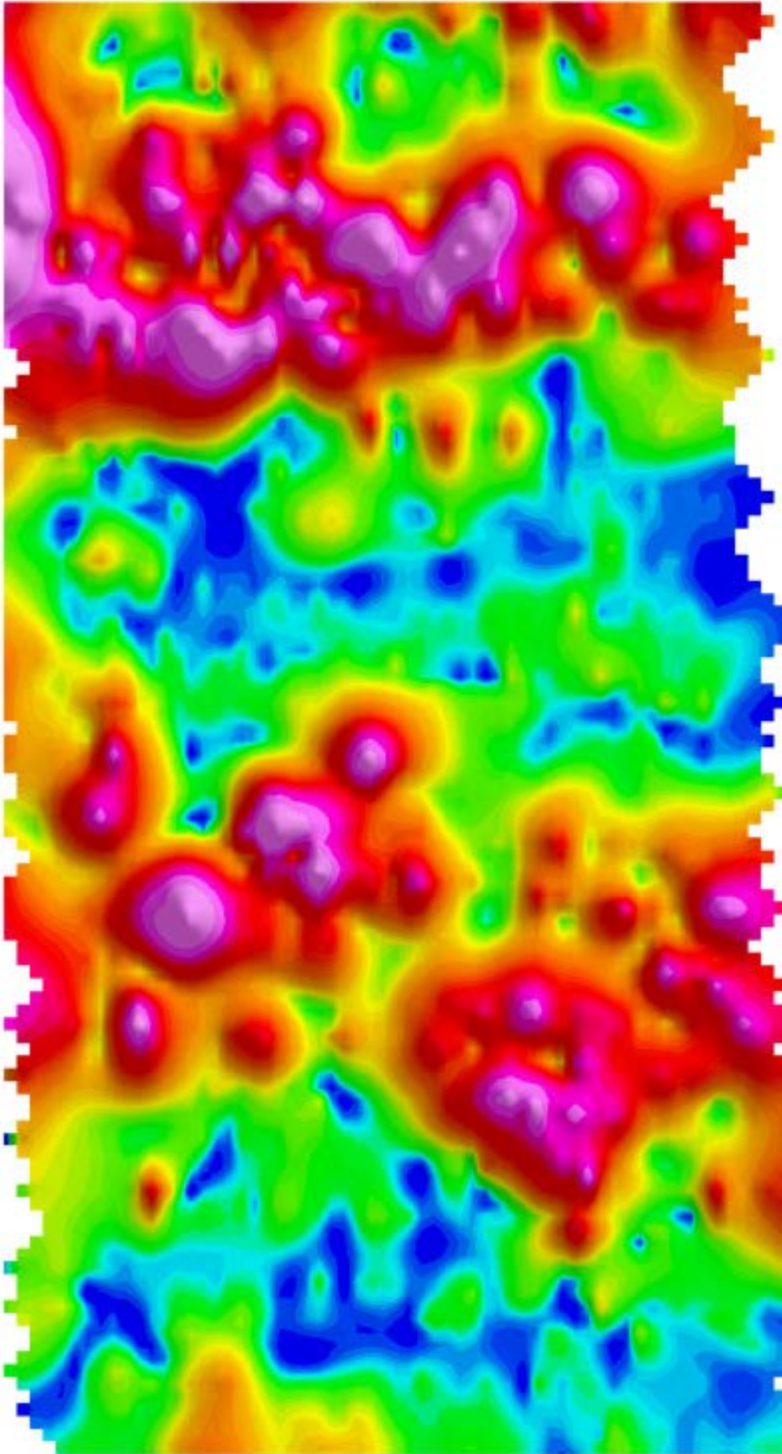


Figure 12 – Area 1 Color Contour Map

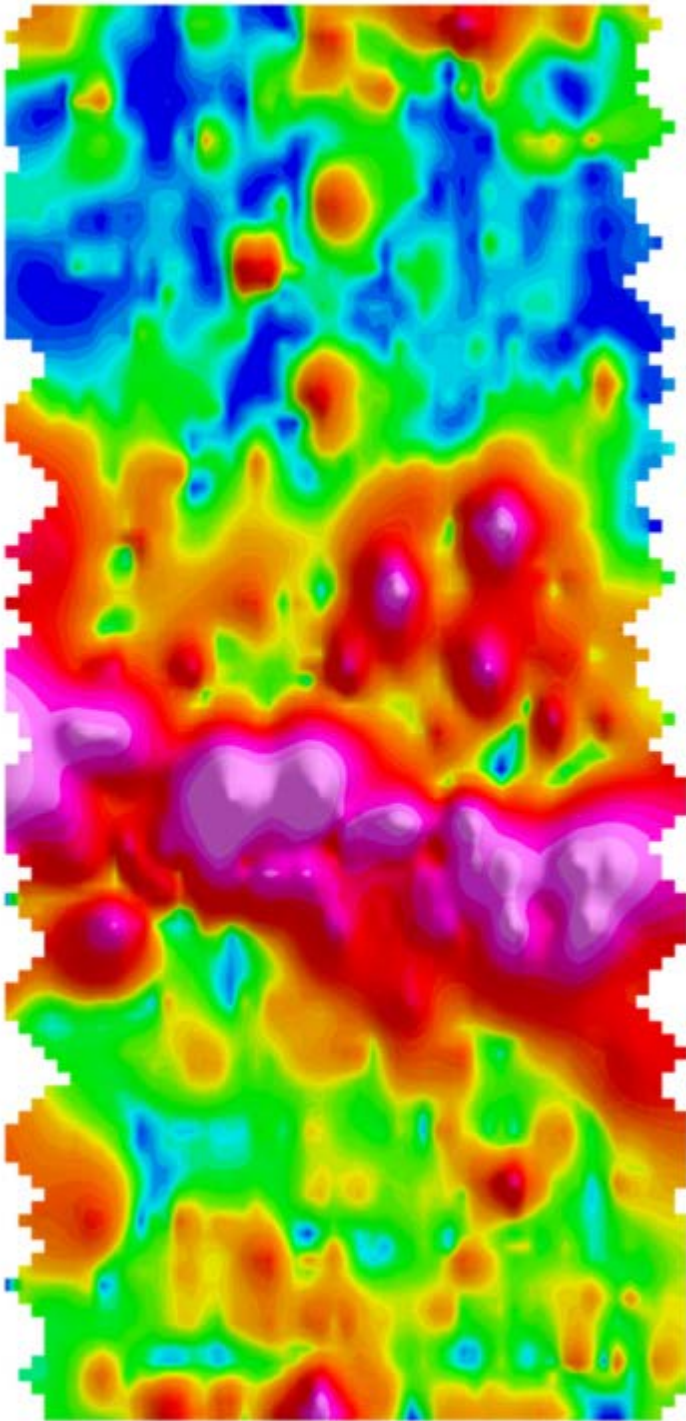


Figure 13 – Area 3 Color Contour Map

CONCLUSION

The best analysis of the data comes from viewing the results of both the Ground Penetrating Radar and the Magnetometer survey together. This provides a more complete understanding of the subsoil conditions on the site and the potential for anomalies that are the subject of this survey.

From examining the GPR survey the site is unremarkable. The MAG survey reveals an area rich in targets. When considered together it is evident that in the area of the survey, we were unable to find significant sized remnants, targets of manmade origin that would hamper the construction of building footing and foundations.

Remote sensing is not a clear-cut science and not without its faults. Please review the Appendix for limitations and comments on the two sources of geophysical survey.

APPENDIX

AMERICAN SURVEYING & ENGINEERING

GROUND PENETRATING RADAR (GPR) LIMITATIONS

Ground Penetrating Radar transmits pulses of high-frequency radio waves down into the ground through a transducer or antenna. Various antennas with various frequencies are used for different applications. The transmitted energy is reflected from various buried objects or distinct contacts between different materials. The antenna receives the reflected waves back and stores them in the digital control unit.

GPR waves reach variable depths depending on antenna frequency and the medium through which it passes. Depths up to 70 feet or more in low conductivity materials such as dry sand or granite is possible. However, clays, shale, and other high conductivity materials, may attenuate or absorb Ground Penetrating Radar signals, greatly decreasing the depth of penetration to 3 feet or less. Depth is a function of the Earth's conductivity in the area tested. The lower the conductivity the deeper the depth of penetration.

The performance capability of this type of radar is strongly dependent on the soil electrical conductivity at the site. If the soil conductivity is high, attenuation of the radar signal in the soil can severely restrict the maximum penetration depth of the radar signal. Whereas maximum penetration depth achievable with these radars can be many feet in favorable conditions, these numbers can be reduced to a few feet or less at many sites in Illinois due primarily to moisture and soil type. The best results are obtained during dry seasons. As such, significant rain events 24 hours prior to or during the GPR survey will impede the work.

There can also be interference, noise, in the signals caused by a variety of underground objects, debris. The specific targets that are the subject of the study can be masked by these objects since the signal can be scattered as the soils are more heterogenous than homogeneous. In addition, the vertical accuracy can often be suspect when there is no means of calibrating the data. That is taking readings on targets of known or verified depths within close proximity to the study area.

We have performed GPR studies in Illinois many times for several years very successfully. However, GPR is not a guaranteed science due to these limitations. Even test pilot areas can be misrepresented by differing soil types or moisture content. No guarantees can be made in advance of performing the work as to its functionality or usefulness. Unfortunately, the risk must be borne solely by the client should you decide to have us perform a GPR Study.

AMERICAN SURVEYING & ENGINEERING

FLUXGATE MAGNETOMETER/ GRADIOMETER LIMITATIONS

To make accurate anomaly maps, temporal changes in the Earth's field during the period of the survey must be considered. Normal changes during a day, sometimes called diurnal drift, are a few tens of nT, but changes of hundreds or thousands of nT may occur over a few hours during magnetic storms. During severe magnetic storms, which occur infrequently, magnetic surveys should not be made. The correction for diurnal drift can be made by repeat measurements of a base station at frequent intervals. The measurements at field stations are then corrected for temporal variations by assuming a linear change of the field between repeat base station readings. However, many external factors will impact the effectiveness of Magnetometer surveys.

Intense fields from man-made electromagnetic sources can be a problem in magnetic surveys. Most magnetometers are designed to operate in intense 60-Hz and radio frequency fields. However, extremely low frequency fields caused by equipment using direct current or the switching of large alternating currents can be a problem. Pipelines carrying direct current for cathodic protection can be particularly troublesome. Although some modern ground magnetometers have a sensitivity of 0.1 nT, sources of cultural and geologic noise usually prevent full use of this sensitivity in ground measurements. Nearby metal objects may cause interference. Some items, such as automobiles, are obvious, but some subtle interference will be recognized only by the experienced magnetics operator and in careful design of the magnetic survey. Old buried curbs and foundations with rebar, scrap iron, buried cans and bottles, power lines, fences, and other hidden factors can greatly affect magnetic readings.

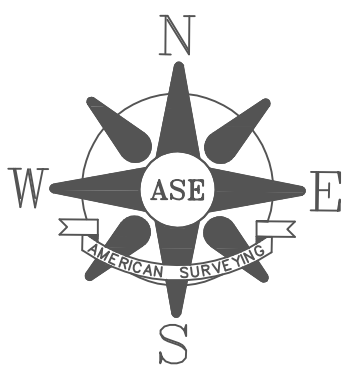
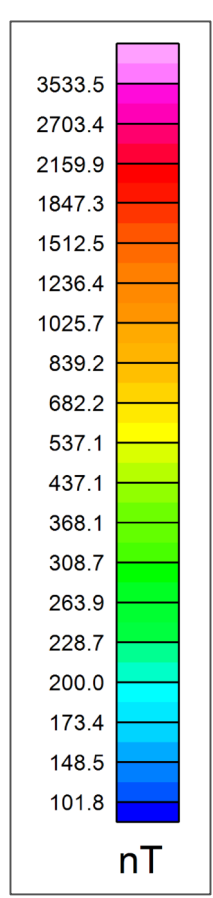
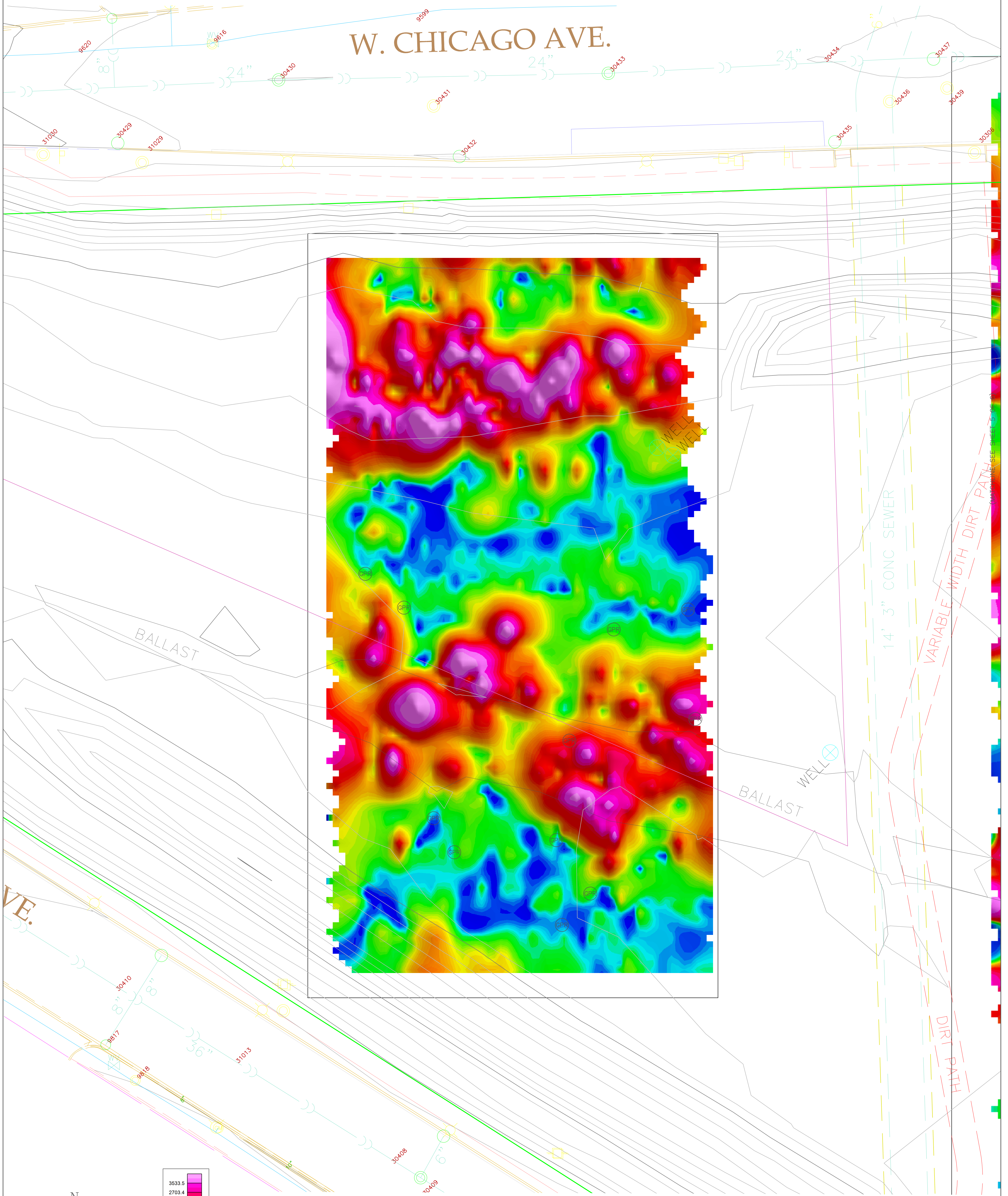
From a geologic standpoint, magnetite and its distribution determine the magnetic properties of most rocks. There are other important magnetic minerals in mining prospecting, but the amount and form of magnetite within a rock determines how most rocks respond to an inducing field. Iron, steel, and other ferromagnetic alloys have susceptibilities one to several orders of magnitude larger than magnetite. However, the importance of magnetite cannot be exaggerated. Some tests on rock materials have shown that a rock containing 1% magnetite may have a susceptibility as large as 10^{-3} , or 1,000 times larger than most rock materials.

Many urban areas or industrial sites are littered with the presence of ferrous materials. These materials in ordinary municipal trash and in most industrial waste does allow the magnetometer to be effective in direct detection of landfills. Other ferrous objects, which may be detected, include pipelines, underground storage tanks, buried storage barrels and in areas where military operations have been performed ordnance. However, in areas of considerable surface anomalies, more important targets may be masked from interpretation by their presence.

MAGNETOMETER RESULTS EXHIBIT

PART OF THE NORTH HALF OF SECTION 1,
TOWNSHIP 39 NORTH, RANGE 13 EAST
COOK COUNTY, IL

W. CHICAGO AVE.



BEARINGS AND COORDINATES ARE REFERENCED TO THE ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE, NORTH AMERICAN DATUM OF 1983 (2011 ADJUSTMENT).

NOT TO SCALE

- LEGEND**
- EXISTING PUBLIC RIGHT OF WAY LINE
 - PROPERTY LINE (LEASE LINE)
 - SUBDIVISION LINE
 - WROUGHT IRON FENCE UNLESS NOTED
 - METAL GUARD RAIL
 - MEASURED OR COMPUTED DIMENSION
 - RECORD DATA
 - FOUND MAG NAIL OR PK NAIL
 - SET 1/8 INCH IRON ROD OR MAG NAIL
 - CUT CROSS FOUND OR SET
 - UTILITY POLE
 - DECIDUOUS TREE & SIZE
 - CONIFEROUS TREE & SIZE
 - TREE STUMP & SIZE
 - GPR
 - GROUND PENETRATING RADAR RESPONSE

- CATCH BASIN
- INLET
- MANHOLE
- VAULT
- B-BOX / VALVE
- LIGHT POLE
- UTILITY POLE
- FIRE HYDRANT
- SIGN
- BOLLARD POST
- SPOT GRADE
- GAS VALVE
- SPRINKLER
- TRAFFIC SIGNAL
- GUY WIRE



AMERICAN SURVEYING & ENGINEERING, P.C.

SURVEYORS - ENGINEERS - GEODESISTS - MAPPING SCIENTIST
ILLINOIS PROFESSIONAL DESIGN FIRM NO. 184-003192 WWW.AMERICANSURVEY.COM

841 N. Galena Ave. 30 N. LaSalle St. Suite 3440 1548 Bond St. Suite 105
Down. IL 61021 Chicago, IL 60602 Naperville, IL 60563
815-288-6231 / Fax 815-288-6277 312-277-2000 / Fax 312-277-2002 630-897-4105 / Fax 630-897-4121

CLIENT: AECOM

PIN SURVEYED: 16-10-200-061-0000

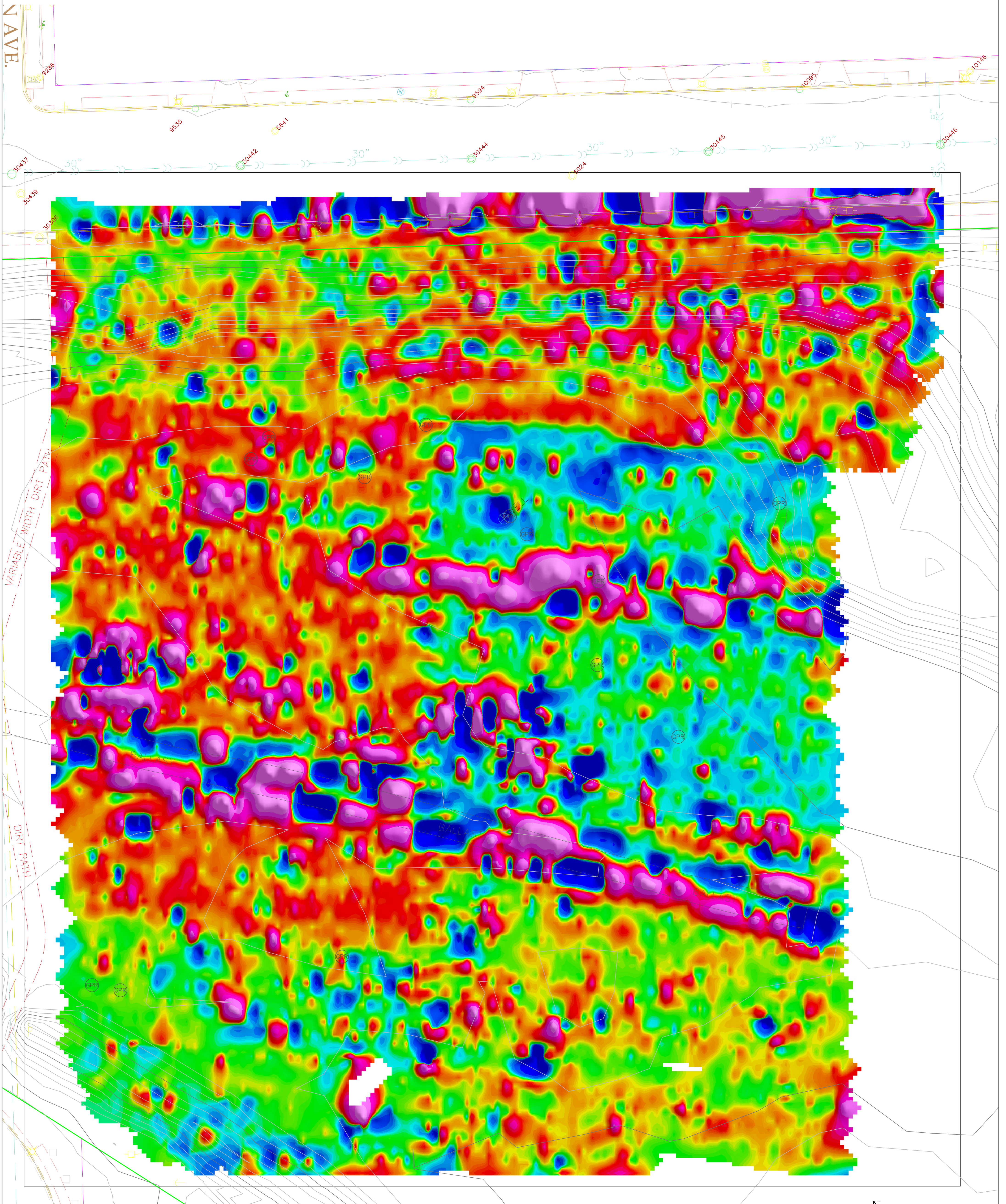
PROJECT: 4301 W. CHICAGO AVE., CHICAGO

TASK ORDER:

1	REVISION	REV. DATE
	LOCATION: 4301 W. CHICAGO AVE., CHICAGO	
	PROJECT NO: 219076	DATE: 9/18/2020
	DRAWN BY: M. BARAN Z. RAWLINGS	SHEET: 2 of 4

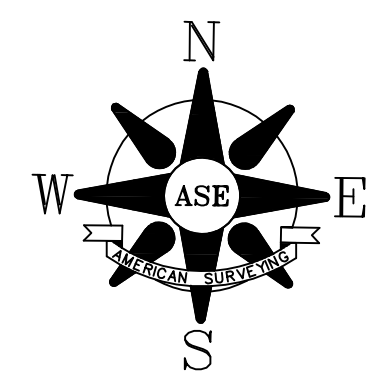
MAGNETOMETER RESULTS EXHIBIT

PART OF THE NORTH HALF OF SECTION 1,
TOWNSHIP 39 NORTH, RANGE 13 EAST
COOK COUNTY, IL



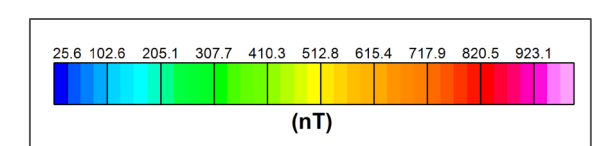
LEGEND

- | | | | |
|--|-----------------------------------|--|----------------|
| | EXISTING PUBLIC RIGHT OF WAY LINE | | CATCH BASIN |
| | PROPERTY LINE (LEASE LINE) | | INLET |
| | SUBDIVISION LINE | | MANHOLE |
| | WROUGHT IRON FENCE UNLESS NOTED | | VAULT |
| | METAL GUARD RAIL | | B-BOX / VALVE |
| | MEASURED OR COMPUTED DIMENSION | | LIGHT POLE |
| | RECORD DATA | | UTILITY POLE |
| | FOUND MAG NAIL OR PK NAIL | | FIRE HYDRANT |
| | SET 3/8 INCH IRON ROD OR MAG NAIL | | SIGN |
| | CUT CROSS FOUND OR SET | | BOLLARD POST |
| | UTILITY POLE | | SPOT GRADE |
| | DECIDUOUS TREE & SIZE | | GAS VALVE |
| | CONIFEROUS TREE & SIZE | | SPRINKLER |
| | TREE STUMP & SIZE | | TRAFFIC SIGNAL |
| | GROUND PENETRATING RADAR RESPONSE | | GUY WIRE |



BEARINGS AND COORDINATES ARE REFERENCED TO THE ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE, NORTH AMERICAN DATUM OF 1983 (2011 ADJUSTMENT).

NOT TO SCALE



AMERICAN SURVEYING & ENGINEERING, P.C.

SURVEYORS - ENGINEERS - GEODESISTS - MAPPING SCIENTIST
ILLINOIS PROFESSIONAL DESIGN FIRM NO. 184-003192 WWW.AMERICANSURVEY.COM
841 N. Galena Ave. 30 N. LaSalle St. Suite 3440 1548 Bond St. Suite 105
Down. IL 61021 Chicago, IL 60602 Naperville, IL 60563
815-288-6231 / Fax 815-288-6277 312-277-2000 / Fax 312-277-2002 630-897-4105 / Fax 630-897-4121

CLIENT: AECOM

PIN SURVEYED: 16-10-200-061-0000

PROJECT: 4301 W. CHICAGO AVE., CHICAGO

TASK ORDER:

LOCATION: 4301 W. CHICAGO AVE., CHICAGO

PROJECT NO: 219076

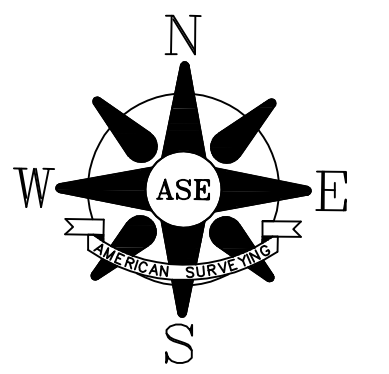
DRAWN BY: M. BARAN Z. RAWLINGS

DATE: 9/18/2020

SHEET: 3 of 4

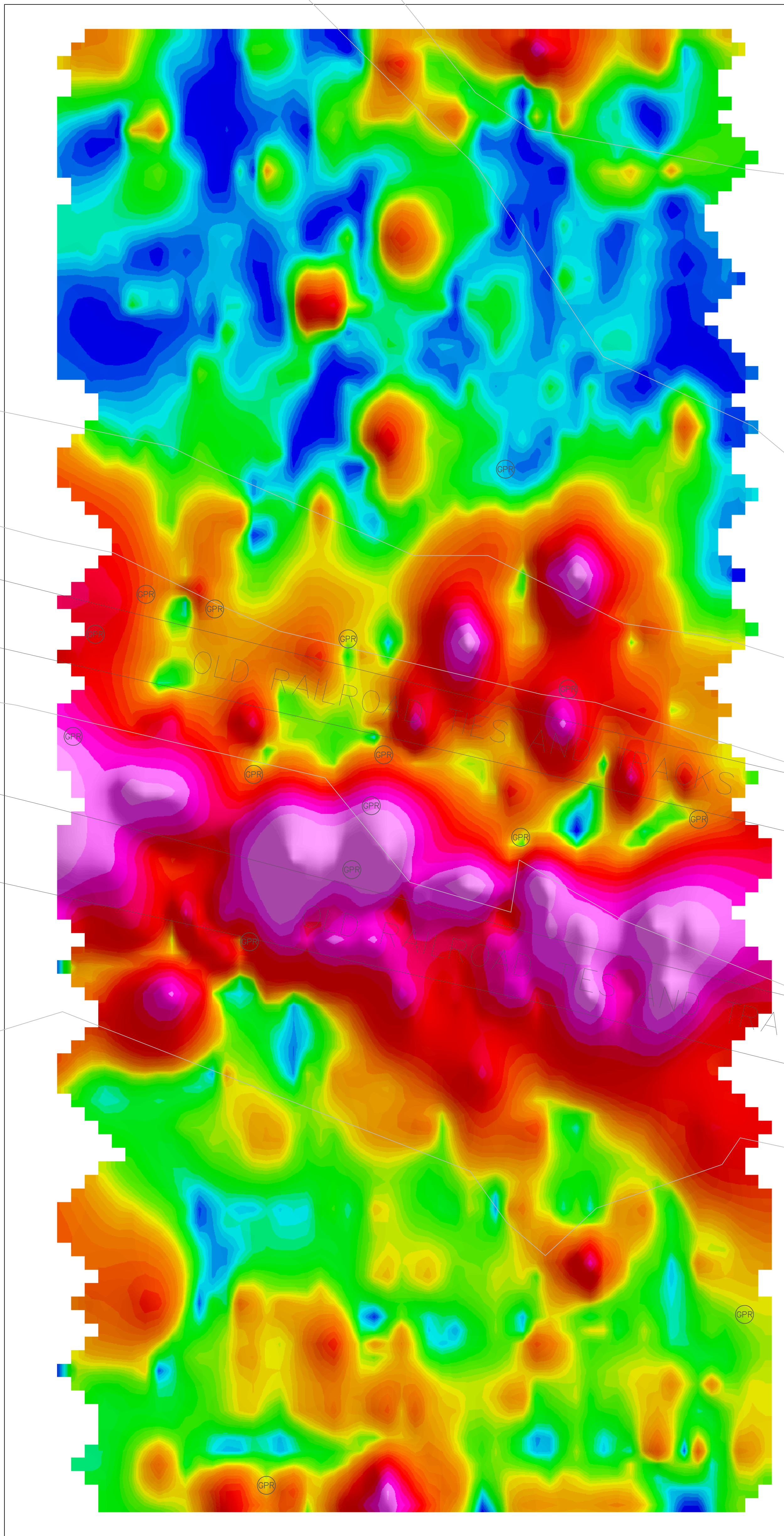
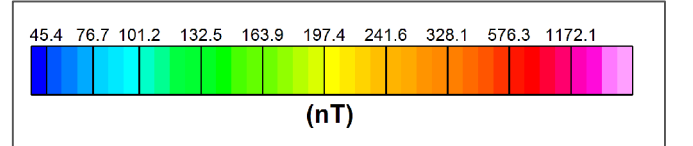
MAGNETOMETER RESULTS EXHIBIT

PART OF THE NORTH HALF OF SECTION 1,
TOWNSHIP 39 NORTH, RANGE 13 EAST
COOK COUNTY, IL



BEARINGS AND COORDINATES ARE REFERENCED TO THE ILLINOIS STATE PLANE COORDINATE SYSTEM, EAST ZONE, NORTH AMERICAN DATUM OF 1983 (2011 ADJUSTMENT).

NOT TO SCALE



LEGEND

- | | | | |
|--|-----------------------------------|--|----------------|
| | EXISTING PUBLIC RIGHT OF WAY LINE | | CATCH BASIN |
| | PROPERTY LINE (LEASE LINE) | | INLET |
| | SUBDIVISION LINE | | MANHOLE |
| | WROUGHT IRON FENCE UNLESS NOTED | | VAULT |
| | METAL GUARD RAIL | | B-BOX / VALVE |
| | MEASURED OR COMPUTED DIMENSION | | LIGHT POLE |
| | RECORD DATA | | UTILITY POLE |
| | FOUND MAG NAIL OR PK NAIL | | FIRE HYDRANT |
| | SET 3/8 INCH IRON ROD OR MAG NAIL | | SIGN |
| | CUT CROSS FOUND OR SET | | BOLLARD POST |
| | UTILITY POLE | | SPOT GRADE |
| | DECIDUOUS TREE & SIZE | | GAS VALVE |
| | CONIFEROUS TREE & SIZE | | SPRINKLER |
| | TREE STUMP & SIZE | | TRAFFIC SIGNAL |
| | GROUND PENETRATING RADAR RESPONSE | | GUY WIRE |



AMERICAN SURVEYING & ENGINEERING, P.C.

SURVEYORS - ENGINEERS - GEODESISTS - MAPPING SCIENTIST
ILLINOIS PROFESSIONAL DESIGN FIRM NO. 184-003192 WWW.AMERICANSURVEY.COM
841 N. Galena Ave. 30 N. LaSalle St. Suite 3440 1548 Bond St. Suite 105
Dixon, IL 61021 Chicago, IL 60602 Naperville, IL 60563
815-288-6231 / Fax 815-288-6277 312-277-2000 / Fax 312-277-2002 630-897-4105 / Fax 630-897-4121

CLIENT: AECOM

PIN SURVEYED: 16-10-200-061-0000

PROJECT: 4301 W. CHICAGO AVE., CHICAGO

LOCATION: 4301 W. CHICAGO AVE., CHICAGO

PROJECT NO: 219076

TASK ORDER:

DRAWN BY: M. BARAN Z. RAWLINGS

DATE: 9/18/2020

SHEET: 4 of 4



PHASE I ENVIRONMENTAL SITE ASSESSMENT

4301 W. Chicago Avenue

Chicago, Illinois

Property Index Number: 16-10-200-061-0000

Prepared for:

City of Chicago Department of Fleet and Facility Management

30 North LaSalle, Suite 300

Chicago, Illinois 60602-2575

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.

8745 West Higgins Road, Suite 300

Chicago, Illinois 60631

December 6, 2017

Project No. 3205171606

Copyright © 2015 by Amec Foster Wheeler Environment & Infrastructure, Inc.
All rights reserved.



amec
foster
wheeler

December 11, 2017

Ms. Abby Mazza, P.E.
City of Chicago Department of Fleet and Facility Management
30 North LaSalle Street, Suite 300
Chicago, Illinois 60602-2575

Subject: Phase I Environmental Site Assessment
4301 West Chicago Avenue
Chicago, Illinois
Project No. 3205171606

Dear Ms. Mazza:

Amec Foster Wheeler Environment & Infrastructure, Inc. is pleased to present this Phase I Environmental Site Assessment (ESA) report for the above-referenced site in Chicago, Illinois. Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition is expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase have been updated in this, the final Phase I ESA report.

We have appreciated the opportunity to serve you on this project. If you have any questions or desire further information, please feel free to contact us at 773-693-6030.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure, Inc.

Mary E. Jank, PG
Sr. Associate

for Carmen Yung, LEED AP *w/permission*
Yung Environmental, Inc.

Attachments



TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY.....	IV
1.0 INTRODUCTION.....	1
1.1 Project Overview.....	1
1.2 Property Description	2
1.3 Scope of Work	2
1.4 Limitations, Exceptions, Special Terms and Conditions	3
1.4.1 Significant Assumptions.....	5
1.4.2 User Reliance	5
1.5 Data Gaps.....	6
2.0 PROPERTY OVERVIEW	6
2.1 Property Location and Land Use	6
2.1.1 Property Location.....	6
2.1.2 Current Uses of the Adjoining Properties.....	6
2.1.3 Utilities	7
2.2 Physical Setting	7
2.2.1 Topography.....	7
2.2.2 Geology/Hydrogeology	7
2.2.3 Surface Water Bodies	9
2.2.4 Wetlands.....	9
2.2.5 Flood Maps	9
3.0 PROPERTY BACKGROUND/OPERATING HISTORY	9
3.1 Interviews.....	9
3.1.1 Interview With Property Owner	10
3.1.2 Attempted Interviews	11
3.2 Aerial Photographs	11
3.3 Historical Topographic Maps	12
3.4 Fire Insurance Maps	13
3.5 Local Street Directory	14
3.6 User Provided Information	14
3.6.1 Environmental Liens or Activity and Use Limitations	15
3.6.2 Specialized Knowledge.....	16
3.6.3 Valuation Reduction for Environmental Issues	19
3.7 Vapor Migration/Intrusion Evaluation.....	19
4.0 REGULATORY REVIEW.....	19
4.1 Regulatory Database Search and Significant Findings	19
4.1.1 EDR Identified Sites.....	20
4.1.2 Orphan sites List.....	27

4.2	Additional Environmental Record Sources	27
4.2.1	City of Chicago.....	27
4.2.2	Illinois Environmental Protection Agency.....	28
4.2.3	United State Environmental Protection Agency	28
4.2.4	Illinois Office of the State Fire Marshal	28
5.0	PROPERTY INSPECTION	29
5.1	Site Reconnaissance	29
5.1.1	Hazardous Substances and Petroleum Products Storage Containers	29
5.1.2	Aboveground Storage Tanks/Underground Storage Tanks.....	29
5.1.3	Buildings and Structures	30
5.1.4	Odors/Staining	30
5.1.5	Drums/Unidentified Substance Containers	30
5.1.6	Debris 30	
5.1.7	Asbestos Containing Materials	30
5.1.8	Transformers.....	30
5.1.9	Stressed Vegetation.....	30
5.1.10	Other Notable Features	30
5.2	Adjacent Properties Reconnaissance.....	31
5.2.1	Hazardous Substances and Petroleum Products Storage Containers	31
5.2.2	Aboveground Storage Tanks/Underground Storage Tanks.....	31
5.2.3	Buildings and Structures	31
5.2.4	Odors/Staining	31
5.2.5	Drums/Unidentified Substance Containers	31
5.2.6	Debris 31	
5.2.7	Transformers.....	31
5.2.8	Stressed Vegetation.....	31
5.2.9	Other Notable Features	32
6.0	CONCLUSIONS AND RECOMMENDATIONS	32
7.0	SIGNATURE(S) OF ENVIRONMENTAL PROFESSIONAL(S)	35

TABLES

Table 1: Adjoining Properties7
Table 2: Site Utilities.....7
Table 3: Summary of Interviews 10
Table 4: Aerial Photograph Search Results 11
Table 5: Historical Topographic Map Search Results 12
Table 6: Sanborn Fire Insurance Map Search Results 13
Table 7: Information Obtained from User Questionnaire..... 15
Table 8. Environmental Database Search Results.....20
Table 9: On-Site RECs.....33
Table 10: Off-Site RECs.....33

FIGURES

Figure 1 Site Location
Figure 2 Site Layout

APPENDICES

Appendix A Aerial Photographs
Appendix B Topographic Maps
Appendix C Sanborn Maps
Appendix D City Directories
Appendix E Title Search Information
Appendix F Regulatory Database Information
Appendix G Interview Documentation
Appendix H FOIA Requests/Responses
Appendix I Photographs
Appendix J Addendum Information (Reserved)
Appendix K Consultant Qualifications

EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), was retained by the City of Chicago Department of Fleet and Facility Management (2FM) to conduct a Phase I Environmental Site Assessment (ESA) for the site located at 4301 West Chicago Avenue in Chicago, Cook County, Illinois (the site) in general accordance with the scope and limitations of ASTM International (ASTM) E 1527-13, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition is expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase have been updated by our subcontractor, Yung Environmental, Inc. in this final Phase I ESA report.

The site is a 30.4-acre parcel that is currently vacant. This Phase I ESA was performed in conformance with the scope and limitations of ASTM International (ASTM) Standard E 1527-13.

The purpose of this Phase I ESA was to identify known environmental conditions or concerns associated with the site, which include any recognized environmental conditions (RECs) associated with the site. RECs do not include *de minimis* conditions that generally do not present a material risk of harm to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. The results of our Phase I ESA are summarized below.

Site History

Based on a review of reasonably ascertainable records, the site was vacant prior to its first developed usage. The site was developed as a rail yard by 1900 according to historic topographic maps. Previous environmental reports for the site indicate that the rail yard was constructed in 1896 by the Chicago and Northwestern Transportation Company on previously undeveloped land. By 1978-1980, most of the rail yard tracks were gone, and by at most 2002, the parcel was totally vacant.

Site Reconnaissance

At the time of Yung Environmental, Inc.'s site reconnaissance on November 15, 2017, the site was observed to be vacant. Yung Environmental, Inc. did not observe evidence of aboveground storage tanks (ASTs), underground storage tanks (USTs), odors, pools of liquid, drums, containers storing potentially hazardous substances or petroleum products, stains or corrosion, pits, ponds, or lagoons. Significant amounts of debris and mounded soil were present and a small demolished building structure was noted in the northwest.

Environmental Records

Review of the federal, state, and tribal (if appropriate) records, including a proprietary records summary provided by Environmental Data Resources, Inc. (EDR), a third-party provider of environmental and land use records, indicates that properties of environmental concern are located within the respective ASTM standard search distances for each category. The property itself has environmental concerns with regard to an UST which may have been present on the property and has no closure documentation (No Further Remediation or NFR letter) and contaminants consisting of metals and polynuclear aromatic hydrocarbons discovered in previous site investigations.

Amec Foster Wheeler has screened the identified properties for significance with respect to their potential impact on the site based on reasonably ascertainable information obtained from the records review, site reconnaissance, and interviews. Based on distances from the site boundary, the types of listings, and the assumed direction of groundwater flow, none of the properties listed is likely to have a negative impact on the site except:

- CTA at 4401 West Chicago Avenue, due to USTs installed in 1992, and because it is a former rail yard and may have fill similar to the site.
- Rail IT Property, 733 North Kilbourn Avenue, due to an UST that was not closed. It is unclear if this is the site or adjacent, as Rail IT at one time owned the site and the street number identified in the EDR report could potentially put it near the southeast corner of Chicago and Kilbourn Avenues, which would be the site.
- Department of Streets and Sanitation, 750 North Kilbourn Avenue, adjacent across North Kilbourn Avenue, due to USTs removed but not closed and since it is a transfer station and incinerator which may have resulted in airborne particulates reaching the site.
- City of Chicago, 715 North Kilbourn Avenue, due to an UST that was not closed. The initial incident report for #940242 lists 715 N. Kilbourn Avenue and then subsequent documentation on the Illinois EPA website for this incident changed to 750 N. Kilbourn Avenue. Amec Foster Wheeler believes the address was mis-identified in the original report and subsequently corrected. Although an incident was reported, a subsequent Illinois EPA letter indicates the site is a non-LUST site, which could indicate there was no confirmed release, or that the incident was from a non-regulated tank.

Phase II Assessment 2017

A Draft Phase I ESA report was prepared in June 2017, and based on that report, a Phase II investigation was completed which included the installation of twenty-four (24) soil borings and two (2) temporary wells. Twenty-six soil samples were obtained and four (4) groundwater samples (2 groundwater samples were from wells already present on the site). Samples were compared to TACO Tier 1 objectives for industrial/commercial sites with Class II groundwater. Based on the

Phase II and previous site investigations, concentrations of PNAs, arsenic, and antimony were detected in soils at concentrations above the objectives. No detected concentrations in groundwater exceeded the objectives. A TACO Tier 2 assessment concluded that the groundwater pathway could be excluded for antimony and benzo(a)anthracene above the soil component of groundwater ingestion objective and that averaging of PNAs and arsenic above the soil ingestion objective would result in three (3) locations which would require remediation or the use of engineered barriers for site closure.

Conclusions

No significant data gaps were identified that affected Amec Foster Wheeler’s ability to identify RECs for the site, except overgrown vegetation which prevented viewing all of the ground surface.

Amec Foster Wheeler has performed this Phase I ESA in conformance with the scope and limitations of ASTM Standard E 1527-13. This assessment has revealed no evidence of RECs in connection with the site, except for the following:

Table 9: On-Site RECs

PIN#	Address	Acreage	Current/ Historic Land	RECs	COCs	Pathways
16-10-200-061-0000	4301 W Chicago Ave	30.4	Vacant/ Former Railyard	USTs	BTEX, Lead, PNAs	Groundwater, Soil Ingestion, Soil Inhalation, Vapor Intrusion
				Fill, Debris	PNAs, Metals	
				Rail Ties	Arsenic, Cresols	
				Previous Contaminants	PNAs, Metals	

Off-site sources of contamination that have the potential to migrate onto the site have been identified as a REC(s), as follows:

Table10: Off-Site RECs

Address	Distance	Current/ Historic Land	RECs	COCs	Pathways
CTA 4401 West Chicago Ave	Adjacent North EDR: 477 ft North	Bus Garage/ Rail yard	USTs	BTEX, Lead, PNAs	Groundwater Ingestion Inhalation, Vapor Intrusion
			Rail yard	Arsenic, Cresols	
			Fill	PNAs, Metals	
RAIL IT Property 733 N Kilbourn Ave	AdjacentWest or Property EDR: 910 ft West	Vacant/ Rail yard	UST	BTEX, PNAs	Groundwater Ingestion Inhalation Vapor Intrusion
Department of Streets and Sanitation 750 N. Kilbourn Ave	Adjacent West EDR: 1044 ft West	Transfer Station and Incinerator/ Rail yard	USTs	BTEX, Lead	Groundwater Ingestion Inhalation Vapor Intrusion
			Air Particulate from Former Incinerator	Metals, PNAs	
City of Chicago 715 N. Kilbourn Ave (750 N. Kilbourn Ave.)	Adjacent West EDR: 800 ft West	Vacant/ Rail yard	UST with Release	BTEX, PNAs	Groundwater Ingestion Inhalation Vapor Intrusion

ft = feet

Based on the results and conclusions of the Phase I ESA, Amec Foster Wheeler recommended further evaluation of soil and/or groundwater quality beneath the site.

Limitations

This Executive Summary is provided as a summary only, and should be used only in conjunction with a full review of the complete Phase I ESA report. Amec Foster Wheeler completed this work under the contract terms and conditions presented in Amec Foster Wheeler’s proposal dated May 18, 2017 as updated on September 26, 2017.



PHASE I ENVIRONMENTAL SITE ASSESSMENT

4301 West Chicago Avenue
Chicago, Illinois

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), was retained by the City of Chicago Department of Fleet and Facility Management (2FM) to perform a Phase I Environmental Site Assessment (ESA) for the site located at 4301 West Chicago Avenue in Chicago, Cook County, Illinois (the site) in general accordance with the scope and limitations of ASTM International (ASTM) E 1527-13, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition is expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase have been updated by our subcontractor, Yung Environmental, Inc. in this final Phase I ESA report.

Amec Foster Wheeler prepared this Phase I ESA in accordance with a proposal dated May 18, 2017 as updated on September 26, 2017.

1.1 PROJECT OVERVIEW

This Phase I ESA is intended to satisfy one of the requirements to permit 2FM to qualify for the innocent landowner, adjoining property owner, or bona fide prospective purchaser limitations on liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (landowner liability protections). This Phase I ESA conforms to standards for "*all appropriate inquiries*"¹ into the previous ownership and uses of the site as specified by the US Environmental Protection Agency (EPA) in 40 CFR Part 312, and in accordance with good commercial or customary practice.

The goal of the Phase I ESA process is to identify recognized environmental conditions (RECs). The term *REC* means the presence or likely presence of any hazardous substances or petroleum products in, on, or at a site:(1) due to any release to the environment, (2) under conditions

¹As defined at 42 U.S.C. Section 9601(35)(B) and 40 CFR Part 312.

indicative of a release to the environment, or (3) under conditions that pose a material threat of a future release to the environment. *De minimis* conditions are not RECs. A *de minimis* condition generally does not present a threat to human health or the environment and generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies.

Separate and distinct from a REC are two other types of conditions that may be noted in a Phase I ESA: a controlled REC (CREC) or an historical REC (HREC).

A CREC is a REC resulting from a past release of hazardous substances or petroleum products that has been addressed to the current satisfaction of the applicable regulatory authority (for example, as evidenced by a no further action [NFA] letter or the equivalent, or meeting risk-based criteria established by the regulatory authority), with hazardous substances or petroleum products allowed to remain in place subject to the implementation of required controls, such as site use restrictions, activity and use limitations (AULs), institutional controls, or engineering controls.

An HREC is a REC from a past release of any hazardous substances or petroleum products that has occurred in connection with the site and has been addressed to the satisfaction of the applicable regulatory authority (using current criteria) or meets the unrestricted residential use criteria established by the regulatory authority and applicable at the time of this Phase I ESA without subjecting the site to any required controls.

1.2 PROPERTY DESCRIPTION

The site consists of 30.4 acres located on the southeast corner of the intersection of Kilbourn and West Chicago Avenue. The Parcel ID (Tax ID) number for the site is 16-10-200-061-0000. The site is located in a mixed land use area. The site is partially fenced and no buildings or other improvements are present on the site.

1.3 SCOPE OF WORK

The scope of services for conducting a Phase I ESA is outlined in ASTM E 1527-13. This Phase I ESA report should not be used for any purposes outside the scope.

Significant additions, deletions, or deviations to ASTM E 1527-13 are noted below or in corresponding sections of this report. To complete the scope of services, the following tasks were performed:

A physical site reconnaissance to identify likely RECs in connection with the site;

Visual observation of adjoining properties or facilities to assess conditions that may indicate RECs on the site or on an adjoining property;

Review of historical land use of the site back to the first developed use or 1940, whichever is earlier;

Review of existing published information related to geology, hydrology, and topographical information for the site;

Review of reasonably ascertainable records and regulatory agency file database searches to identify federal and state-listed properties of known potential environmental concern located within the minimum search distances from the site, as specified in ASTM E 1527-13;

Lien/AUL search

Interviews with present and past site owners or occupants;

Interviews with representatives of the state, county, or local regulatory agencies with knowledge of the site;

Evaluation of compiled information and documentation; and

Preparation of this report.

This Phase I ESA does not address non-scope considerations as defined in Section 13 of ASTM E 1527-13. The scope of work does not include items considered to be beyond the scope of an ASTM Standard Phase I ESA, such as the collection and testing of groundwater samples, surface and drinking water samples, air samples (including radon), or building material samples for hazardous materials (including polychlorinated biphenyls [PCBs], asbestos, and lead-based paint). It also does not include the identification of wetlands, endangered or protected plant and animal species, or historical or archeological sites; geotechnical studies; geologic hazards; potential noise or air quality impacts; or concerns related to the Americans with Disabilities Act.

1.4 LIMITATIONS, EXCEPTIONS, SPECIAL TERMS AND CONDITIONS

This report summarizes work performed to fulfill the process specified under ASTM Standard E 1527-13. The ASTM standard is intended to permit a user to satisfy one of the requirements to qualify for the federal CERCLA liability exemptions. Reasonable efforts were limited to observation of accessible areas, review of referenced public records, and interviews. Amec Foster Wheeler was allowed full access to the site; however, overgrown vegetation limited our visual review of the site, as noted in this Phase I ESA.

This report was prepared by Amec Foster Wheeler exclusively for the City of Chicago Department of Fleet and Facility Management. The quality of information, conclusions, and estimates contained herein is consistent with the level of effort involved in Amec Foster Wheeler services and based on: (1) information available at the time of preparation, (2) data supplied by outside sources, and (3) the assumptions, conditions, and qualifications set forth in this report. This Phase I Environmental Site Assessment is intended to be used by the City of Chicago Department of Fleet and Facility Management for the 4301 West Chicago Avenue, Chicago, Illinois site only, subject to the terms and conditions of its contract with Amec Foster Wheeler. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

Environmental impairment of a property may result from many activities, such as illegal or unreported dumping, or the spilling of hazardous wastes or materials. The presence of contaminants at a particular property may not always be apparent, and the completion of a Phase I ESA in accordance with ASTM E 1527-13 cannot provide a guarantee that hazardous wastes or materials do not exist. The scope of services executed for this project does not include an audit for regulatory compliance, ecological resources, endangered species, cultural and historic resources, indoor air quality, industrial hygiene, health and safety, or high-voltage power lines. It also does not include a detailed condition survey for asbestos, lead, radon, lead in drinking water, or other potential hazards or for wetlands, naturally occurring materials, or other items not outlined in Amec Foster Wheeler's scope of services.

The findings contained herein are relevant to the dates of Amec Foster Wheeler's site reconnaissance and should not be relied upon to represent conditions at later dates. In the event that changes in the nature, usage, or layout of the property or nearby properties are made, the conclusions and recommendations contained in this report may not be valid. If additional information becomes available, it should be provided to Amec Foster Wheeler so the original conclusions and recommendations can be modified as necessary.

Regardless of findings stated in this Phase I ESA, Amec Foster Wheeler is not responsible for consequences of conditions arising from facts that were withheld or not fully disclosed to Amec Foster Wheeler during this Phase I ESA.

This report does not address permit compliance or safety concerns, if any, associated with the site. It is the responsibility of the user of this Phase I ESA to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.

Amec Foster Wheeler has completed this work under the contract terms and conditions presented in Amec Foster Wheeler's proposal dated May 18, 2017 as updated on September 26, 2017.

1.4.1 Significant Assumptions

Amec Foster Wheeler has prepared this Phase I ESA using reasonable efforts to identify RECs associated with hazardous substances or petroleum products at the site. Findings in this Phase I ESA are presented as professional judgments expressed herein and are based on the facts currently available to Amec Foster Wheeler within the limits of the existing data, scope of work, budget, and schedule.

An independent data research company, Environmental Data Resources, Inc. (EDR), of Milford, Connecticut, provided Amec Foster Wheeler with the government agency database search report referenced in this Phase I ESA. The information provided to Amec Foster Wheeler from the government agency database search was assumed to be correct unless obviously contradicted by Amec Foster Wheeler's observations or contradicted by another credible referenced source reviewed by Amec Foster Wheeler.

Similarly, Amec Foster Wheeler has assumed that responses to questions during interviews have been truthful, and that information contained in previous reports for the site or adjoining properties (for example, earlier Phase I ESAs or consultants' reports on tank removals or spill response) is accurate (pursuant to Section 4.7 of ASTM E 1527-13), unless contradicted by Amec Foster Wheeler's observations or contradicted by other credible referenced sources reviewed by Amec Foster Wheeler.

1.4.2 User Reliance

This Phase I ESA is intended to be used by the City of Chicago Department of Fleet and Facility Management subject to the terms and conditions of its contract with Amec Foster Wheeler. This Phase I ESA may not be relied upon by other parties without the express written consent of Client and upon written acceptance of our Terms and Conditions through Amec Foster Wheeler's Third Party Reliance Agreement.

In accordance with ASTM E 1527-13, this report is valid for one year from the date of the intended transaction, assuming interviews, a search for environmental liens, a review of government records, the visual reconnaissance of the site and surrounding properties, and the Environmental Professional declarations are updated within 180 days prior to the intended transaction.

Provided that the report is still valid and reliable, as per the limitations and exceptions listed above, Amec Foster Wheeler will issue a third-party reliance letter to parties that the City of Chicago Department of Fleet and Facility Management identifies in writing, upon payment of the then-current fee for such letters. All third parties relying on Amec Foster Wheeler's report, by such reliance agree to be bound by our proposal and Amec Foster Wheeler's reliance agreement. Amec

Foster Wheeler's standard reliance letter indicates that in no event shall Amec Foster Wheeler be liable for any damages, howsoever arising, relating to third-party reliance on Amec Foster Wheeler's report.

1.5 DATA GAPS

No significant data gaps or data failures were identified that affected Amec Foster Wheeler's ability to identify RECs for the site, except that heavy vegetation was present over much of the site. Amec Foster Wheeler has performed this Phase I ESA in conformance with the scope and limitations of ASTM Standard E 1527-13.

2.0 PROPERTY OVERVIEW

The following is a description of the location, general setting, and usage of the site and adjoining properties, based on information provided by the City of Chicago Department of Fleet and Facility Management and observations during the site reconnaissance.

2.1 PROPERTY LOCATION AND LAND USE

The current site address is 4301 West Chicago Avenue, Chicago, Illinois. The site location is shown on Figure 1, and the general site layout is shown on Figure 2.

2.1.1 Property Location

The site is located in Chicago, Cook County, Illinois.

According to the City of Chicago, the site is zoned PMD9 (special purpose district 9). The Parcel ID (Tax ID) number for the site is 16-10-200-061-0000. A copy of the legal site description is located in **Appendix E**.

At the time of the site reconnaissance, the site was vacant. The site is situated at an elevation of approximately 610 feet above mean sea level (msl). Based on our review of the local topography, it appears that groundwater would generally flow toward the east to Lake Michigan.

2.1.2 Current Uses of the Adjoining Properties

Table 1 summarizes the adjoining properties and their uses that Amec Foster Wheeler identified on the day of the site reconnaissance.

Table 1: Adjoining Properties

Direction	Property Description
North	West Chicago Avenue, commercial buildings
Northeast	N. Kostner Avenue, concrete construction materials yard then Falcon Transportation
East	N. Kostner Avenue, Chicago Transit Authority
Southeast	Railroad tracks, then Grand Warehouse and Distribution, Tec Foods, Inc
South	Railroad tracks, then Grand Worldwide Logistics and 4444 W Ohio-bldg for lease
Southwest	Railroad tracks, then City of Chicago Transfer Station
West	Kilbourn Avenue, industrial properties

2.1.3 Utilities

Table 2 details the utilities provided to the site.

Table 2: Site Utilities

Service	Provider
Electricity	Not applicable, property is vacant
Potable Water	Not applicable, property is vacant
Sanitary Sewer	Not applicable, property is vacant
Storm Sewer	Not applicable, property is vacant
Natural Gas	Not applicable, property is vacant

2.2 PHYSICAL SETTING

Amec Foster Wheeler reviewed reasonably ascertainable sources to assess the physical setting of the site, including the topographic, geologic, hydrogeologic, and hydrologic characteristics of the site. The results of Amec Foster Wheeler’s review are presented below.

2.2.1 Topography

The 7.5-minute Chicago Loop, Illinois, United States Geological Survey (USGS) quadrangle, published in 2012, was examined. Review of the topographic map indicates that the site is located between 600 and 605 feet above msl. The topography of the area is generally flat with a slight slope to the east.

2.2.2 Geology/Hydrogeology

The EDR Radius report provides soil composition information in the general area of the site, provided by the United States Department of Agriculture (USDA) Soil Conservation Service (SCS). EDR indicates the site soils consist primarily of the Urbanland soil type, and consists of fine sand, sandy loam or clay loam.

The region is located in the central portion of the Central Lowlands Physiographic Province, a broad, relatively low area that roughly outlines the glaciated area and extends from the Appalachian Plateaus on the east to the Great Plains on the west, and from the Superior Upland on the north to the Interior Low Plateaus and the Ozark Plateaus on the south. The local relief in the Central Lowlands seldom exceeds a few hundred feet. The Central Lowland Province is divided into two sections, the Till Plains Section and the Great Lakes Section. The Great Lakes Section, which includes the Site, contains surficial features of the youngest part of the Wisconsin Stage glacial drift, and is characterized by its many lakes, and rough surfaced moraines.

Near surface geology in the southeastern Chicago area consists primarily of glacially derived fluvial, lacustrine, and ice-contact sediments. The property is underlain by these glacial deposits which overlie Silurian Dolomite bedrock. The underlying glacial deposits in the area are predominantly the Pleistocene-aged Wadsworth Till Member of the Wedron Formation. Overlying the till in parts of the area is the Carmi Member of the Equality Formation, which is composed primarily of quiet-water, well-bedded silts. In northeastern Illinois, the Wadsworth Till ranges from clay to clayey silt to sandy, clayey silt. All tills of the Wadsworth are characterized by their high clay content and abundance of black shale fragments. The high clay content produces medium to high plasticity and low hydraulic conductivity in the till unit.

The geologic rock stratigraphic unit underlying the site is a Paleozoic Middle Silurian (Niagoaran) dolomite.

Four regional aquifers are present within the Chicago area. The first two are shallow aquifer systems that provide groundwater for domestic and municipal use. The first of these is the sand and gravel located within glacial deposits. These deposits of sand and gravel may occur as shallow, unconfined surficial aquifers or as confined aquifers buried beneath clay till. Groundwater flow within the clay till is expected to be downward toward underlying aquifers.

The upper 50 feet of bedrock forms the second shallow aquifer system in northeastern Illinois. Prior to glaciation, the bedrock was at or near the ground surface and was subject to chemical and physical weathering processes. As a result, the shallow weathered bedrock is generally more permeable and water-bearing than deeper sections of bedrock. The Silurian Dolomite, which is the upper bedrock in much of northeastern Illinois, has historically been used as a water source for municipalities. However, most municipalities in northeastern Illinois, including Chicago, now obtain water from Lake Michigan.

The Silurian Dolomite is underlain by the Maquoketa Shale which is approximately 170 feet thick and is a regional aquitard. An aquitard may be defined as any saturated geologic formation not capable

of yielding useable quantities of groundwater to a well. Sandstone and dolomite formations beneath the Maquoketa Shale form two deep regional aquifer systems capable of yielding large groundwater supplies.

Based on Amec Foster Wheeler's review of topographic maps and observations of the site vicinity, the groundwater flow direction was inferred to be generally to the east toward Lake Michigan. It should be noted that actual groundwater hydraulic gradient and flow direction(s) do not always follow topography, especially in areas influenced by heavy pumping from municipal or agricultural wells, irrigation and/or recharge projects. Additional regional research and/or site-specific groundwater studies would be required to reliably establish groundwater flow direction in the vicinity of the site.

2.2.3 Surface Water Bodies

The closest apparent surface water bodies are small ponds in Garfield Park about 1 mile southeast of the site. Lake Michigan is about 6 miles to the east, the Chicago River is about 4.4 miles to the east and the Des Plaines River is about 5 miles west of the site.

2.2.4 Wetlands

A detailed wetland evaluation is beyond the scope of this investigation. Areas that may be wetlands or nearby surface water bodies were not observed on the site. The closest wetlands appear to be small areas near the ponds in Garfield Park, about 1 mile southeast of the site. National Wetland Inventory data was obtained by EDR from the US Fish and Wildlife Service and Illinois Wetland Inventory Data was obtained by EDR from the Illinois State Geological Survey.

2.2.5 Flood Maps

The property and surrounding properties are not within 100-year and 500-year flood zones as defined by the Federal Emergency Management Agency (FEMA) and obtained by EDR. The information includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.

3.0 PROPERTY BACKGROUND/OPERATING HISTORY

3.1 INTERVIEWS

During the course of the June 2017 Phase I ESA activities, Amec Foster Wheeler interviewed two knowledgeable people to obtain information about the site, particularly regarding possible RECs in connection with the site. The information obtained from the interviews is presumed to have been provided in good faith, and to the full extent of the knowledge of the individual responding. Table 3

lists those people who were interviewed and those for whom an unsuccessful attempt to interview was made. An interview questionnaire was completed and is included in **Appendix G**.

As an update, Amec Foster Wheeler contacted both persons listed below by e-mail in November 2017 to inquire if they knew of any changes to the property or their historical knowledge of the property. Both indicated that no new information was available.

Table 3: Summary of Interviews

Name	Title	Affiliation	Interview Conducted
Matthew J. Grusecki	Senior Vice President Northern Builders, Inc.	Property Owner	Via conference call and e-mail
Ed Garske	Vice President Carlson Environmental, Inc.	Property owner's environmental consultant	Via conference call and e-mail

3.1.1 Interview with Property Owner

Interviews with Mr. Matt Grusecki of Northern Builders, Inc and his environmental consultant, Mr. Ed Garske of Carlson Environmental regarding site information and history were conducted in June 2017. As an update, Amec Foster Wheeler contacted both persons listed below by e-mail in November 2017 to inquire if they knew of any changes to the property or their historical knowledge of the property. Both indicated that no new information was available. Mr. Grusecki and Mr. Garske provided the following information about the site.

Mr. Grusecki has been involved with the site for about 19 years. Northern Builders is part of an entity called Chia LLC which owns the property. Mr. Garske has been their environmental consultant for the property for a number of years. They indicated that the property is vacant and was formerly a railyard. They indicated that two small structures may have formerly stood near the middle of the property when it was a railyard.

They spoke of previous investigations have occurred at the site. Amec Foster Wheeler indicated that we were aware of and had a report of a Phase II completed by Warzyn and a Phase I and Phase II completed by Carlson, as well as a geotechnical investigation report from Testing Service Corporation. They indicated that at least two Phase IIs were performed (one by Warzyn and another by Carlson Environmental) and there may have been another investigation by Carlson Environmental. Polynuclear aromatic hydrocarbons and metals were detected and some concentrations exceeded Illinois remediation objectives from the Tiered Approach to Corrective Action Objectives (35 IAC 742, referred to as TACO). The Phase I indicated that fifteen monitoring wells are present on the site. They were placed at the site when the site was going to be developed as a solid waste transfer station and are still there. The Phase I by Carlson identified

nearby properties with releases. They were going to check on additional reports (another Phase I and another Phase II) that they thought might exist, but that Amec Foster Wheeler did not have. A later e-mail indicated that they found no other reports. They also indicated that there was a site survey which may show utility lines and a storm sewer easement. They indicated that they were not aware of any fill material being brought to the site. They were aware of a potential transformer offsite to the west.

3.1.2 Attempted Interviews

No other interviews were attempted for this assessment.

3.2 AERIAL PHOTOGRAPHS

Aerial photographs are photographs taken from an aerial platform with sufficient resolution to allow identification of development and activities of areas encompassing the site. Amec Foster Wheeler reviewed available aerial photographs of the site and surrounding area dated 1938, 1951, 1962, 1972, 1978, 1980, 1988, 1994, 1999, 2005, 2007, 2009, 2010, 2011, and 2012. Table 4 summarizes the information obtained from review of the topographic maps. It should be noted that site features may not be discernable on the aerial photographs due to the scale or degree of clarity of a given photograph. Copies of the aerial photographs are included in **Appendix A**.

Table 4: Aerial Photograph Search Results

Date	Scale	Property	Adjoining Properties
1938, 1951	1"=500'	Site is western and northern portion of large rail yard. Trains and tracks visible over much of the site	East is more rail yard, south is apparently part of the yard with what appear to be many associated structures and tracks, west appears to be residential/commercial, northeast is residential and northwest is large industrial building on northeast corner of intersection
1962	1"=500'	Site is western and northern portion of large rail yard. Trains and tracks visible over much of the site	Northeast, northwest and south appear similar to previous. Kostner Ave is present to east, where the rail yard is no longer present and across Kostner, commercial buildings
1972	1"=500'	Site is large rail yard. Trains and tracks visible over much of the site	East, northeast and northwest appear similar to previous. To the west, Kilbourn Ave is present and a large facility is present on the southwest corner of Kilbourn and W Chicago. Other buildings which do not appear to be part of the rail yard are now present to the south
1978	1"=500'	Site is large rail yard. Some tracks appear to have been removed	Similar to previous, more non-rail yard development south and east. Ohio Street and other east-west streets off of Kilbourn south of site are visible

Date	Scale	Property	Adjoining Properties
1980, 1988	1"=500'	Site is mainly vacant – rail tracks run through middle of site	Similar to previous, tracks are present only through middle of portion of rail yard southeast of site
1994	1"=500'	Site is vacant	Similar to previous, southeast portion of rail yard now separated from site by extension of Kostner Ave to the south and a new facility (CTA) is east of the extension of Kostner
1999	1"=500'	Site is vacant	Similar to previous
2005, 2007, 2009, 2010, 2011	1"=500'	Site is vacant; bare patch with no vegetation visible on south side, appears to be due to runoff from adjacent parking lot	Similar to previous
2012	1"=500'	Site is vacant; bare patch no longer visible	Similar to previous

Amec Foster Wheeler’s review of the aerial photographs has identified historical usage as a rail yard as a REC in connection with the site and the east adjacent CTA property.

3.3 HISTORICAL TOPOGRAPHIC MAPS

Historical topographic maps of the site and surrounding area were reviewed from the years 1889, 1891, 1900, 1901, 1928/1929, 1953, 1963, 1972, 1978/1980, 1993, 1997/1998 and 2012. Table 5 summarizes the information obtained from review of the topographic maps. Copies of the topographic maps are included in **Appendix B**.

Table 5: Historical Topographic Map Search Results

Date	Scale	Property	Adjoining Properties
1889, 1891	1:62500	Vacant	Surrounding area is generally gridded with streets, except in site vicinity
1900, 1901	1:62500	Site covered with rail tracks	Immediate site vicinity covered in rail tracks and associated buildings, surrounding area gridded with streets, another rail yard is to the north
1928/1929, 1953, 1963	1:24000	Site covered with rail tracks	Immediate site vicinity covered in rail tracks and associated buildings, surrounding area gridded with streets, rail yard is to the north
1972, 1978/1980	1:24000	Site covered with rail tracks	Property west, south and north east of the site has little to no rail tracks, has buildings, area southeast still has tracks

Date	Scale	Property	Adjoining Properties
1993, 1997/1998	1:24000	Site vacant, 1-2 sets of tracks cross center of site northwest to southeast	Most railroad tracks in site and vicinity are gone Property west, south and north east of the site has buildings; southeast appears like site – vacant with 1-2 sets of tracks
2013	1:24000	Vacant	Surrounding property shown as vacant, gridded city streets away from site area

Amec Foster Wheeler’s review of the historical topographic maps identified historical usage as a rail yard as a REC in connection with the site and the east adjacent CTA property.

3.4 FIRE INSURANCE MAPS

EDR provided Sanborn fire insurance maps for the years 1908, 1950, 1975, 1988, 1991, 1993, 2002 and 2004. Table 6 summarizes the information obtained from review of the Sanborn fire insurance maps. Copies of the Sanborn fire insurance maps are included in **Appendix C**.

Table 6: Sanborn Fire Insurance Map Search Results

Date	Scale	Property	Adjoining Properties
1908	1"=300'	Railroad tracks	North, beyond W Chicago Ave, is subdivided into lots with no structures visible; south is railyard with railcar repair shops, erecting shed, etc. West (separate map, also year 1896) railroad tracks, N 46 th Ave, subdivided, residential. East (separate map) is part of yard and full of rail tracks except northeast by W Chicago Ave has separate building
1950	1"=300'	Railroad tracks	North, beyond W Chicago Ave, is industrial: tool and die, metal stamping, scrap steel, pattern shop, steel spring factory and metal finishing; south is railyard with railcar repair shops, erecting shed, etc.; West (separate map) railroad tracks, N Kenton Ave, subdivided, residential/commercial. East (separate map) is part of yard and full of rail tracks except northeast, on same side of W Chicago Ave, is storage, a dairy and a garage

Date	Scale	Property	Adjoining Properties
1975 1988 1991 1993	1"=300'	Railroad tracks; small structure present in northwest corner	North, beyond W Chicago Ave, is industrial as before and some commercial; south developed with industrial buildings; West (separate map) is N Kilbourn Ave, railroad tracks and residential; Southwest is N Kilbourn Ave, then Chicago Northwest Incinerator East (separate map), on the west side of which is a filling station, is part of yard and full of rail tracks except northeast, on same side of W Chicago Ave, storage, a dairy and a garage have expanded south
2002 2004	1"=300'	Vacant	North more commercial, some parking lots, still some industrial; south developed with industrial buildings; West (separate map) is N Kilbourn Ave, railroad tracks and residential; Southwest is N Kilbourn Ave, then Chicago Northwest Incinerator; East (separate map) is part of yard and full of rail tracks except northeast, on same side of W Chicago Ave, storage, a dairy and a garage; south of the dairy is now CTA

Amec Foster Wheeler’s review of the Sanborn fire insurance maps identified historical usage of the site and the east adjacent CTA property as a rail yard as a REC in connection with the site, and use of west adjacent property (across N Kilbourn Ave) as an incinerator as a REC for the site.

3.5 LOCAL STREET DIRECTORY

Amec Foster Wheeler obtained a City Directory Abstract from EDR dated June 15, 2017 for the site and surrounding properties. A complete list of the results is included in EDR’s City Directory Abstract included in **Appendix D**. The site is listed in the EDR local street directory search for 2005 and 1999. The 2005 listing identifies the site as CTA, which is actually on the adjacent southeast property. No other information is provided.

3.6 USER PROVIDED INFORMATION

For the purposes of this assessment, the City of Chicago Department of Fleet and Facility Management is the user of this Phase I ESA report. In accordance with Section 6 of ASTM E 1527-13, the user of this Phase I ESA was informed that they were responsible for providing the following information to Amec Foster Wheeler’s environmental professional for consideration during the assessment:

Reasonably ascertainable title or judicial records related to environmental liens and AULs for the site;

Actual knowledge of the user of any environmental liens or AULs;

Specialized knowledge or experience of the user with regard to the site and activities thereon that may be material to any potential RECs;

Commonly known (within the local community) or reasonably ascertainable information regarding past releases, conditions indicative of releases, or threatened releases of hazardous substances or petroleum;

Information as to whether the purchase price of the site is lower than the fair market value due to contamination; and

The reason why the user wants to have the Phase I ESA performed.

Amec Foster Wheeler provided the user with a questionnaire, and the type of information obtained from the questionnaires summarized in Table 7. The user questionnaire was completed and is included in **Appendix G**.

Table 7: Information Obtained from User Questionnaire

User-Provided Information¹	Was Information Provided to Amec Foster Wheeler? (Yes/No)	Was Amec Foster Wheeler Contracted to Procure the Information? (Yes/No)
Title Records (3.6.1)	Yes	Yes
Environmental Liens and Activity and Use Limitations (3.6.1)	Yes	Yes
Specialized Knowledge (3.6.2)	No	No
Commonly Known or Reasonable Ascertainable Information (3.6.2)	Yes	Yes
Valuation Reduction for Environmental Issues (3.6.3)	Yes	No
Reason for Performing Phase I ESA (1.1)	Yes	No
Other (3.6.2)	Previous Reports	No

1. Numbers in parentheses reflect the report section in which the information is discussed.

3.6.1 Environmental Liens or Activity and Use Limitations

The user is not aware of any environmental liens or AULs, such as engineering controls, land-use restrictions, or institutional controls, that are in place at the site and/or have been filed or recorded in a registry under federal, state, or local law. There is a restrictive covenant on the property which requires It requires financial payment if the site is used as a transfer station (see Appendix E).

The LienSearch™ Report provided by EDR (attached in Appendix E) included a search for title documents for the Site. Review of the EDR LienSearch™ Report (included in Appendix E) for the

site indicates that environmental cleanup liens are not present on the Site. The Lien Search™ Report also indicated no AULs were found for the site. The lien search indicated that the property was most recently (October 2000) transferred from Chicago Avenue Development LLC to BK Chicago Avenue, LLC & Chia LLC by special warranty deed. The lien search document and a copy of the deed are included as **Appendix E** of this report.

3.6.2 Specialized Knowledge

The user does not have specialized knowledge or experience related to the chemicals and processes used at the site or nearby properties.

The user had copies of prior environmental site assessment reports, documents, or correspondence concerning the site and its environmental conditions, that may be deemed pertinent to the assessment by the environmental professional. The following reports were provided for Amec Foster Wheeler review:

- Phase II ESA, Prepared by Warzyn Inc., dated August 1991 – this was a separate report, but was also in Appendix A of the Carlson Phase I ESA
- Preliminary Report of Soils Exploration, Prepared by Testing Service Corporation, April 29, 1998 - this was in Appendix A to the Carlson Phase I
- Phase I ESA, prepared by Carlson Environmental, dated May 11, 1998
- Limited Phase II, prepared by Carlson Environmental, dated October 17, 2007
- Property Screen Summary Report, prepared by 2FM, dated April 10, 2017

The Phase II ESA by Warzyn was performed for RAIL-IT Limited partnership and included what is described as the western half of the 40th Street Yard of the Chicago Northwestern Railroad (CNWR). It references throughout a prior report titled “Environmental Assessment Report”, by Huff and Huff, Inc. dated 1990. The Warzyn report indicates that the Huff and Huff report has information indicating that the rail yard was constructed in about 1896 on previously undeveloped and unfarmed land. There were structures and rail tracks on the land by 1935, but many of these structures were removed by 1936 and additional train tracks were added. From 1936 to 1985, the parcel was used for the storage and movement of trains and there was one small office building in the southeastern corner. Repairs, fuel storage and maintenance activities took place on another parcel south of the site. Most of the tracks were removed by 1985 and at the time of the Warzyn Phase I, two tracks crossed the site. Surrounding land was part of the rail yard until 1950 when it was sold for commercial development. According to the Warzyn report, there were two abandoned buildings in the northeast portion of the site and numerous piles of debris throughout the site,

composed mainly of construction and demolition debris, although industrial materials may also have been present.

The Warzyn investigation consisted of the installation of ten (10) soil borings and three (3) temporary wells in three (3) of the borings. Twenty (20) soil samples were collected and analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) and total cyanides. Total xylene was detected in two (2) samples from one (1) boring and trichlorofluoromethane was detected in samples from two (2) other borings. PNAs were widespread, but generally below 1 mg/kg concentration, although some locations were higher. Metals were detected but at concentrations considered to be background or naturally occurring. Cyanides were not detected. Groundwater flow in the shallow soils was thought to be to the north, but could not be determined based on the temporary wells. No VOCs were detected and low concentrations of PNAs, metals and cyanide (one sample) were detected in the water samples. The Warzyn report concluded that no significant concentrations of VOCs, PNAs, metals or cyanide were present in soil or groundwater at the site; although localized hot spots may exist.

The Carlson Phase I ESA, performed for Northern Builders, Inc., determined that natural drainage was in an easterly direction to the North Branch of the Chicago River, 4.4 miles east of the site. Two sets of train tracks were still present on the site. No structures were present on the site. Numerous piles of construction debris and railroad ties were noted on the site. No wetlands were observed on the site. Fifteen (15) monitoring wells were noted on the site. The Carlson report indicates that at one time, plans were to use the site as a solid waste transfer station and the wells were installed for required monitoring. The report recommended the proper disposal of the railroad ties on the property. The Carlson report notes that all of the analytical results for the Warzyn report are below TACO Tier 1 Remediation Objectives for Industrial/Commercial sites with Class I groundwater (applicable Illinois objectives). Based on their review, they indicate that the site has not been significantly impacted by its previous use as rail yard. No RECs are identified and the risk for impact from surrounding properties is identified as low.

The Testing Service Corporation report provides information on geotechnical testing performed at the site. Nineteen (19) soil borings were drilled to 20 to 24 feet below ground surface. According to the boring logs in the report, the soils consisted mainly of fill material at the surface to up to 20 feet below the surface, underlain by stiff grey and brown silty clay. The fill materials consisted mainly of sands, silty sands and/or clayey sands with cinders and cobbles. No odors or staining were noted. Groundwater was found at depths ranging from 3 to 23 feet below the ground surface.

The 2007 Phase II by Carlson was performed for Northern Builders. Nineteen (19) soil borings were completed and fill was encountered in borings at depths of 0 to 16 feet, below which was silty

clay. Moist soils were noted at 2 to 4 feet below surface, but groundwater was not encountered in any of the borings. Staining was noted in some soil borings. Twenty-four soil samples were analyzed. Analyses included VOCs, semivolatile organic compounds (SVOCs), priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc), pH, pesticides, polychlorinated biphenyls (PBCs) and chlorinated herbicides. Results were compared to TACO Tier 1 soil screening objectives (35 IAC 742).

No VOCs were detected at concentrations exceeding the TACO objectives; although VOCs were detected at some locations. PNAs and carbazole were detected at concentrations that exceeded the TACO Tier 1 screening objectives. Antimony, arsenic, chromium, lead and mercury were detected at concentrations above their TACO Tier 1 objectives. PCBs, pesticides and herbicides were not detected in the two (2) samples analyzed for these parameters. The report concluded that concentrations of five (5) PNAs, one (1) SVOC and five (5) metals were present at concentrations exceeding the most stringent TACO Tier 1 residential screening levels. However, these soils could be managed during construction and no active remediation would be required to address soils on the site.

2FM also provided a Property Screen Report and associated documentation for the site and nearby properties. This was a 436-page document which consisted of a review of records from various databases including City of Chicago Department of Public Health (inspection, complaint investigation and UST records), OSFM, Illinois EPA, and USEPA. The Property Screen concluded that seven USTs of unknown contents were associated with the site; however, a subsequent review of the Property Screen documentation determined that the seven USTs are associated with 4401 W. Chicago and not the site. In addition, the 550-gallon fuel oil UST associated with the site was described as installed in 1959 and containing fuel oil. While the record does list this UST as being at 4301 W. Chicago, it should be noted that the facility name is listed as the Chicago Transit Authority and the contents are actually listed as gasoline. As discussed above, an adjacent site at 4401 W Chicago Avenue had seven flammable product USTs installed in 1992. The document indicated that a 550-gallon heating oil UST was removed in 2004 from a nearby site at 4155 W Chicago Avenue. It also indicated the following for another nearby site (4201 W Chicago Avenue): one 20,000 heating oil UST and one 20,000 diesel UST removed in 1993; two 4,000-gallon gasoline USTs installed in 1947; one 8,000-gallon fuel oil UST installed in 1949; one 10,000-gallon gasoline UST inspected in 1965, fuel oil USTs were sandfilled in 1967; two 12,000 gallon USTs installed in 1979; one 6,000 gallon UST sandfilled in 1979; one 10,000 gallon UST and one 4,000 gallon UST gravel filled in 1979; and two 12,000-gallon gasoline USTs and one 5,000-gallon fuel oil UST removed in 1992. At 4457 W Chicago Avenue, a 1,000-gallon fuel oil UST was installed in 1958. Contaminated fill material was removed from 733 N Kilbourn Avenue in 1995. The document also includes a search of both the OSFM and Illinois EPA databases for the site and nearby properties. Installation and removal of USTs for nearby properties is documented.

3.6.3 Valuation Reduction for Environmental Issues

The user has indicated that the purchase price being paid for the site reasonably reflects the fair market value of the site, and has not been reduced due to contamination.

3.7 VAPOR MIGRATION/INTRUSION EVALUATION

Potential vapor contamination sources on the site or on nearby properties can represent vapor encroachment concerns through the indoor air exposure pathway. The exposure pathway is complete if soil gas has the potential to migrate from a nearby subsurface source into an occupied building foundation. As the site has no structures, the indoor air inhalation exposure pathway is currently incomplete. Also, no identified contaminants on the site would be a vapor intrusion threat. An UST was reported to previously be present at the site and low levels of chlorinated solvents were detected in soils during a previous investigation and a recently completed Phase II ESA. Buildings may in the future be constructed on the site, so further evaluation is recommended.

Nearby properties have also had releases which may affect the site. There are 15 properties within 1/3 mile of the site which have had past releases and one property (CTA, adjacent) within 1/10 mile of the site. CTA had a LUST release of gasoline, and a NFR letter was received on April 27, 2000. However, Chicago building department records indicate that 7 USTs containing flammable material were installed on the CTA property in 1992 and there is no indication that they were removed.

4.0 REGULATORY REVIEW

This section presents the results from the environmental records review. Section 5.1 discusses results from the search of standard environmental databases. These records were reviewed to assess potential environmental concerns for the site, and, when applicable, surrounding properties. Section 5.2 discusses results from additional environmental record sources that were reviewed for this Phase I ESA.

4.1 REGULATORY DATABASE SEARCH AND SIGNIFICANT FINDINGS

Amec Foster Wheeler reviewed the results of a search of standard environmental records sources as required by ASTM Standard E 1527-13. EDR provided results of a regulatory agency database search in their report dated November 15, 2017. Amec Foster Wheeler reviewed that report for information pertaining to storage and/or reported releases of hazardous substances and petroleum products on the site and on surrounding properties that may affect the site. The EDR search report is included in **Appendix F**.

4.1.1 EDR Identified Sites

Amec Foster Wheeler reviewed the EDR report for databases that indicate potential releases or environmental impacts to soil, groundwater or soil vapor. Review of the federal, state and proprietary records summary provided by EDR of sites of potential environmental concern located within the respective ASTM standard search radii are summarized in the table below. Based on distances from the site, the types of listings and the assumed direction of groundwater flow, none of the properties listed is likely to have a negative impact on the site except for the properties described below the table.

Table 8. Environmental Database Search Results

EDR MAP ID	SITE NAME	SITE ADDRESS	DATABASES	RELATIVE ELEVATION	MAPPED DISTANCE FROM SITE (FT, MILES, DIRECTION)*	ID'ED AS REC	ELIMINATED DUE TO			COMMENT
							DISTANCE FROM SITE	ASSUMED GW FLOW DIRECTION	REGULATORY STATUS	
1	PROPERTY	4301 W CHICAGO AVE	IL CHICAGO ENV	Higher	64, 0.012, ESE	X			X	1959 Permit, UST – see below
2	CHICAGO TRANSIT AUTH	4401 W CHICAGO AVE	IL LUST, RCRA NonGen / NLR, FINDS, ECHO	Lower	477, 0.090, North	X			X	Adjacent UST – see below
A3	FLORENCE MACARONI CO	4346 W CHICAGO	IL LUST	Lower	586, 0.112, NNE		X	X		Cross gradient, LUST incident 982757 - see below
A4	FLORENCE MACARONI CO	4344 W CHICAGO	IL UST	Lower	657, 0.112, NNE		X	X		Cross gradient, NNE 1,000-gallon heating oil UST exempt from registration

Table 8. Environmental Database Search Results

EDR MAP ID	SITE NAME	SITE ADDRESS	DATABASES	RELATIVE ELEVATION	MAPPED DISTANCE FROM SITE (FT., MILES, DIRECTION)*	ID'ED AS REC	ELIMINATED DUE TO			COMMENT
							DISTANCE FROM SITE	ASSUMED GW FLOW DIRECTION	REG ULATORY STATUS	
5	MACHINE SHOP	4416 W. CHICAGO AVE	IL UST	Lower	663, 0.126, NNW		X	X	X	Adjacent (across Chicago) Heating oil UST, no release
B6	MOORE SUPPLY CO	4318 W CHICAGO AVE	IL UST, IL BOL	Lower	721, 0.137, NE		X	X		Cross gradient; UST removed 1992
B7	MOORE SUPPLY CO	4318 W CHICAGO AVE	RCRA-SQG, FINDS, ECHO	Lower	721, 0.137, NE		X	X		Cross gradient; no violations
8	SIMPLOMATIC MFG	816 N KOSTNER	RCRA-SQG, FINDS, ECHO	Lower	734, 0.139, North				X	No violations
C9	AMERICAN ENVELOPE	4440 WEST OHIO STREE	IL ENG CONTROLS , IL INST CONTROL, IL SRP	Lower	800, 0.152, South				X	Adjacent SRP; NFR 12/2010; soil barrier See below
D10	CHICAGO, CITY OF	700 NORTH KILBOURN AVE	IL LUST	Higher	806, 0.153, West				X	Adjacent Upgradient NFR 5/1995
C11	U. S. ART	4400 W OHIO ST	RCRA NonGen / NLR	Lower	854, 0.162, SSE				X	Adjacent Cross gradient LQG, violations, last 1997
E12	KERRIGAN LEWIS CO.	4421 W RICE ST	RCRA-SQG, IL LUST, ICIS, FINDS	Lower	838, 0.159, NNW		X	X	X	Cross gradient; no violations; LUST NFR 5/2008

Table 8. Environmental Database Search Results

EDR MAP ID	SITE NAME	SITE ADDRESS	DATABASES	RELATIVE ELEVATION	MAPPED DISTANCE FROM SITE (FT, MILES, DIRECTION)*	ID'ED AS REC	ELIMINATED DUE TO			COMMENT
							DISTANCE FROM SITE	ASSUMED GW FLOW DIRECTION	REG ULATORY STATUS	
E13	KERRIGAN LEWIS WIRE	4421 W RICE ST	IL UST	Lower	838, 0.159, NNW		X	X	X	2 USTs removed; 1 UST abandoned in place; LUST NFR 5/2008
F14	STRONA WAREHOUSE	4350 W OHIO ST	RCRA NonGen / NLR, FINDS, ECHO	Lower	851, 0.161, SSE			X	X	Adjacent Cross gradient; no violations See below
F 15	PPG INDUSTRIES INC S	4350 W OHIO ST	RCRA NonGen / NLR	Lower	851, 0.161, SSE			X	X	Adjacent Cross gradient; no violations See below
D16	CHICAGO, CITY OF	715 NORTH KILBOURN	IL LUST	Higher	865, 0.164, West		X			Adjacent Upgradient; non LUST
G17	JOYCE BEVERAGES	4433 W OHIO ST	IL UST	Lower	948, 0.180, SSW		X	X	X	Cross gradient; LUST; NFR 11/1993
G18	KEMMERER BOTTLING	4433 WEST OHIO ST.	IL LUST	Lower	948, 0.180, SSW		X	X	X	Cross gradient; LUST; NFR 11/1993
19	F&B MFG CO	4248 W CHICAGO AVE	RCRA NonGen / NLR, FINDS, ECHO	Lower	966, 0.183, NE		X	X	X	Previous generator
G20	COLOVOS CO	4444 W OHIO ST	IL UST, IL BOL	Lower	974, 0.184, SSW			X	X	Adjacent 4 USTs, heating oil See below

Table 8. Environmental Database Search Results

EDR MAP ID	SITE NAME	SITE ADDRESS	DATABASES	RELATIVE ELEVATION	MAPPED DISTANCE FROM SITE (FT, MILES, DIRECTION)*	ID'ED AS REC	ELIMINATED DUE TO			COMMENT
							DISTANCE FROM SITE	ASSUMED GW FLOW DIRECTION	REG ULATORY STATUS	
G21	COLOVOS	4444 W OHIO ST	SEMS-ARCHIVE CORRACTS RCRA-SQG, IL LUST, IL ENG...	Lower	974, 0.184, SSW			X	X	Adjacent LQG, LUST NFR 4/1993 SRP NFR 7/1996; Barrier, CW, Ind/Com See below
22	RAIL IT PROPERTY	733 N KILBOURN	IL UST	Higher	977, 0.185, West	X				Adjacent Upgradient; heating oil UST removed 1995; see below
23	INDUSTRIAL STORAGE W	4343 W OHIO ST	RCRA NonGen / NLR	Lower	1005, 0.190, SSE		X	X		Previous generator, no violations
H24	LC SQUARED	4455 W RICE ST	IL UST	Lower	1023, 0.194, NW		X	X		Cross gradient; Heating oil UST
H25	BRACHS CANDY FACTORY	4545 RACE ST	IL UST	Lower	1040, 0.197, NW		X	X		Heating oil UST
H26	BRACHS CANDY FACTORY	4545 RACE ST	RCRA NonGen / NLR, FINDS, ECHO	Lower	1040, 0.197, NW		X	X	X	Ignitable waste, one time, no violations
H27	BRACH & BROCK CONFEC	4545 WEST RACE ST.	IL LUST	Lower	1040, 0.197, NW		X	X	X	LUST NFR Letter 12/1996
I28	DUNBAR ARMORED	4500 W. CHICAGO AVE.	IL UST	Higher	1071, 0.203, WNW			X	X	Adjacent, across Chicago, current compliant UST

Table 8. Environmental Database Search Results

EDR MAP ID	SITE NAME	SITE ADDRESS	DATABASES	RELATIVE ELEVATION	MAPPED DISTANCE FROM SITE (FT., MILES, DIRECTION)*	ID'ED AS REC	ELIMINATED DUE TO			COMMENT
							DISTANCE FROM SITE	ASSUMED GW FLOW DIRECTION	REG ULATORY STATUS	
I29	FEDERAL ARMORED EXPR	4500 W CHICAGO AVE	RCRA-CESQG, FINDS, ECHO	Higher	1071, 0.203, WNW			X	X	Adjacent, across Chicago, ignitable, lead waste
J30	NORTHWEST SORTING CT	750 N KILBOURN AVE	RCRA-SQG, ICIS, FINDS, ECHO, NY MANIFEST	Higher	1112, 0.211, West	X				Adjacent, across Kilbourn; upgradient 6 USTs removed 1994; no NFR
J31	DEPT STREETS & SANIT	750 N KILBOURN AVE	IL UST	Higher	1112, 0.211, West	X				See above
K32	COUNTRY DELIGHT	4201 W CHICAGO AVE	IL UST	Lower	1171, 0.222, ENE		X	X		Downgradient 3 USTs removed 1991
k33	FORMER SWISS VALLEY	4155 W. CHICAGO AVEN	IL UST	Lower	1259, 0.238, ENE		X	X		Used oil UST removed in 2004
K34	CERTIFIED GROCERS	4206 WEST CHICAGO AV	IL LUST	Lower	1274, 0.241, ENE		X	X	X	LUST; NFR letter 01/2002
35	HOSPITAL LAUNDRY SER	4141 W CHICAGO ST	IL LUST	Lower	1480, 0.28 ENE		X	X	X	LUST: NFR 08/18/93
36	LIDLAW TRANSIT, INC	902 KILBOURN ST.	IL LUST	Lower	1482, 0.281, NNW			X	X	Adjacent, across Chicago; UST removed 1992; NFR 10/1992
37	PROSPERITY TRUCKING	4600 WEST ERIE	IL LUST	Lower	1586, 0.3, WSW		X	X	X	LUST, NFR 07/14/94

4301 West Chicago Ave, Chicago, Illinois
Phase I Environmental Site Assessment

- * Distances and direction from EDR search. Additional information provided below regarding actual proximity to site

The 4301 West Chicago entry is for City of Chicago permit and UST records. According to information from the City of Chicago Fire Department in response to Amec Foster Wheeler's request under FOIA during the June 2017 Phase I ESA, one UST was identified onsite: a 550-gallon heating oil tank installed in 1959. However, the installation permit on file with the City of Chicago Department of Public Health indicates that the Chicago Transit Authority was the owner having the tank installed. The Illinois Office of the State Fire Marshal does not identify USTs as present on the site. Since no further information is available, this would be an REC for the site.

Chicago Transit Authority, 4401 West Chicago, adjacent to the southeast, is listed in City of Chicago environmental records as having seven flammable USTs installed in 1992, as a generator of ignitable RCRA waste in 1993, and on the FINDs, SPILLs and ECHO databases, probably as a result of its generator and LUST status. A LUST incident 923534 is recorded in 1992 for a gasoline release. The incident was closed with an NFR letter on April 27, 2000. Since no information is available indicating the 1992 installed tanks were removed, this would be an REC for the site.

Florence Macaroni, 4346 West Chicago, located to the north and northeast of the site, across Chicago Avenue, is listed as a UST and LUST site. One 1,000-gallon heating oil tank is listed as exempt. A LUST incident was reported in 1998 (LUST incident 982757). Based on its distance and cross to downgradient location, this would not be an REC.

City of Chicago, 700 N Kilbourn Ave, upgradient and west of the site, is listed as a LUST site. One tank was removed in 1993 and a NFR letter was received on 5/15/1995. Based on its current regulatory status, this would not be an REC.

City of Chicago, 715 N Kilbourn Ave, upgradient and adjacent west of the site, is listed as a LUST site. The initial incident report for #940242 lists 715 N. Kilbourn Avenue and then subsequent documentation on the Illinois EPA website for this incident changed to 750 N. Kilbourn Avenue. Amec Foster Wheeler believes the address was mis-identified in the original report and subsequently corrected. Although an incident was reported, a subsequent Illinois EPA letter indicates the site is a non-LUST site, which could indicate there was no confirmed release, or that the incident was from a non-regulated tank. Since it is adjacent, upgradient and no sampling was performed, this would be an REC for the site.

US Art, 4400 West Ohio Street, adjacent to the south, is listed as a former large quantity generator of F-code solvents, ignitable and listed wastes. It appears to be at the same location as American Envelope discussed below and the generator listing is for American Envelope. It has violations

which were resolved. Based on its current regulatory status (see below) and cross gradient position with regard to the site, this would not be an REC.

American Envelope, 4440 West Ohio Street, adjacent to the south, is listed as a Site Remediation Program (SRP) site, that is closed with a Comprehensive NFR dated 12/21/2010. There are restrictions indicating that the site is restricted to industrial/commercial use, a construction worker caution and engineered barriers of asphalt and concrete. However, there is no groundwater use restriction on the property. Based on its regulatory status and cross gradient position with regard to the site, this would not be an REC.

PPG Industries Inc, 4350 W Ohio St, is listed as a former large quantity generator of ignitable and U-Listed waste, and on the FINDs and ECHO databases, and is adjacent to the south. No violations were noted. Based on its regulatory status and cross gradient position with regard to the site, this would not be an REC.

RAIL IT Property, 733 N Kilbourn Avenue, west and upgradient of the site, is listed as having a 2000-gallon heating oil UST, which according to the OSFM database was removed in May 1995. It is unclear if this is the site or adjacent, as Rail IT formerly owned the 4301 W Chicago property and the street number identified in the EDR report could potentially put it near the southeast corner of Chicago and Kilbourn Avenues, which would be the site. Since it is adjacent, upgradient and no sampling was performed, this would be an REC for the site.

Colovos Co, 4444 W Ohio St, is listed as a SEMS-ARCHIVE, CORRACTS RCRA-SQG and LQG, LUST site and SRP site. It was evaluated under the National Priority List (NPL), archived and deferred to RCRA. As a CORRACT site, it was assigned a low corrective action priority. The LUST listing is for a fuel oil tank removed in 1992 and a NFR letter was received in June 1993. It was entered into the SRP in 1994 and a focused NFR letter was received on 7/3/1996. There are restrictions indicating that the site is restricted to industrial/commercial use, a construction worker caution and an engineered barrier of concrete. There is no groundwater use restriction on the property. Based on its regulatory status and cross gradient position with regard to the site, this would not be an REC.

Department of Streets & Sanitation, Northwest Sorting Center, 750 N Kilbourn Ave, west of the site, is listed as a UST site, a RCRASQG and on the ICIS (air), FINDS, ECHO, NY MANIFEST (PCB disposal) databases. It operates as a City of Chicago waste sorting and transfer facility, and is a SQG of ignitable waste. Six petroleum product tanks were removed in 1994. Since it is adjacent, upgradient and no sampling was performed, this would be an REC for the site.

4.1.2 Orphan sites List

EDR also provides a second category of sites, referred to as the “orphan site list,” which includes sites without adequate location information to be mapped precisely in the EDR system. No unmappable sites were identified in the EDR report.

4.2 ADDITIONAL ENVIRONMENTAL RECORD SOURCES

Additional environmental record sources were reviewed to enhance and supplement the standard environmental record sources. This section provides information obtained based on review of information obtained from local departments to assist in ascertaining potential environmental risks associated with the site.

4.2.1 City of Chicago

Fire Department

The site is located in the jurisdiction of the City of Chicago. On June 19, 2017, a Freedom of Information Act (FOIA) request was submitted to the department’s FOIA coordinator requesting any files available for the site. A response was received on June 26, 2017. Documentation was provided for installation of a 550-gallon gasoline UST by ‘Chicago NW Rlway’ in January 1959 and the removal of a 550-gallon gasoline UST on June 1, 1965.

On November 19, 2017, a Freedom of Information Act (FOIA) request was submitted to the department’s FOIA coordinator requesting any files available for the site. At the time of this report, no response has been received. If environmental concerns are identified based on our request by the City of Chicago Fire Department, an addendum to this report will be prepared.

Department of Public Health

On June 19, 2017, a FOIA request was submitted to the Chicago Department of Public Health (CDPH) FOIA coordinator requesting any available information that may be on file. On 6/21/2017, an email was received referring Amec Foster Wheeler to an online database. The database was queried and provided the same information as the EDR report

On November 19, 2017, a FOIA request was submitted to the Chicago Department of Public Health (CDPH) FOIA coordinator requesting any available information that may be on file. On November 21, 2017, an email was received referring Amec Foster Wheeler to an online database. The database was queried and provided the same information as the EDR report.

Department of Buildings

On June 19, 2017, a FOIA request was submitted to the Chicago Department of Buildings FOIA coordinator requesting any available information that may be on file. At the time of the original Phase I report, no response had been received.

On November 19, 2017, a FOIA request was submitted to the Chicago Department of Buildings FOIA coordinator requesting any available information that may be on file. At the time of this report, no response has been received. If environmental concerns are identified based on our request by the City of Chicago Department of Buildings, an addendum to this report will be prepared.

4.2.2 Illinois Environmental Protection Agency

On June 19, 2017, a FOIA request was submitted to the Illinois Environmental Protection Agency (Illinois EPA) FOIA coordinator requesting any available information that may be on file. On June 21, 2017, the Illinois EPA indicated that no information was located for the site.

On November 19, 2017, a FOIA request was submitted to the Illinois Environmental Protection Agency (Illinois EPA) FOIA coordinator requesting any available information that may be on file. On November 20, 2017, an email was received from the Illinois EPA indicating that the Illinois EPA had no information on file for the site.

4.2.3 United State Environmental Protection Agency

On June 25, 2017, a FOIA request was submitted to the United States Environmental Protection Agency (USEPA) requesting any available information that may be on file. At the time of the original Phase I report, no response had been received.

On November 19, 2017, a FOIA request was submitted to the United States Environmental Protection Agency (USEPA) requesting any available information that may be on file. On November 22, 2017, an email was received from the USEPA indicating that the USEPA had no information on file for the site.

4.2.4 Illinois Office of the State Fire Marshal

On June 19, 2017, a FOIA request (request no. 21399) was submitted to the Illinois Office of the State Fire Marshal FOIA coordinator requesting any available information that may be on file. At the time of the original Phase I report, no response had been received.

On November 19, 2017, a FOIA request was submitted to the Illinois Office of the State Fire Marshal FOIA coordinator requesting any available information that may be on file. On November 21, 2017, an email was received from the Office of the State Fire Marshal indicating that the Illinois Office of the State Fire Marshal had no information on file for the site.

5.0 PROPERTY INSPECTION

Mr. Salvatore Consalvi of Yung Environmental, Inc. completed the site reconnaissance on November 15, 2017, observing the general site conditions on the site. Mr. Consalvi was unaccompanied during the site reconnaissance. This section presents the findings of the site reconnaissance. These observations pertain to the general conditions of the physical land, including location and presence of ponded water, wetlands, stained and stressed vegetation, monitoring wells, wastewater, and solid or liquid waste. Due to the presence of vegetation, visibility of ground features was restricted.

5.1 SITE RECONNAISSANCE

On the day of the site reconnaissance, the weather conditions were cloudy and very cold. It was possible to walk the entire site. Photographs were taken of notable site features and are included in **Appendix I**.

The exterior of the site was visually and/or physically observed from the periphery, including adjacent public thoroughfares, and then systematically traversed to view the site. Observations of the site were in places obstructed by vegetation.

At the time of the site reconnaissance, the site was used as a vacant lot. The site is located on the southeast corner of the intersection of North Kilbourn Avenue and West Chicago Avenue. No structures are currently present on the site. No hazardous substance or petroleum products were observed.

Unpaved pathways with no apparent outlet randomly throughout the site that may have been used as an avenue for dumping of hazardous materials or petroleum products were observed during site reconnaissance.

5.1.1 Hazardous Substances and Petroleum Products Storage Containers

No containers identified as containing hazardous substances or petroleum products were observed on the site during the site reconnaissance.

5.1.2 Aboveground Storage Tanks/Underground Storage Tanks

No ASTs and associated dispenser and piping were observed on the site. No USTs or associated dispensers and piping were observed on the site.

5.1.3 Buildings and Structures

No buildings or structures were present on the site. Building debris indicating the possible past presence of a structure was noted in the northwest corner of the site.

5.1.4 Odors/Staining

No unusual odors or staining were noted at the site on the day of the site reconnaissance.

5.1.5 Drums/Unidentified Substance Containers

No drums were observed on the site during the site reconnaissance. No unidentified containers containing unidentified substances suspected of being hazardous substances or petroleum products were observed on the site during the site reconnaissance.

5.1.6 Debris

Several areas with debris were noted during the site reconnaissance. The building debris in the northwest corner noted above, a pile of stone in the northwest corner near Chicago Avenue, mounded soil near the north central, north west and north-east corner of the site, a clay pipe pile near the northeast corner, piled railroad ties in two locations on the southern portion of the site, and an abandoned rail spur near the southern boundary of the site.

5.1.7 Asbestos Containing Materials

No potential asbestos containing materials were noted on the site during the site reconnaissance.

5.1.8 Transformers

No transformers were noted on the site during the site reconnaissance. No electrical or hydraulic equipment known to contain PCBs or likely to contain PCBs was visually observed

5.1.9 Stressed Vegetation

No stressed vegetation was observed on the site during the site reconnaissance

5.1.10 Other Notable Features

Standing surface water was not observed on the site during the site reconnaissance. Pools, catchment structures, or sumps containing liquids or oily sheen likely to be hazardous substances or petroleum products were not observed on the site during the site reconnaissance.

Areas that have been filled or graded suggesting trash, construction debris, demolition debris, or other solid waste disposal were observed on the site during the site reconnaissance. A large long

mound of soil is present along the north and west portions of the site. Stacked railroad ties, a pile of clay pipe, mounded stone and an abandoned rail spur are present on the site.

A few monitoring wells were observed on the site during the site reconnaissance. Previous interviews with the site owner and his environmental consultant and review of a previous Phase I indicated that 15 monitoring wells were placed on the site. The wells were designed to monitor the site when its development as a solid waste transfer station was planned.

5.2 ADJACENT PROPERTIES RECONNAISSANCE

5.2.1 Hazardous Substances and Petroleum Products Storage Containers

No containers identified as containing hazardous substances or petroleum products were observed on adjacent sites during the site reconnaissance.

5.2.2 Aboveground Storage Tanks/Underground Storage Tanks

No ASTs were observed on adjacent sites. No UST- associated dispensers and piping were observed on adjacent sites.

5.2.3 Buildings and Structures

Buildings were present on adjacent sites.

5.2.4 Odors/Staining

No unusual odors or staining were noted at adjacent sites on the day of the site reconnaissance.

5.2.5 Drums/Unidentified Substance Containers

No drums were observed on adjacent sites during the site reconnaissance. No unidentified containers suspected of being hazardous substances or petroleum products were observed on adjacent sites during the site reconnaissance.

5.2.6 Debris

No debris was observed on adjacent sites during the site reconnaissance.

5.2.7 Transformers

No transformers were noted on adjacent sites during the site reconnaissance.

5.2.8 Stressed Vegetation

No stressed vegetation was observed on adjacent sites during the site reconnaissance.

5.2.9 Other Notable Features

No other notable features were observed on adjacent sites during the site reconnaissance.

6.0 CONCLUSIONS AND RECOMMENDATIONS

Amec Foster Wheeler was retained by the City of Chicago Department of Fleet and Facility Management (2FM) to conduct a Phase I ESA for the site located at 4301 West Chicago Avenue in Chicago, Cook County, Illinois in general accordance with the scope and limitations of ASTM International E 1527-13, "Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process." Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition is expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase have been updated by our subcontractor, Yung Environmental, Inc. in this final Phase I ESA report.

Amec Foster Wheeler prepared this Phase I ESA in accordance with a proposal dated May 18, 2017 as updated on September 26, 2017.

This Phase I ESA is intended to satisfy one of the requirements to permit 2FM to qualify for the innocent landowner, adjoining property owner, or bona fide prospective purchaser limitations on liability under the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (landowner liability protections). This Phase I ESA conforms to standards for "*all appropriate inquiries*" into the previous ownership and uses of the site as specified by the US Environmental Protection Agency (EPA) in 40 CFR Part 312, and in accordance with good commercial or customary practice.

Site History

Based on a review of reasonably ascertainable records, the site was vacant prior to its first developed usage. The site was developed as a rail yard by 1900 according to historic topographic maps. Previous environmental reports for the site indicate that the rail yard was constructed in 1896 by the Chicago and Northwestern Transportation Company on previously undeveloped land. By 1978-1980, most of the rail yard tracks were gone, and by at most 2002, the parcel was totally vacant.

Site Reconnaissance

At the time of Yung Environmental, Inc.'s site reconnaissance on November 15, 2017, the site was observed to be vacant. Amec Foster Wheeler did not observe evidence of aboveground storage tanks (ASTs), underground storage tanks (USTs), odors, pools of liquid, drums, containers storing potentially hazardous substances or petroleum products, stains or corrosion, pits, ponds, or

lagoons. Significant amounts of debris and mounded soil were present and a small demolished building structure was noted in the northeast.

Environmental Records

Review of the federal, state, and tribal (if appropriate) records, including a proprietary records summary provided by Environmental Data Resources, Inc (EDR), a third-party provider of environmental and land use records, indicates that properties of environmental concern are located within the respective ASTM standard search distances for each category. Amec Foster Wheeler has screened the identified properties for significance with respect to their potential impact on the site based on reasonably ascertainable information obtained from the records review, site reconnaissance, and interviews. Based on distances from the site boundary, the types of listings, and the assumed direction of groundwater flow, none of the properties listed is likely to have a negative impact on the site except those listed in Table 10 below.

Conclusions

No significant data gaps were identified that affected Amec Foster Wheeler's ability to identify RECs for the site, except overgrown vegetation which prevented viewing all of the ground surface.

Amec Foster Wheeler has performed this Phase I ESA in conformance with the scope and limitations of ASTM Standard E 1527-13. This assessment has revealed no evidence of RECs in connection with the site, except for the following:

Table 9: On-Site RECs

PIN#	Address	Acreage	Current/ Historic Land	RECs	COCs	Pathways
16-10-200-061-0000	4301 W Chicago Ave	30.4	Vacant/ Former Railyard	USTs	BTEX, Lead, PNAs	Groundwater, Soil Ingestion, Soil Inhalation, Vapor Intrusion
				Fill, Debris	PNAs, Metals	
				Rail Ties	Arsenic, Cresols	
				Previous Contaminants	PNAs, Metals	

Off-site sources of contamination that have the potential to migrate onto the site have been identified as a REC(s), as follows:

Table 10: Off-Site RECs

4301 West Chicago Ave, Chicago, Illinois
Phase I Environmental Site Assessment

Address	Distance	Current/ Historic Land Use	RECs	COCs	Pathways
CTA 4401 West Chicago Ave	Adjacent North EDR: 477 ft North	Bus Garage/ Rail yard	USTs	BTEX, Lead, PNAs	Groundwater Ingestion Inhalation, Vapor Intrusion
			Rail yard	Arsenic, Cresols	
			Fill	PNAs, Metals	
RAIL IT Property 733 N Kilbourn Ave	AdjacentWest or Property EDR: 910 ft West	Vacant/ Rail yard	UST	BTEX, PNAs	Groundwater Ingestion Inhalation Vapor Intrusion
Department of Streets and Sanitation 750 N. Kilbourn Ave	Adjacent West EDR: 1044 ft West	Transfer Station and Incinerator/ Rail yard	USTs	BTEX, Lead	Groundwater Ingestion Inhalation Vapor Intrusion
			Air Particulate from Former Incinerator	Metals, PNAs	
City of Chicago 715 N. Kilbourn Ave (750 N. Kilbourn Ave.)	Adjacent West EDR: 800 ft West	Vacant/ Rail yard	UST with Release	BTEX, PNAs	Groundwater Ingestion Inhalation Vapor Intrusion

ft= feet

Based on the results and conclusions of the Phase I ESA, Amec Foster Wheeler recommends further evaluation of soil and/or groundwater quality beneath the site.

7.0 SIGNATURE(S) OF ENVIRONMENTAL PROFESSIONAL(S)

We declare that, to the best of our professional knowledge and belief, we meet the definition of environmental professional as defined in Title 40 of the Code of Federal Regulations (CFR), Part 312. We have the specific qualifications based on education, training, and experience (see **Appendix K**) to assess a site of the nature, history, and setting of the subject site. We have developed and performed all the appropriate inquiries in conformance with the standards and practices set forth in 40 CFR 312.

We appreciate the opportunity to be of service to 2FM on this project. If you have any questions or comments regarding this report, please contact the undersigned at 773-693-6030.

Amec Foster Wheeler Environment & Infrastructure, Inc.
Reviewed By:



Mary E. Jank, PG
Sr. Associate Geologist

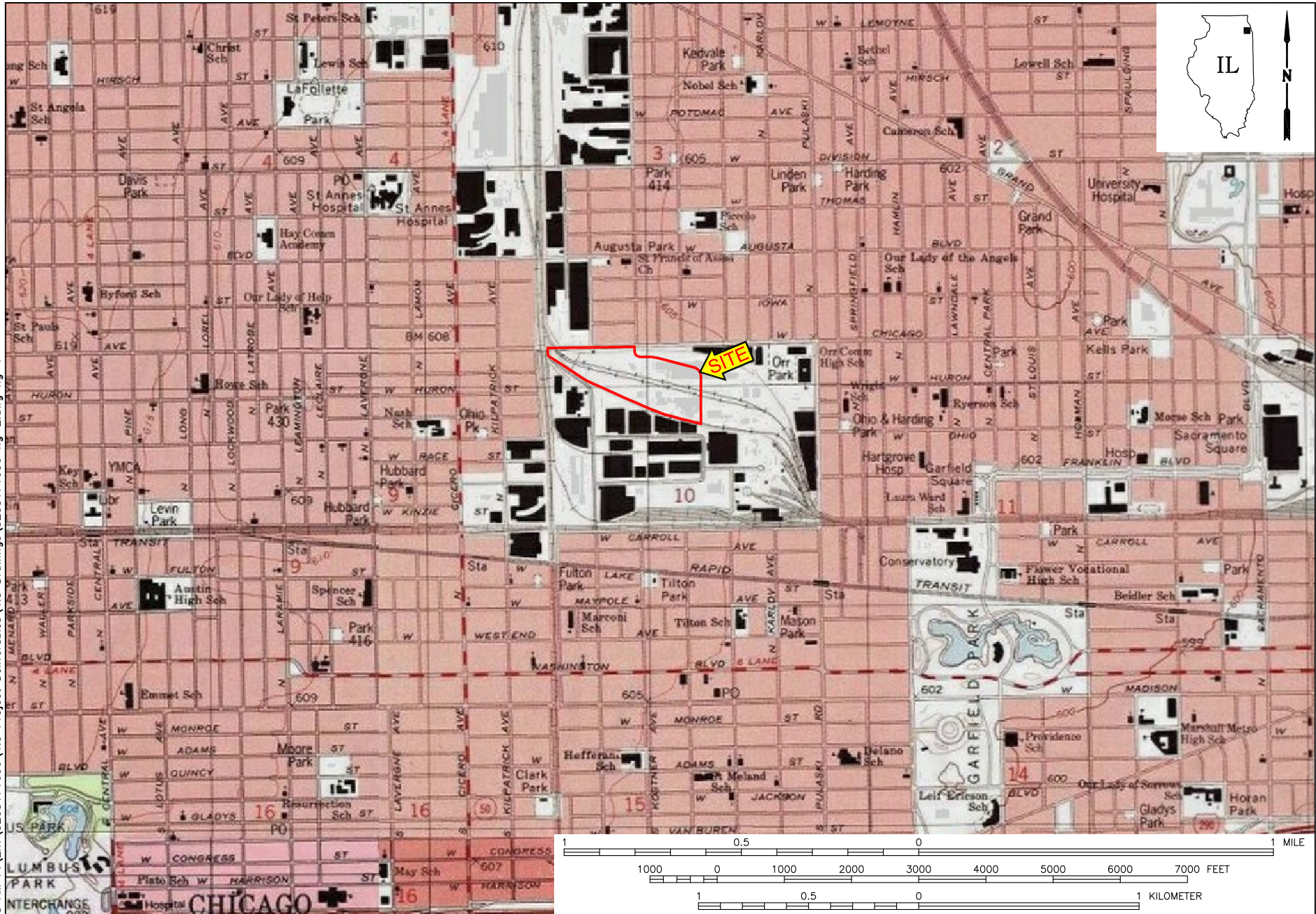


For Carmen Yung, LEED AP
Yung Environmental, Inc. *w/permission*



FIGURES

12/5/2017 10:38 AM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606 fig-2.dwg fig-1



LEGEND:

——— = APPROXIMATE SITE BOUNDARY



Amec Foster Wheeler
Environment & Infrastructure, Inc.

Property Location Map
Vacant Parcel
Chicago Avenue & Kilbourn Avenue
Chicago, IL

DRAWN: GAP
PROJECT NUMBER: 3205171606

APPROVED: [Signature]
DATE: 6/19/17

REVISED DATE: [Blank]
REV. #: [Blank]

FIGURE
1



APPENDIX A

Aerial Photographs

Vacant Parcel

W. Chicago Ave. & N. Kilbourn Ave.

Chicago, IL 60624

Inquiry Number: 4967723.12

June 15, 2017

The EDR Aerial Photo Decade Package



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Site Name:

Vacant Parcel
 W. Chicago Ave. & N. Kilbourn
 Chicago, IL 60624
 EDR Inquiry # 4967723.12

Client Name:

AMEC Environment & Infrastructure, Inc.
 8745 West Higgins Rd
 Chicago, IL 60631
 Contact: Mary Jank



Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

Search Results:

<u>Year</u>	<u>Scale</u>	<u>Details</u>	<u>Source</u>
2012	1"=500'	Flight Year: 2012	USDA/NAIP
2011	1"=500'	Flight Year: 2011	USDA/NAIP
2010	1"=500'	Flight Year: 2010	USDA/NAIP
2009	1"=500'	Flight Year: 2009	USDA/NAIP
2007	1"=500'	Flight Year: 2007	USDA/NAIP
2005	1"=500'	Flight Year: 2005	USDA/NAIP
1999	1"=500'	Acquisition Date: March 22, 1999	USGS/DOQQ
1994	1"=500'	Flight Date: March 25, 1994	USGS
1988	1"=500'	Flight Date: April 12, 1988	USGS
1980	1"=500'	Flight Date: January 01, 1980	USGS
1978	1"=500'	Flight Date: October 30, 1978	USGS
1972	1"=500'	Flight Date: October 26, 1972	USGS
1962	1"=500'	Flight Date: April 20, 1962	USGS
1951	1"=500'	Flight Date: December 04, 1951	USGS
1938	1"=500'	Flight Date: November 29, 1938	ILGS

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.



SITE

INQUIRY #: 4967723.12

YEAR: 2012

— = 500'





SITE

INQUIRY #: 4967723.12

YEAR: 2011

— = 500'





SITE

INQUIRY #: 4967723.12

YEAR: 2010

— = 500'





INQUIRY #: 4967723.12

YEAR: 2009

— = 500'





SITE

INQUIRY #: 4967723.12

YEAR: 2007

— = 500'





INQUIRY #: 4967723.12

YEAR: 2005

— = 500'





SITE

INQUIRY #: 4967723.12

YEAR: 1999

— = 500'





SITE

INQUIRY #: 4967723.12

YEAR: 1994

— = 500'





INQUIRY #: 4967723.12

YEAR: 1988

— = 500'





INQUIRY #: 4967723.12

YEAR: 1980

— = 500'





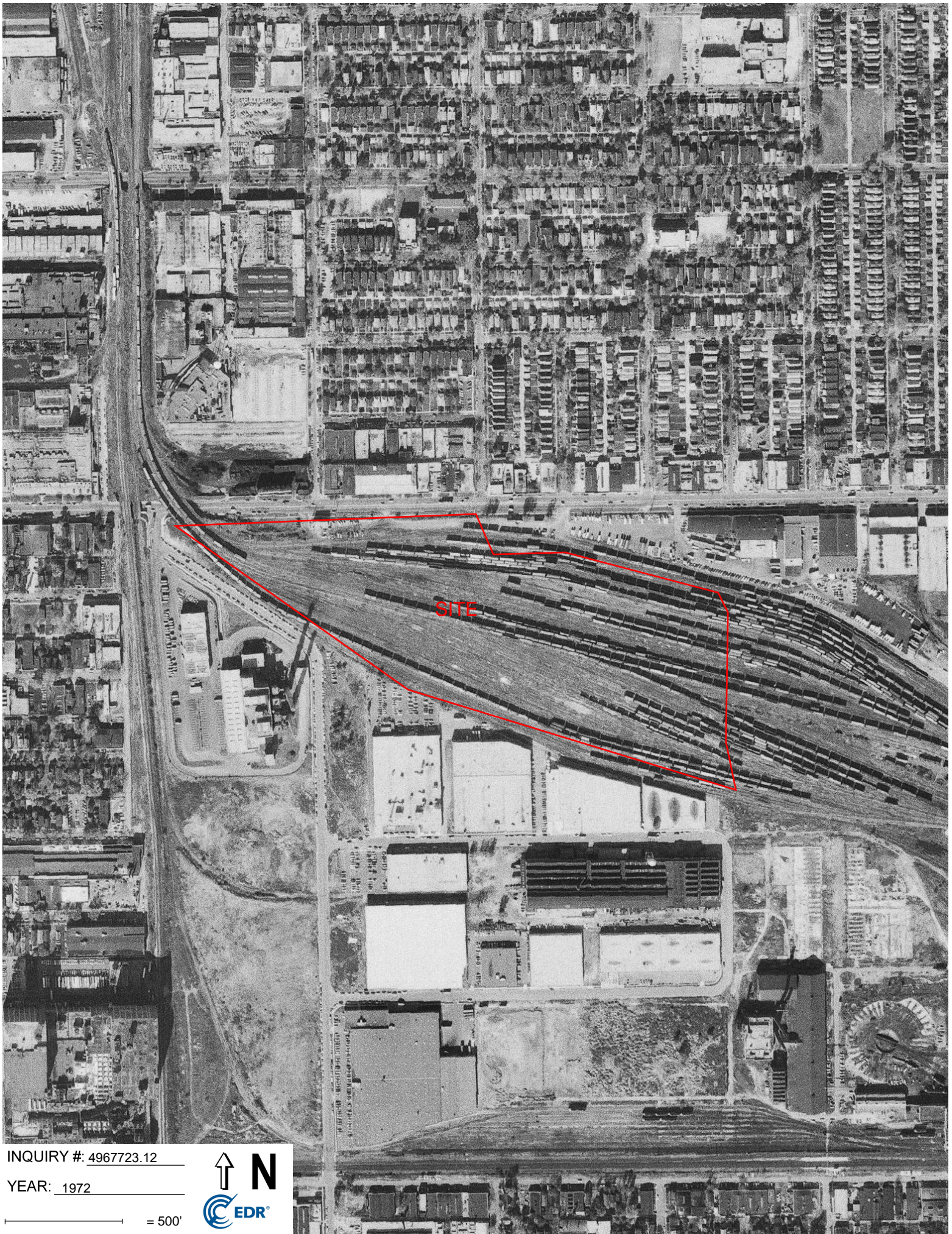
SITE

INQUIRY #: 4967723.12

YEAR: 1978

— = 500'





INQUIRY #: 4967723.12

YEAR: 1972

— = 500'





INQUIRY #: 4967723.12

YEAR: 1962

— = 500'





INQUIRY #: 4967723.12

YEAR: 1951

— = 500'





INQUIRY #: 4967723.12

YEAR: 1938

— = 500'





APPENDIX B

Topographic Maps

Vacant Parcel

W. Chicago Ave. & N. Kilbourn Ave.

Chicago, IL 60624

Inquiry Number: 4967723.4

June 15, 2017

EDR Historical Topo Map Report

with QuadMatch™



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

06/15/17

Site Name:

Vacant Parcel
W. Chicago Ave. & N. Kilbourn
Chicago, IL 60624
EDR Inquiry # 4967723.4

Client Name:

AMEC Environment & Infrastructure, Inc.
8745 West Higgins Rd
Chicago, IL 60631
Contact: Mary Jank



EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by AMEC Environment & Infrastructure, Inc. were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDR's Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results:**Coordinates:**

P.O.#	3205171606	Latitude:	41.89386 41° 53' 38" North
Project:	City of Chicago 2FM	Longitude:	-87.735983 -87° 44' 10" West
		UTM Zone:	Zone 16 North
		UTM X Meters:	438946.27
		UTM Y Meters:	4638253.58
		Elevation:	610.00' above sea level

Maps Provided:

2012	1901
1997, 1998	1900
1993	1891
1978, 1980	1889
1972	
1963	
1953	
1928, 1929	

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2012 Source Sheets



Berwyn
2012
7.5-minute, 24000



Englewood
2012
7.5-minute, 24000

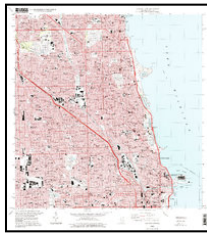


Chicago Loop
2012
7.5-minute, 24000



River Forest
2012
7.5-minute, 24000

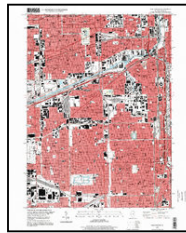
1997, 1998 Source Sheets



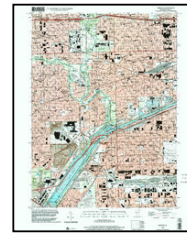
Chicago Loop
1997
7.5-minute, 24000
Aerial Photo Revised 1988



River Forest
1997
7.5-minute, 24000
Aerial Photo Revised 1997

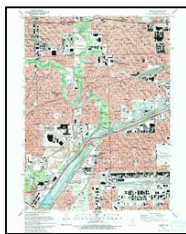


Englewood
1997
7.5-minute, 24000
Aerial Photo Revised 1997

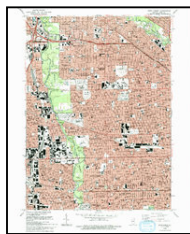


Berwyn
1998
7.5-minute, 24000
Aerial Photo Revised 1998

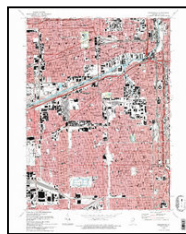
1993 Source Sheets



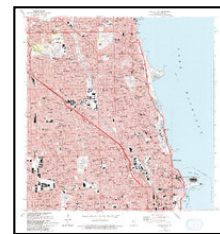
Berwyn
1993
7.5-minute, 24000
Aerial Photo Revised 1988



River Forest
1993
7.5-minute, 24000
Aerial Photo Revised 1988



Englewood
1993
7.5-minute, 24000
Aerial Photo Revised 1988



Chicago Loop
1993
7.5-minute, 24000
Aerial Photo Revised 1988

1978, 1980 Source Sheets



River Forest
1978
7.5-minute, 24000
Aerial Photo Revised 1972



Chicago Loop
1978
7.5-minute, 24000
Aerial Photo Revised 1972



Berwyn
1980
7.5-minute, 24000
Aerial Photo Revised 1978



Englewood
1980
7.5-minute, 24000
Aerial Photo Revised 1978

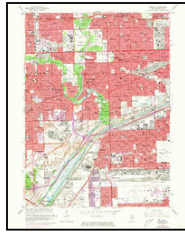
Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1972 Source Sheets



Englewood
1972
7.5-minute, 24000
Aerial Photo Revised 1972



Berwyn
1972
7.5-minute, 24000
Aerial Photo Revised 1972

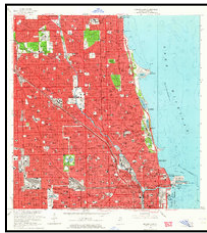


River Forest
1972
7.5-minute, 24000
Aerial Photo Revised 1972

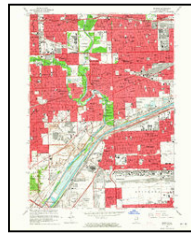


Chicago Loop
1972
7.5-minute, 24000
Aerial Photo Revised 1972

1963 Source Sheets



Chicago Loop
1963
7.5-minute, 24000
Aerial Photo Revised 1962



Berwyn
1963
7.5-minute, 24000
Aerial Photo Revised 1963



River Forest
1963
7.5-minute, 24000
Aerial Photo Revised 1963

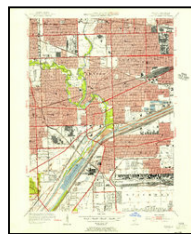


Englewood
1963
7.5-minute, 24000
Aerial Photo Revised 1963

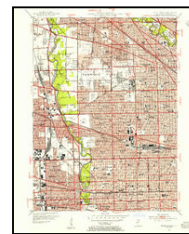
1953 Source Sheets



Englewood
1953
7.5-minute, 24000



Berwyn
1953
7.5-minute, 24000



River Forest
1953
7.5-minute, 24000

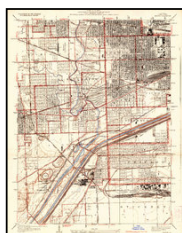


Chicago Loop
1953
7.5-minute, 24000

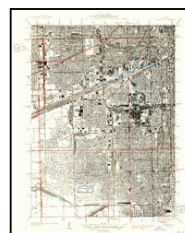
1928, 1929 Source Sheets



River Forest
1928
7.5-minute, 24000



Berwyn
1928
7.5-minute, 24000



Englewood
1929
7.5-minute, 24000



Chicago Loop
1929
7.5-minute, 24000

Topo Sheet Key

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

1901 Source Sheets



Riverside
1901
15-minute, 62500

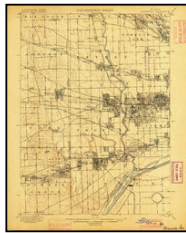


Chicago
1901
15-minute, 62500

1900 Source Sheets



Chicago
1900
15-minute, 62500

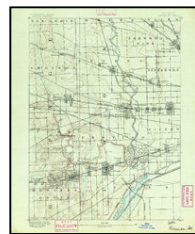


Riverside
1900
15-minute, 62500

1891 Source Sheets



Chicago
1891
15-minute, 62500

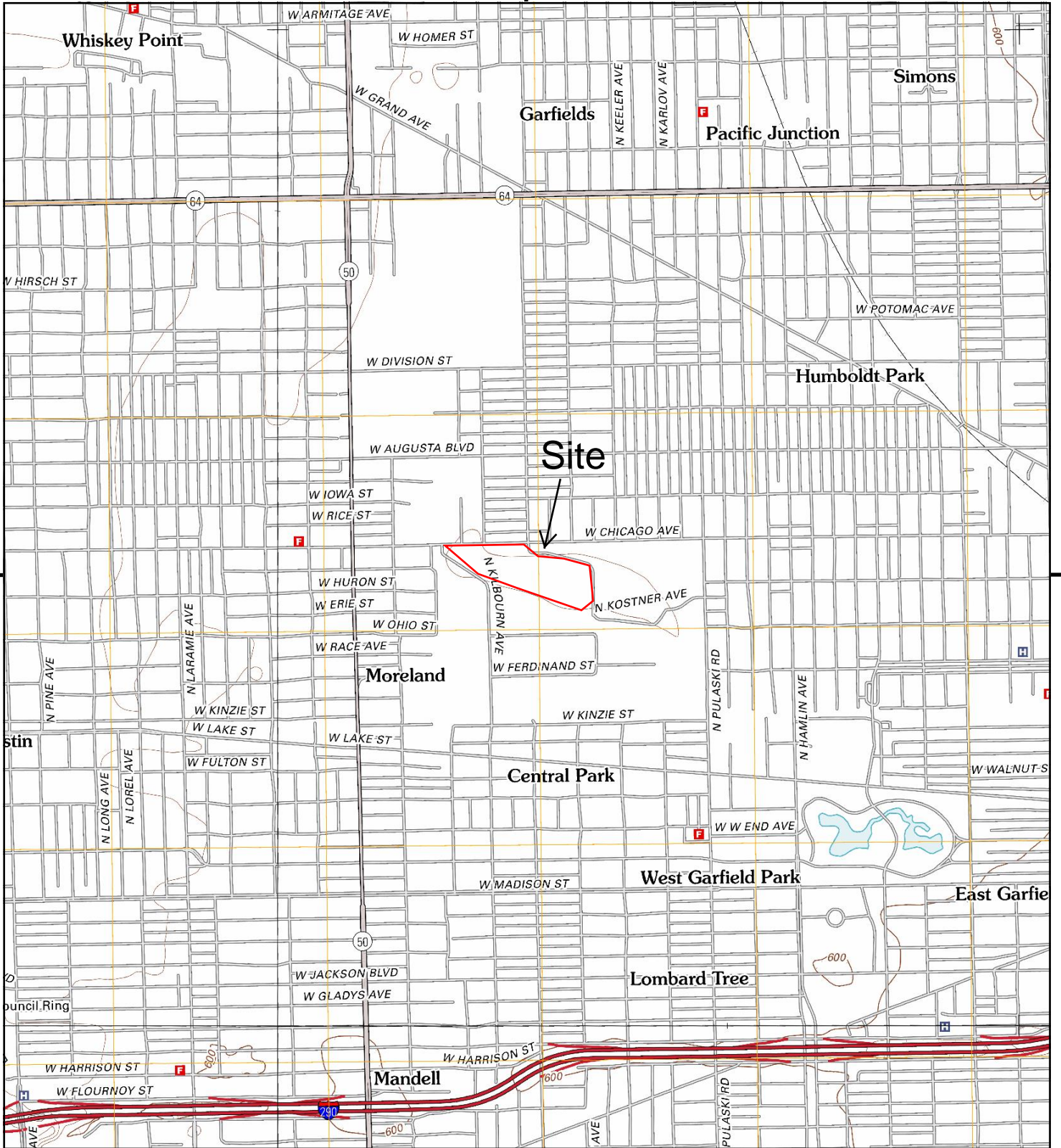


Riverside
1891
15-minute, 62500

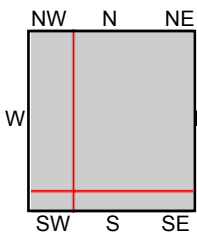
1889 Source Sheets



Chicago
1889
15-minute, 62500



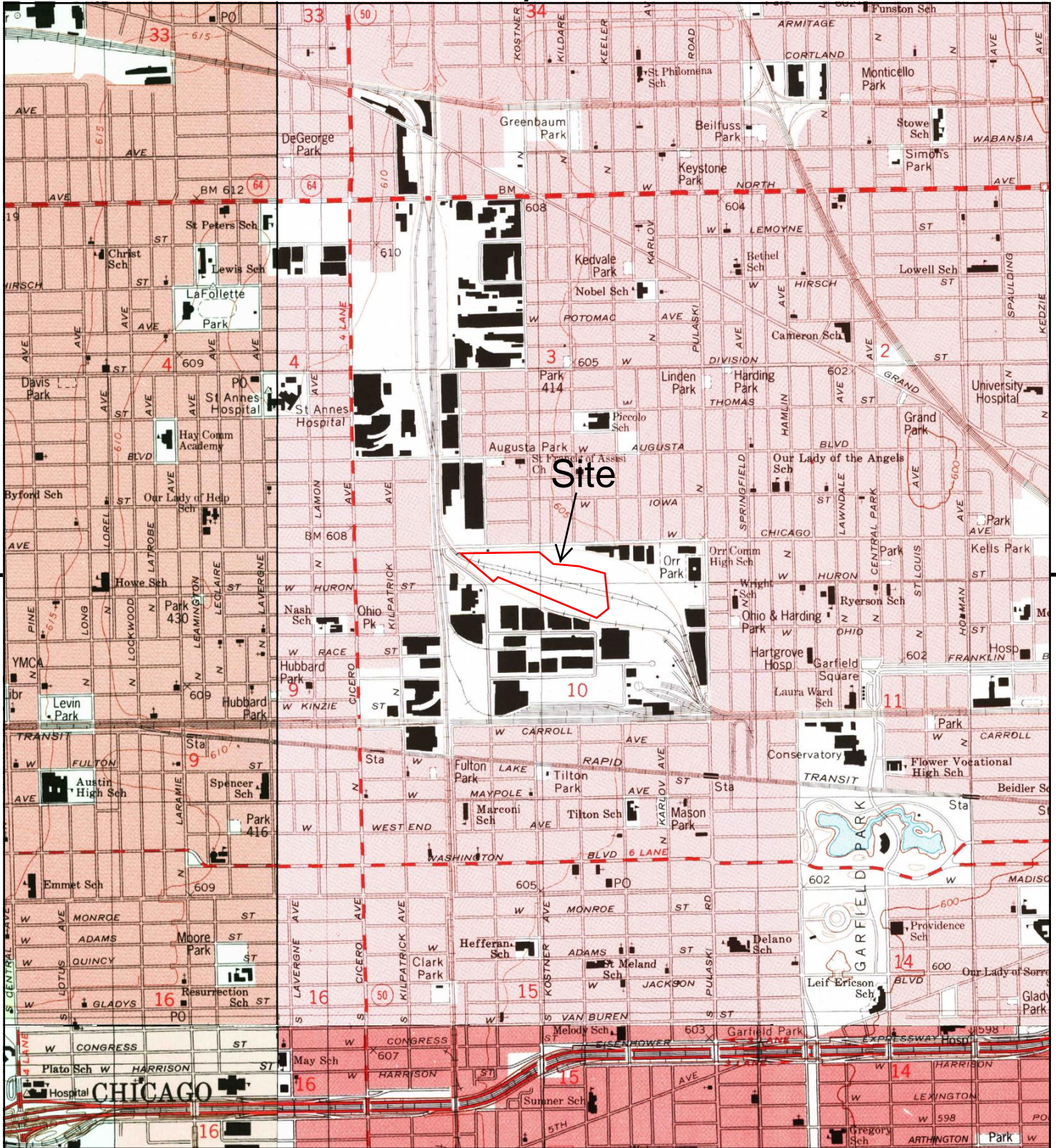
This report includes information from the following map sheet(s).



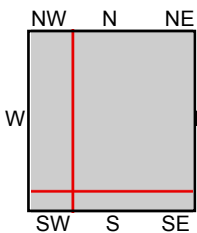
TP, Chicago Loop, 2012, 7.5-minute
 SE, Englewood, 2012, 7.5-minute
 SW, Berwyn, 2012, 7.5-minute
 NW, River Forest, 2012, 7.5-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





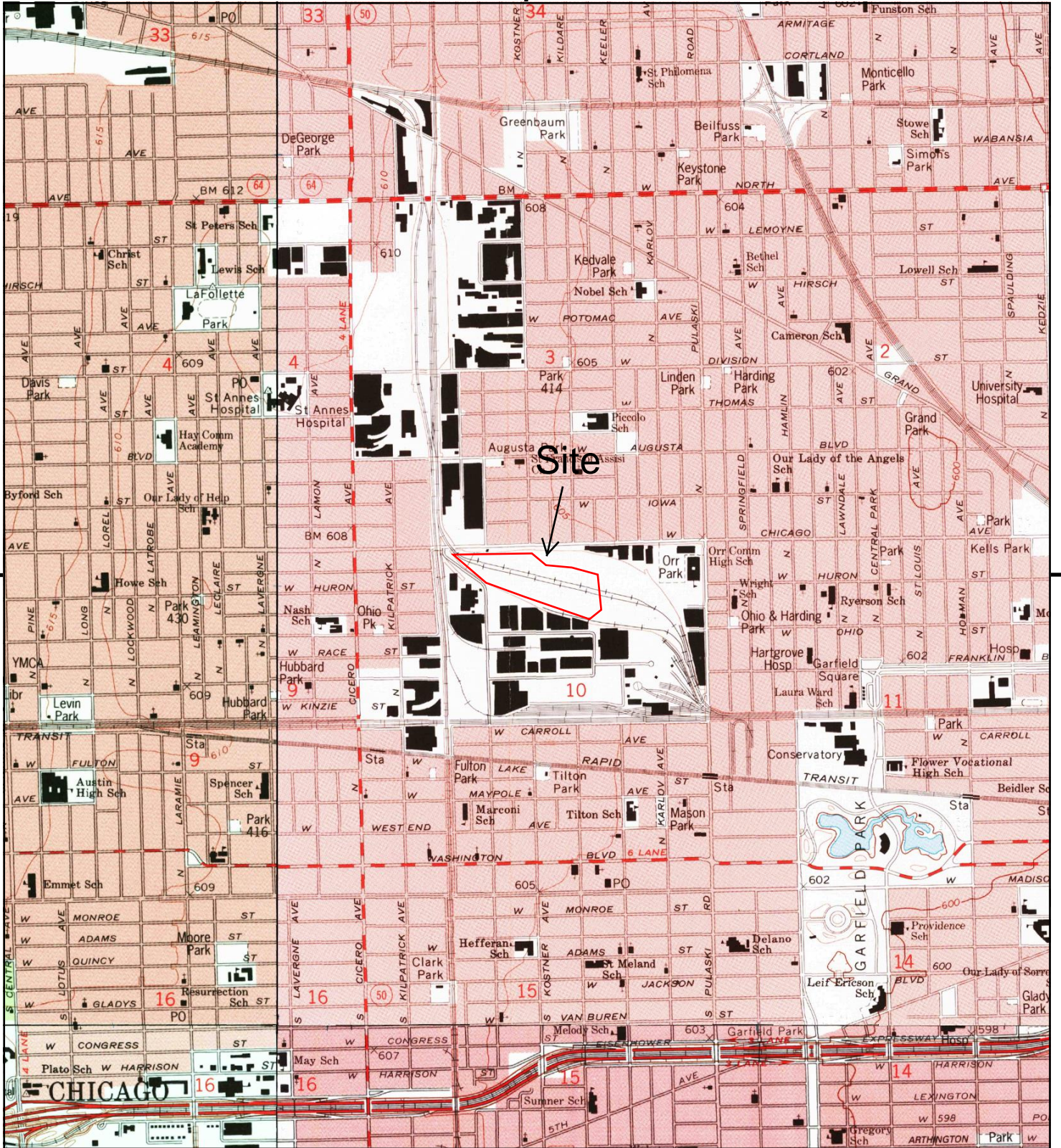
This report includes information from the following map sheet(s).



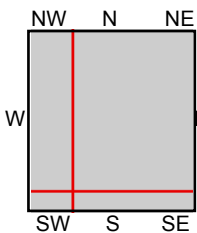
TP, Chicago Loop, 1997, 7.5-minute
 SE, Englewood, 1997, 7.5-minute
 SW, Berwyn, 1998, 7.5-minute
 NW, River Forest, 1997, 7.5-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





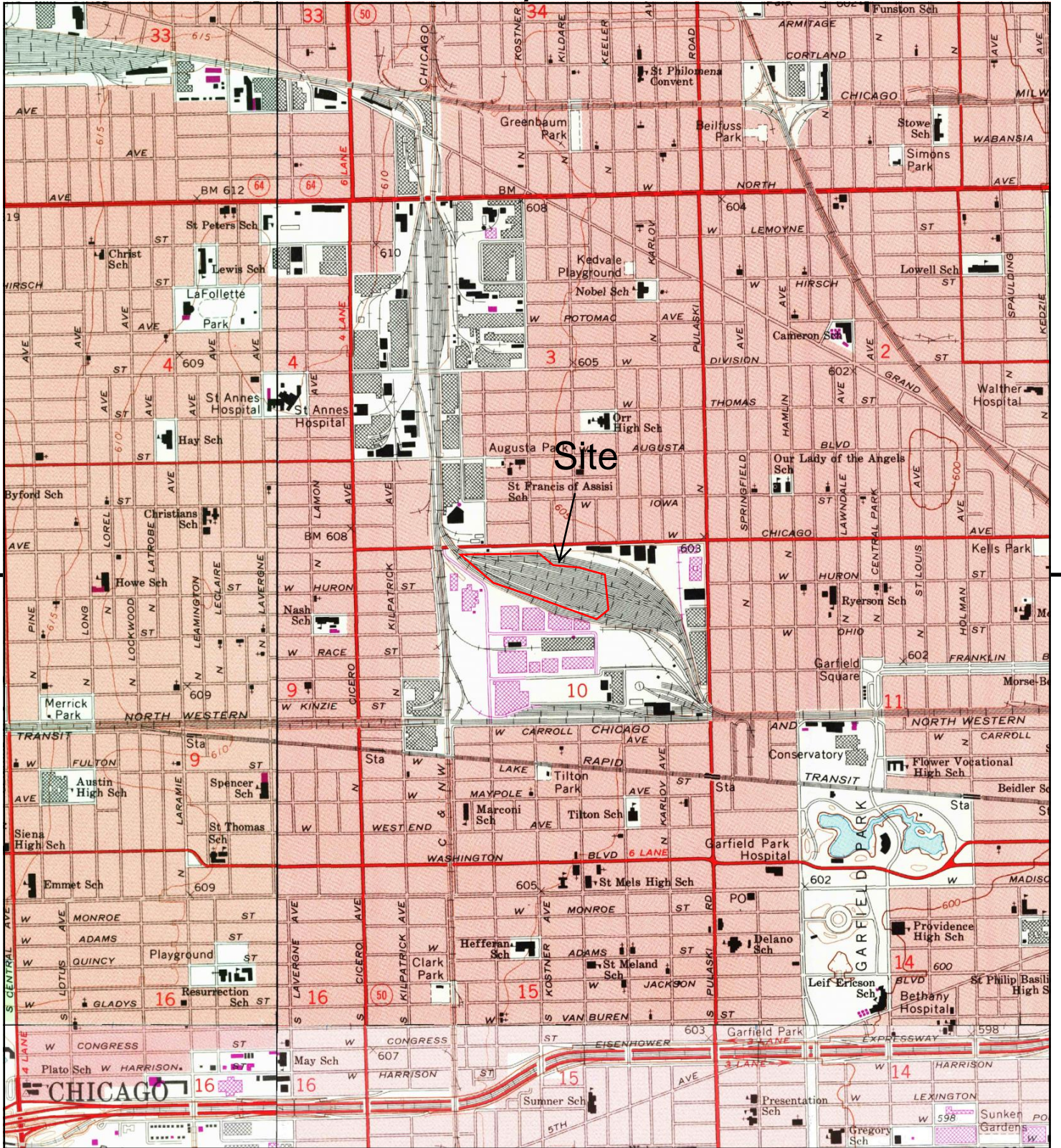
This report includes information from the following map sheet(s).



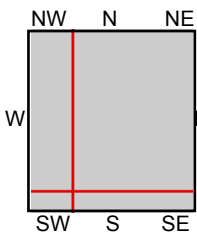
TP, Chicago Loop, 1993, 7.5-minute
 SE, Englewood, 1993, 7.5-minute
 SW, Berwyn, 1993, 7.5-minute
 NW, River Forest, 1993, 7.5-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





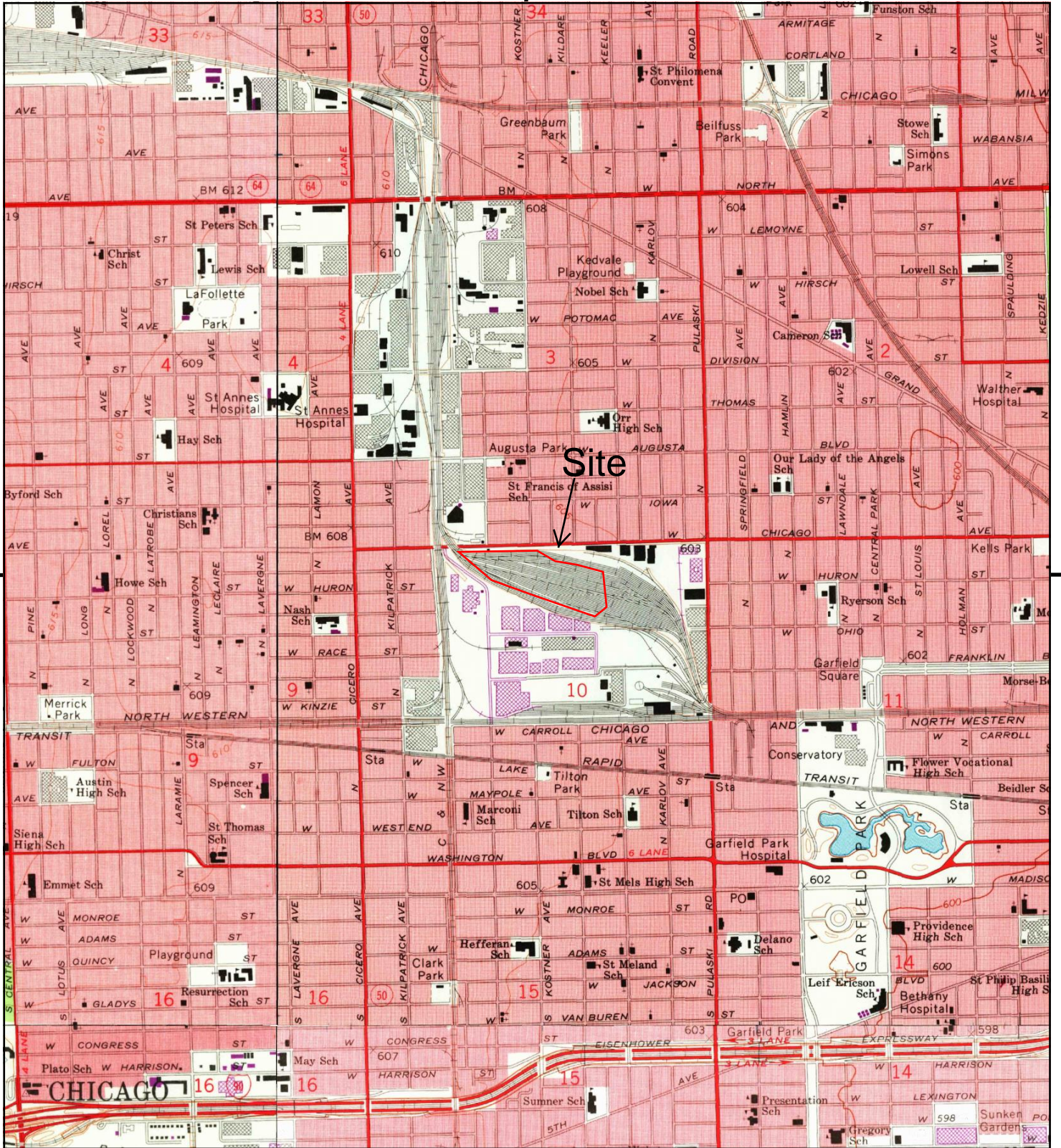
This report includes information from the following map sheet(s).



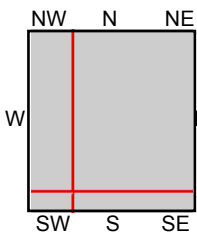
TP, Chicago Loop, 1978, 7.5-minute
 SE, Englewood, 1980, 7.5-minute
 SW, Berwyn, 1980, 7.5-minute
 NW, River Forest, 1978, 7.5-minute

SITE NAME: Vacant Parcel
 ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
 CLIENT: AMEC Environment & Infrastructure, Inc.





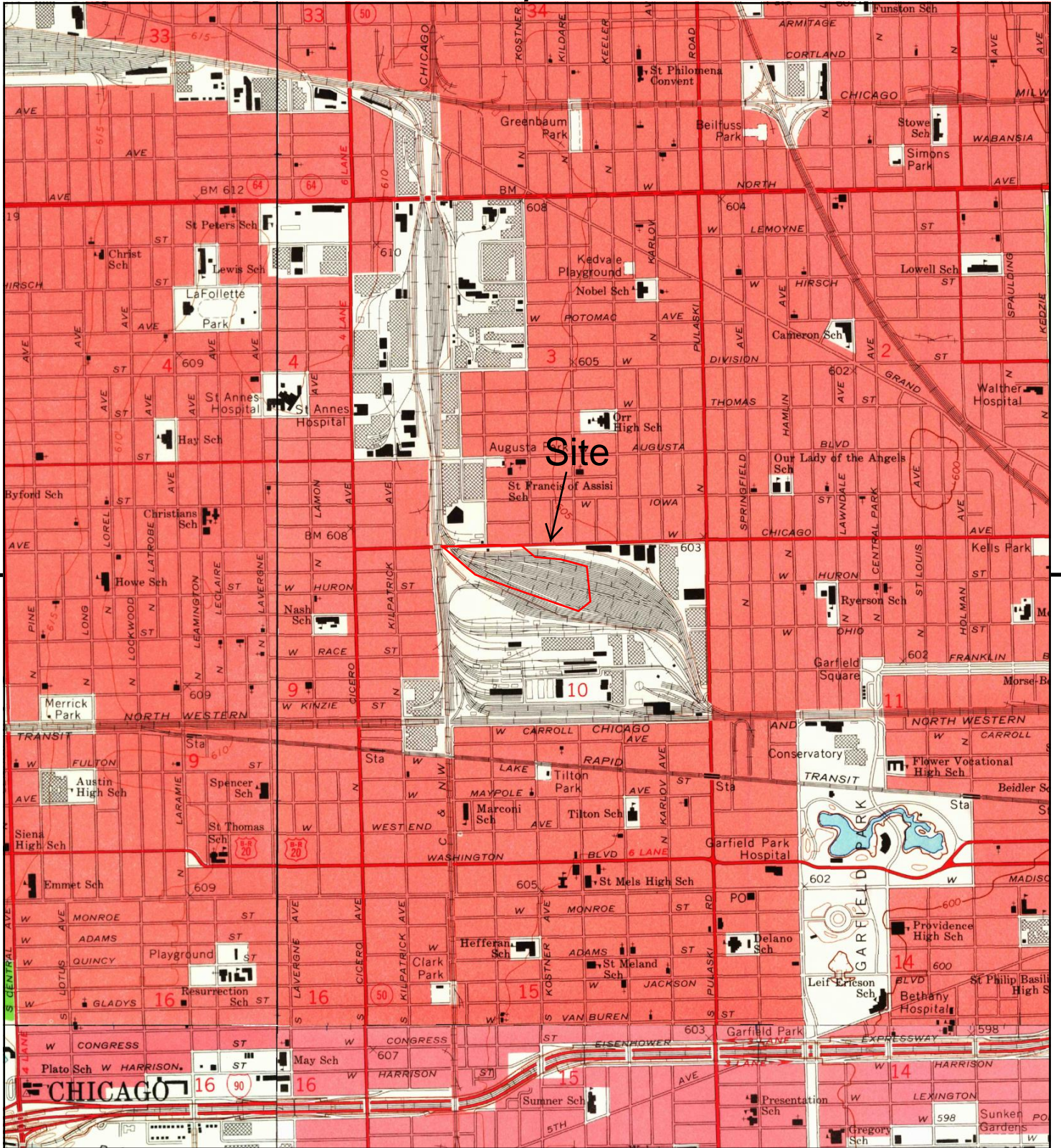
This report includes information from the following map sheet(s).



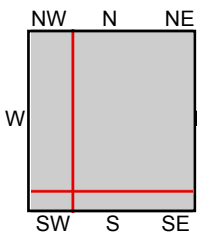
TP, Chicago Loop, 1972, 7.5-minute
 SE, Englewood, 1972, 7.5-minute
 SW, Berwyn, 1972, 7.5-minute
 NW, River Forest, 1972, 7.5-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





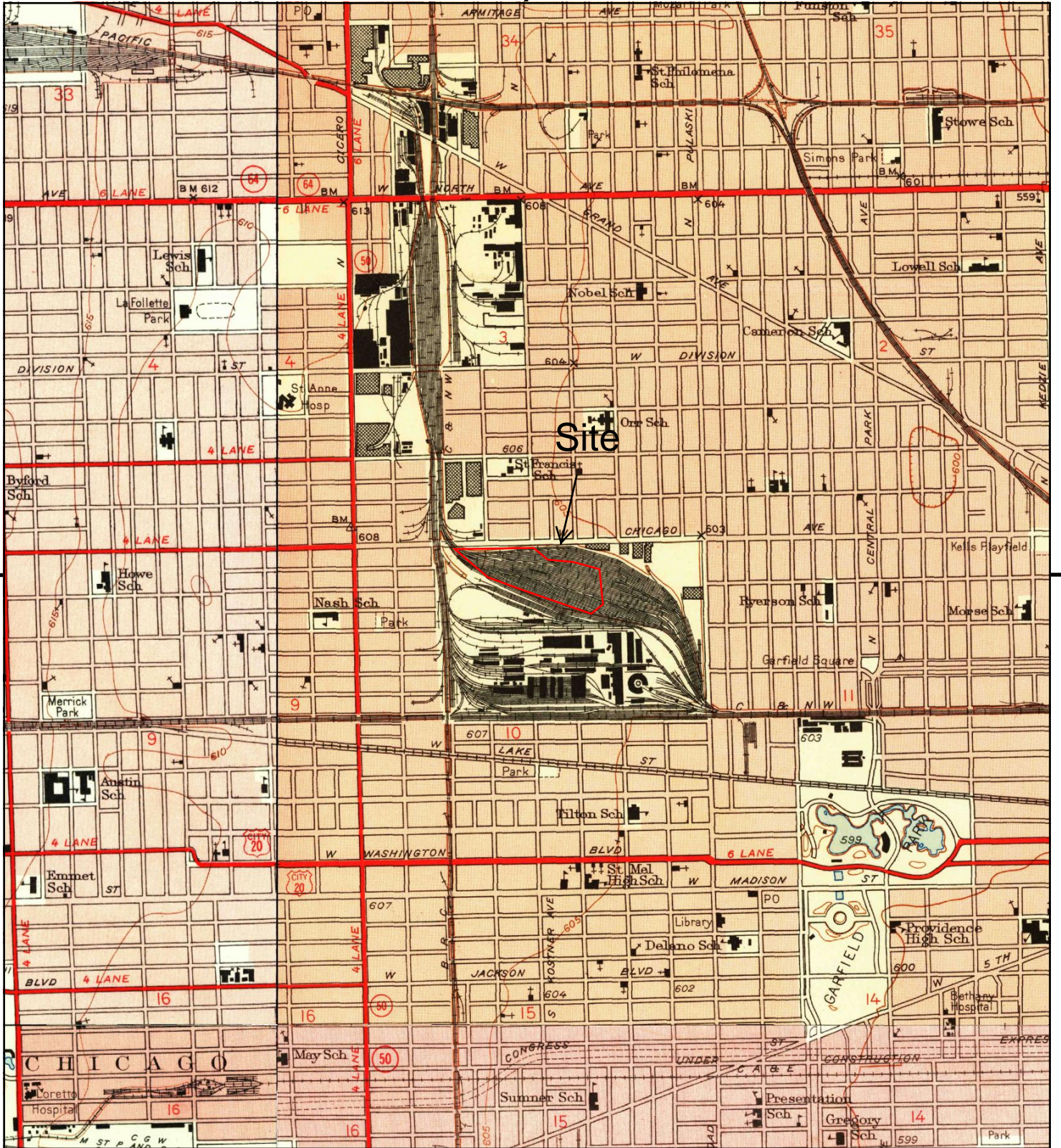
This report includes information from the following map sheet(s).



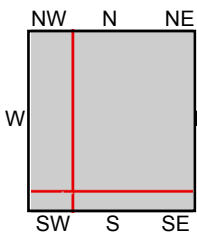
TP, Chicago Loop, 1963, 7.5-minute
 SE, Englewood, 1963, 7.5-minute
 SW, Berwyn, 1963, 7.5-minute
 NW, River Forest, 1963, 7.5-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





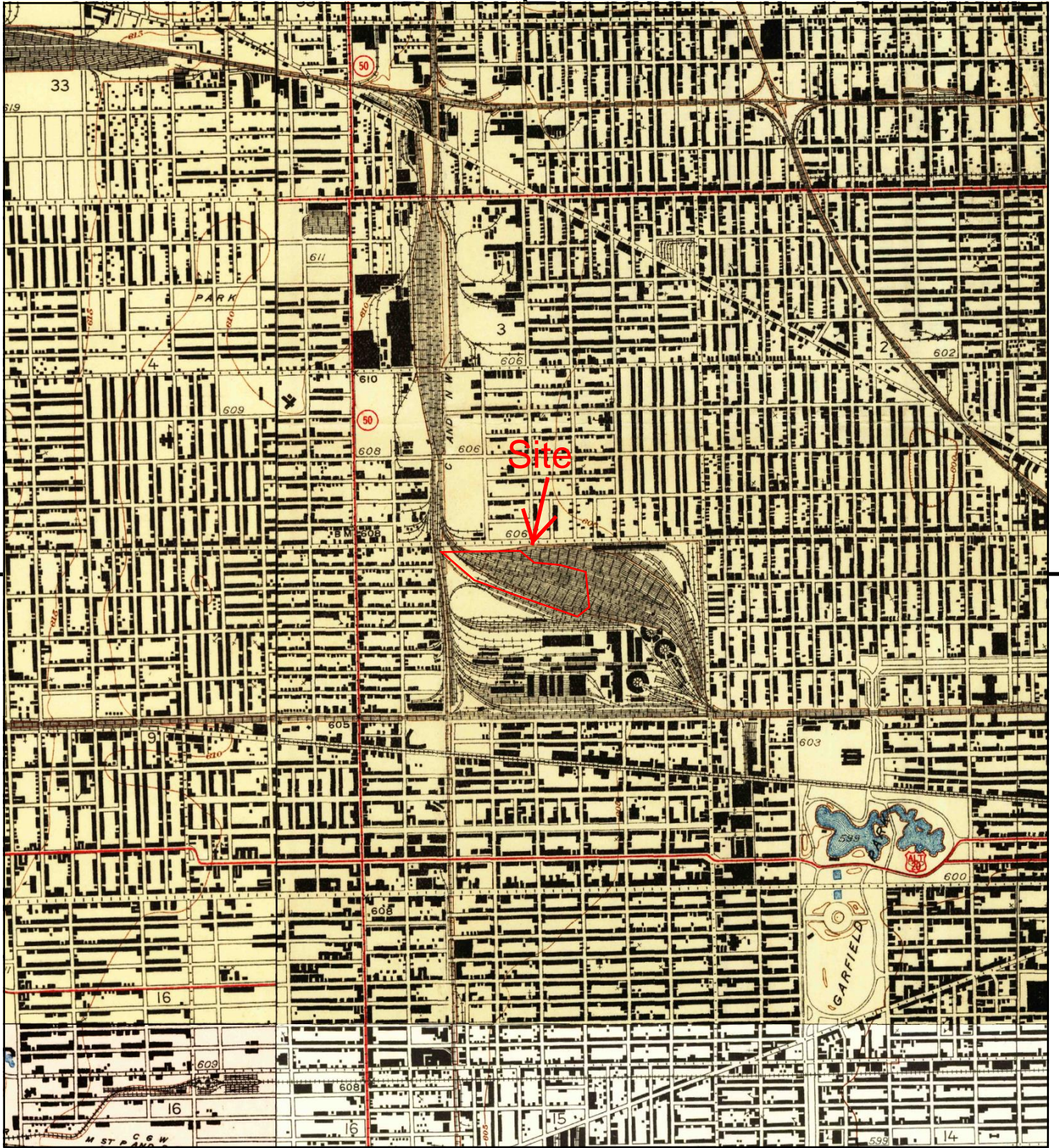
This report includes information from the following map sheet(s).



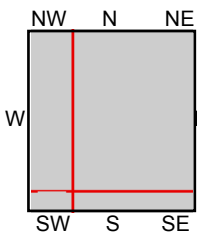
TP, Chicago Loop, 1953, 7.5-minute
 SE, Englewood, 1953, 7.5-minute
 SW, Berwyn, 1953, 7.5-minute
 NW, River Forest, 1953, 7.5-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





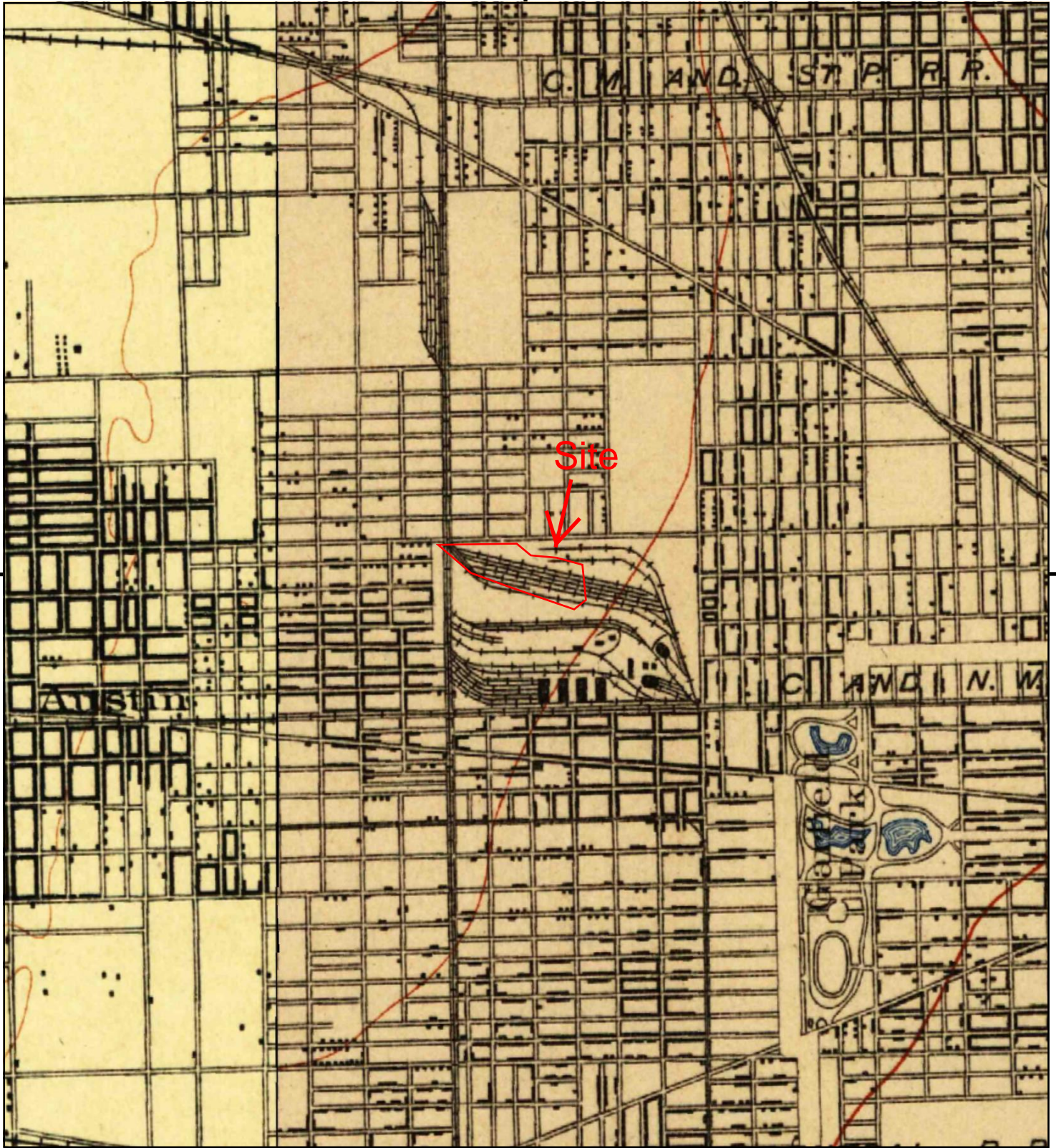
This report includes information from the following map sheet(s).



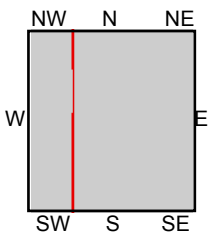
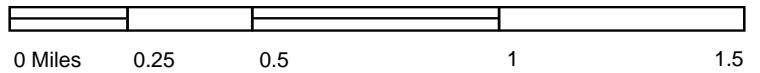
TP, Chicago Loop, 1929, 7.5-minute
 SE, Englewood, 1929, 7.5-minute
 SW, Berwyn, 1928, 7.5-minute
 NW, River Forest, 1928, 7.5-minute

SITE NAME: Vacant Parcel
 ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
 CLIENT: AMEC Environment & Infrastructure, Inc.





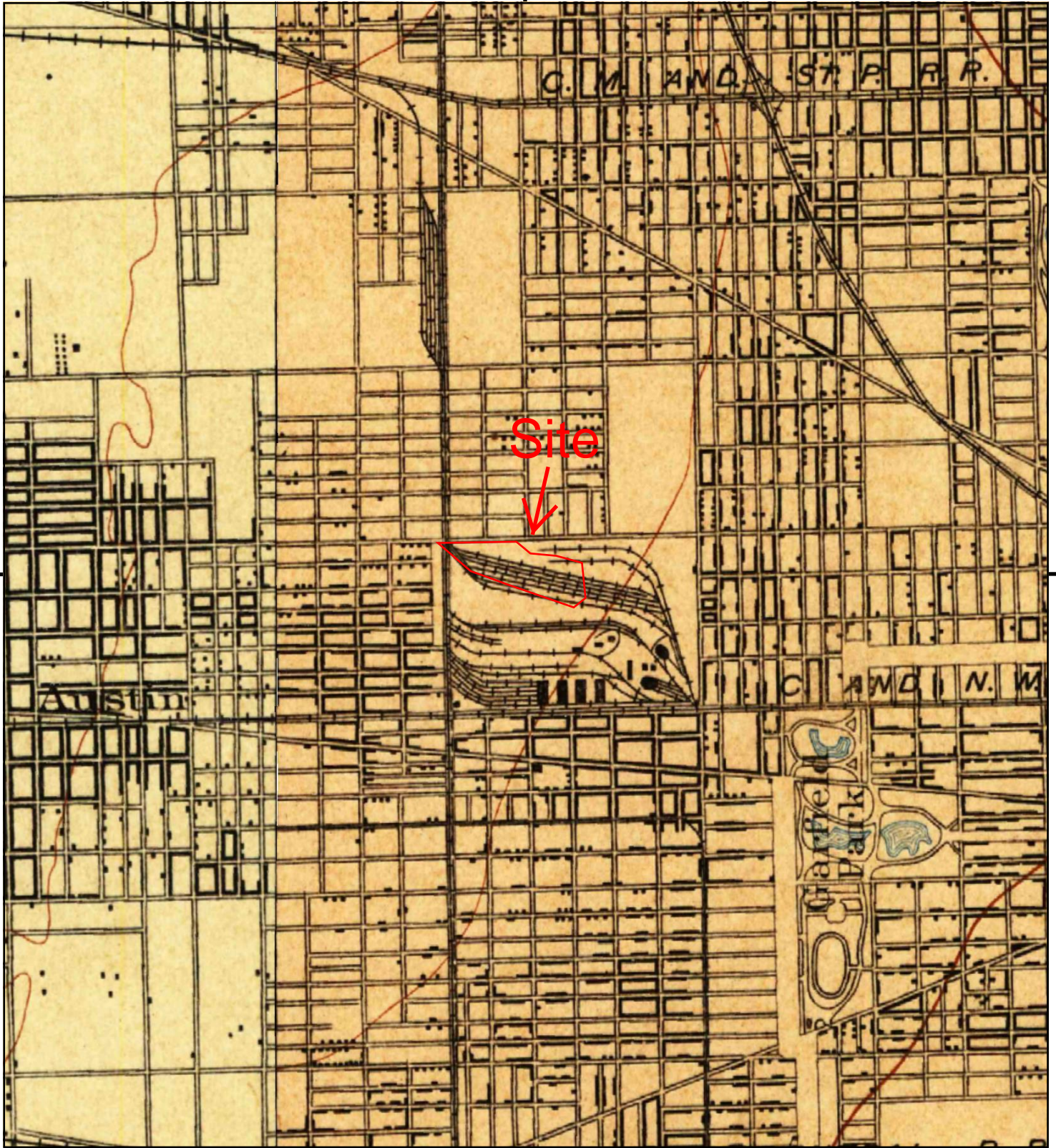
This report includes information from the following map sheet(s).



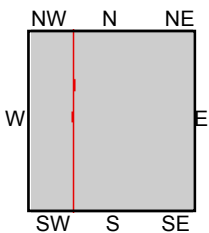
TP, Chicago, 1901, 15-minute
W, Riverside, 1901, 15-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





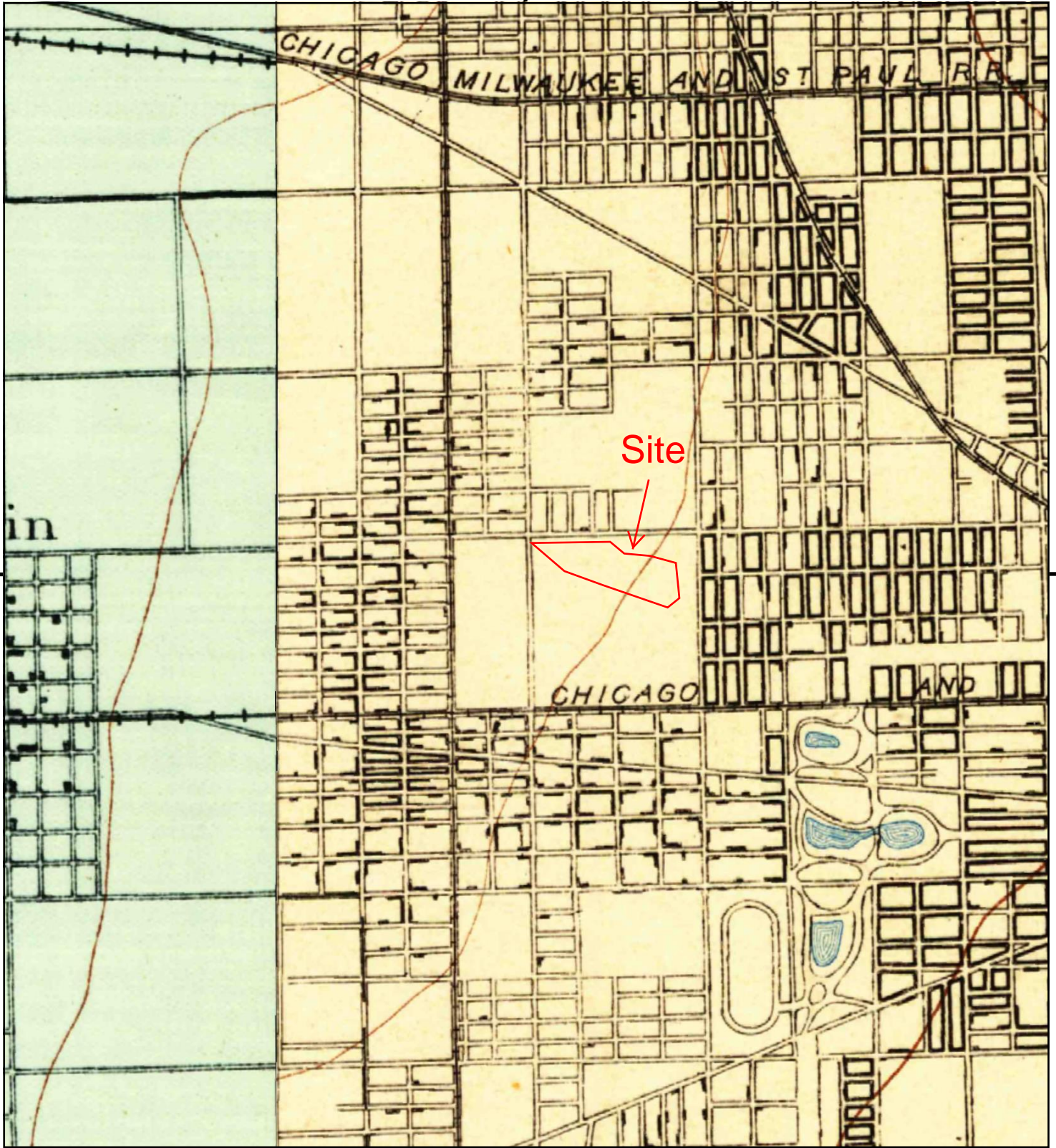
This report includes information from the following map sheet(s).



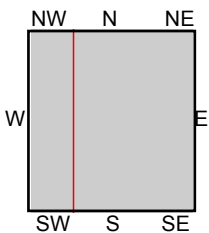
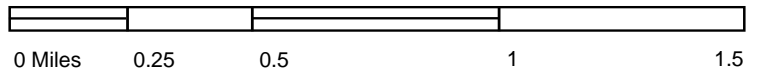
TP, Chicago, 1900, 15-minute
W, Riverside, 1900, 15-minute

SITE NAME: Vacant Parcel
 ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
 CLIENT: AMEC Environment & Infrastructure, Inc.





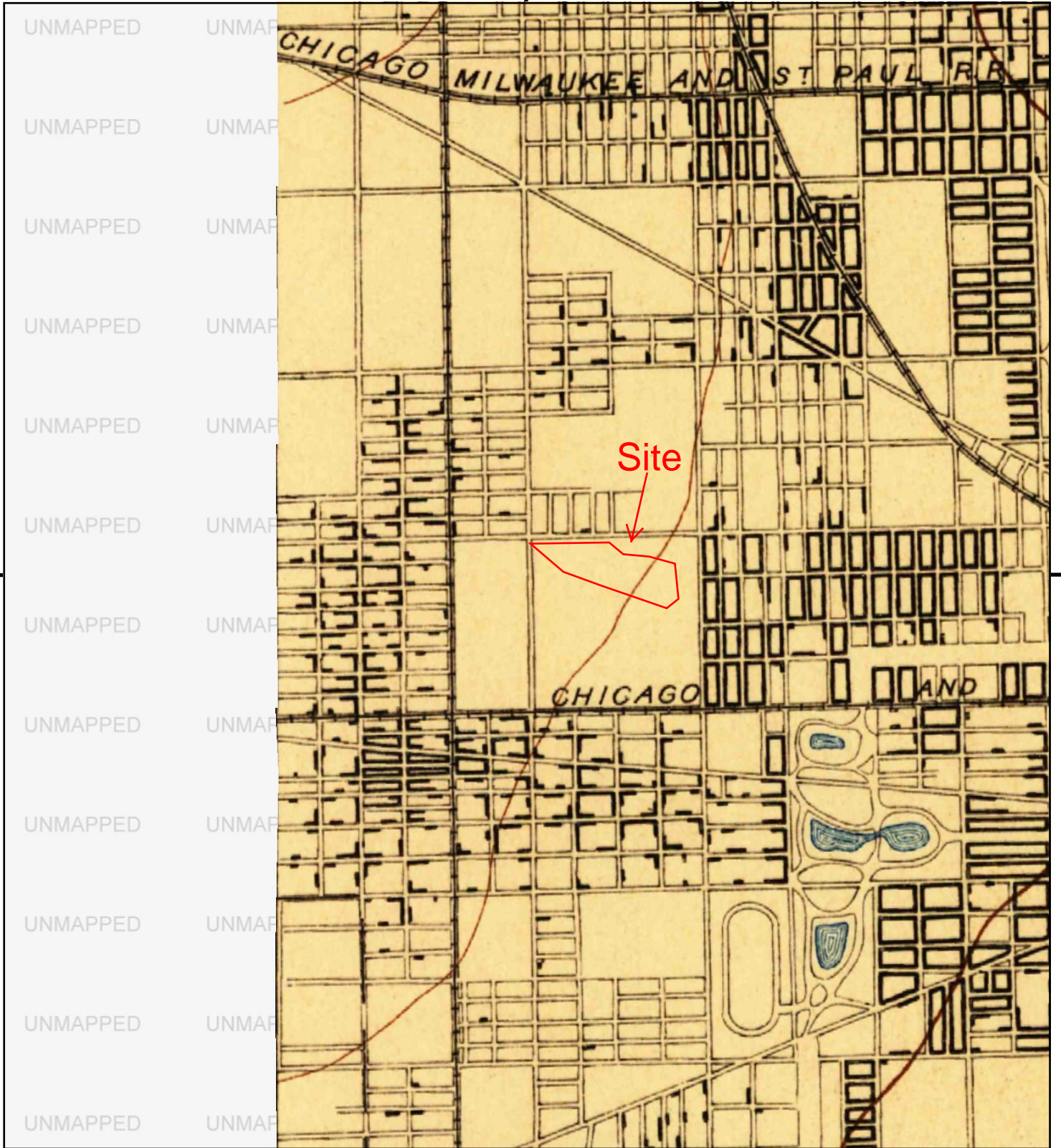
This report includes information from the following map sheet(s).



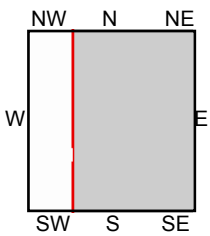
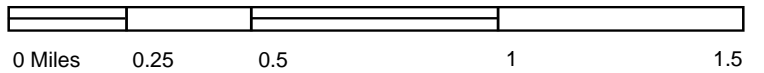
TP, Chicago, 1891, 15-minute
W, Riverside, 1891, 15-minute

SITE NAME: Vacant Parcel
ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
CLIENT: AMEC Environment & Infrastructure, Inc.





This report includes information from the following map sheet(s).



TP, Chicago, 1889, 15-minute

SITE NAME: Vacant Parcel
 ADDRESS: W. Chicago Ave. & N. Kilbourn Ave.
 Chicago, IL 60624
 CLIENT: AMEC Environment & Infrastructure, Inc.





APPENDIX C

Sanborn Maps

Vacant Parcel

W. Chicago Ave. & N. Kilbourn Ave.

Chicago, IL 60624

Inquiry Number: 4967723.3

June 15, 2017

Certified Sanborn® Map Report



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

06/15/17

Site Name:

Vacant Parcel
W. Chicago Ave. & N. Kilbourn
Chicago, IL 60624
EDR Inquiry # 4967723.3

Client Name:

AMEC Environment & Infrastructure, Inc.
8745 West Higgins Rd
Chicago, IL 60631
Contact: Mary Jank



The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AMEC Environment & Infrastructure, Inc. were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # 4A9D-4C18-B92A
PO # 3205171606
Project City of Chicago 2FM

Maps Provided:

- 2004
- 2002
- 1993
- 1991
- 1988
- 1975
- 1950
- 1908



Sanborn® Library search results

Certification #: 4A9D-4C18-B92A

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- Library of Congress
- University Publications of America
- EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

AMEC Environment & Infrastructure, Inc. (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

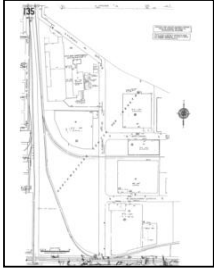
EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



2004 Source Sheets

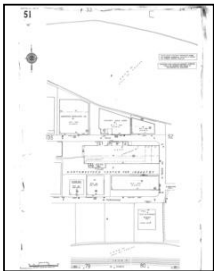


Volume 18, Sheet 135
2004

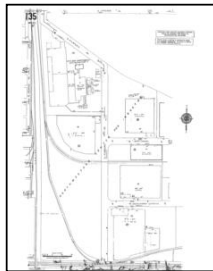


Volume 18, Sheet 51
2004

2002 Source Sheets

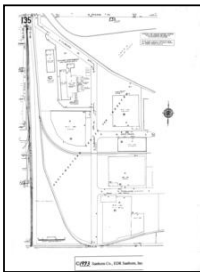


Volume 18, Sheet 51
2002

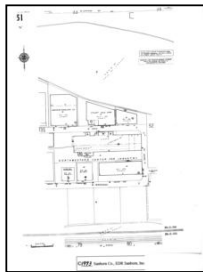


Volume 18, Sheet 135
2002

1993 Source Sheets



Volume 18, Sheet 135
1993

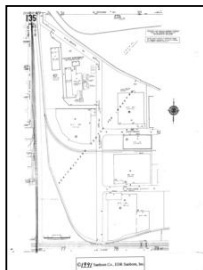


Volume 18, Sheet 51
1993

1991 Source Sheets



Volume 18, Sheet 51
1991



Volume 18, Sheet 135
1991

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



1988 Source Sheets



Volume 18, Sheet 51
1988

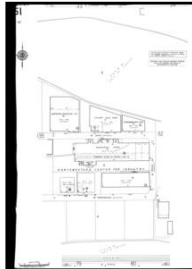


Volume 18, Sheet 135
1988

1975 Source Sheets

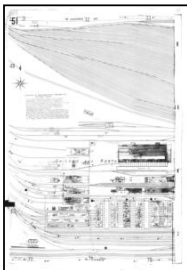


Volume 18, Sheet 135
1975



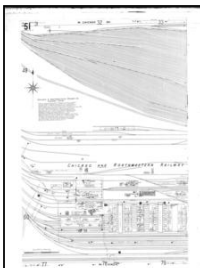
Volume 18, Sheet 51
1975

1950 Source Sheets

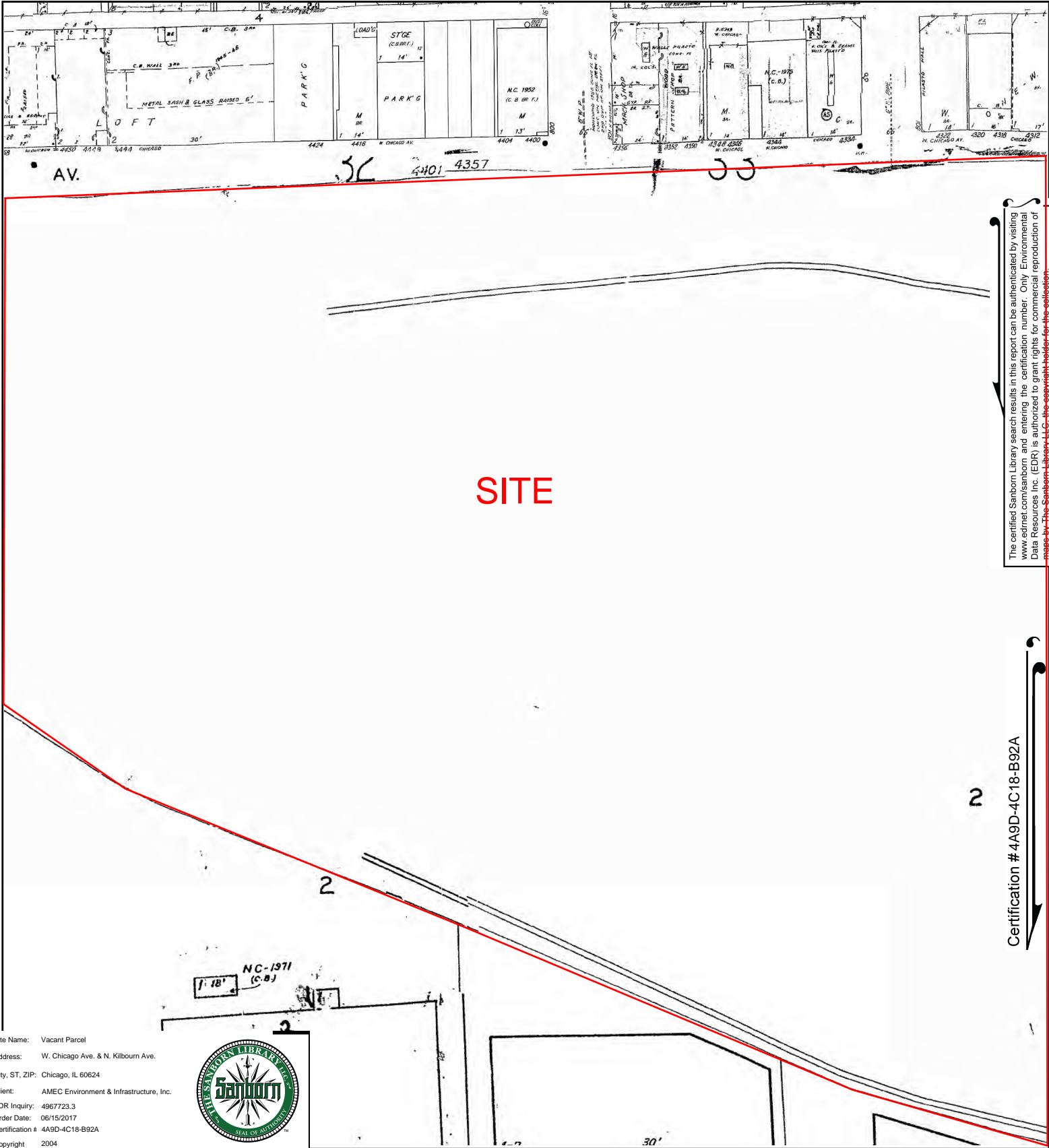


Volume 18, Sheet 51
1950

1908 Source Sheets



Volume 18, Sheet 51
1908



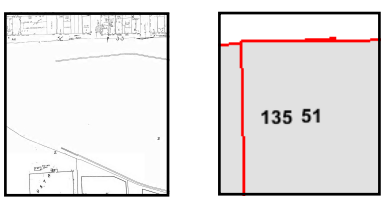
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

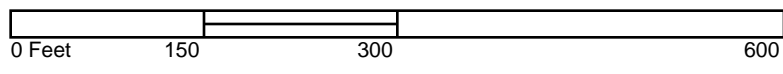
Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/15/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2004

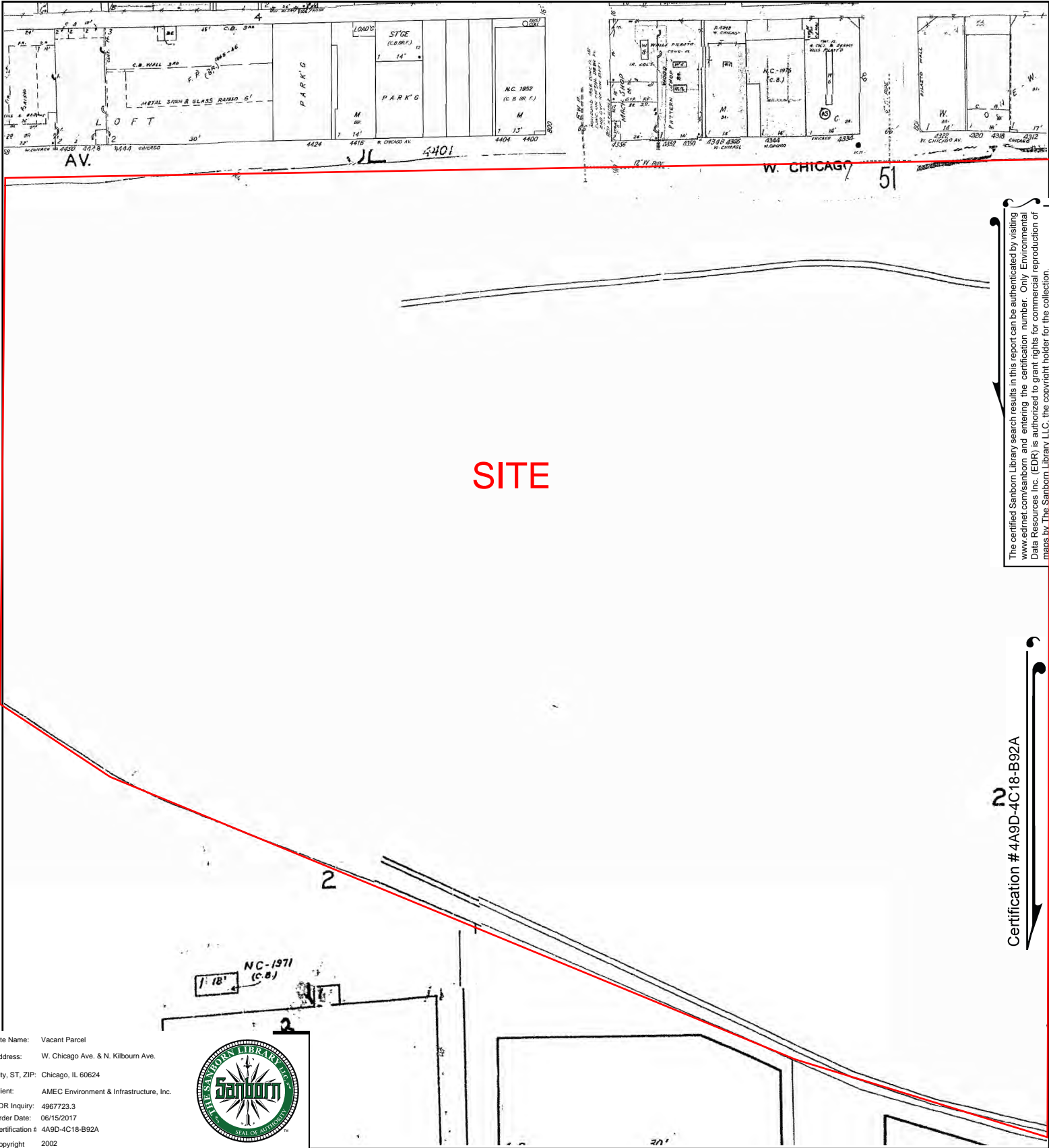


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 51
 Volume 18, Sheet 135





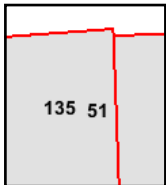
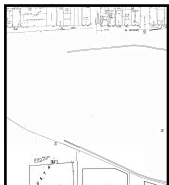
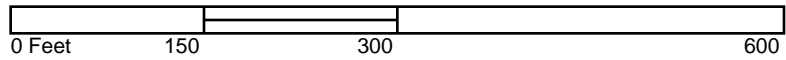
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/15/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2002

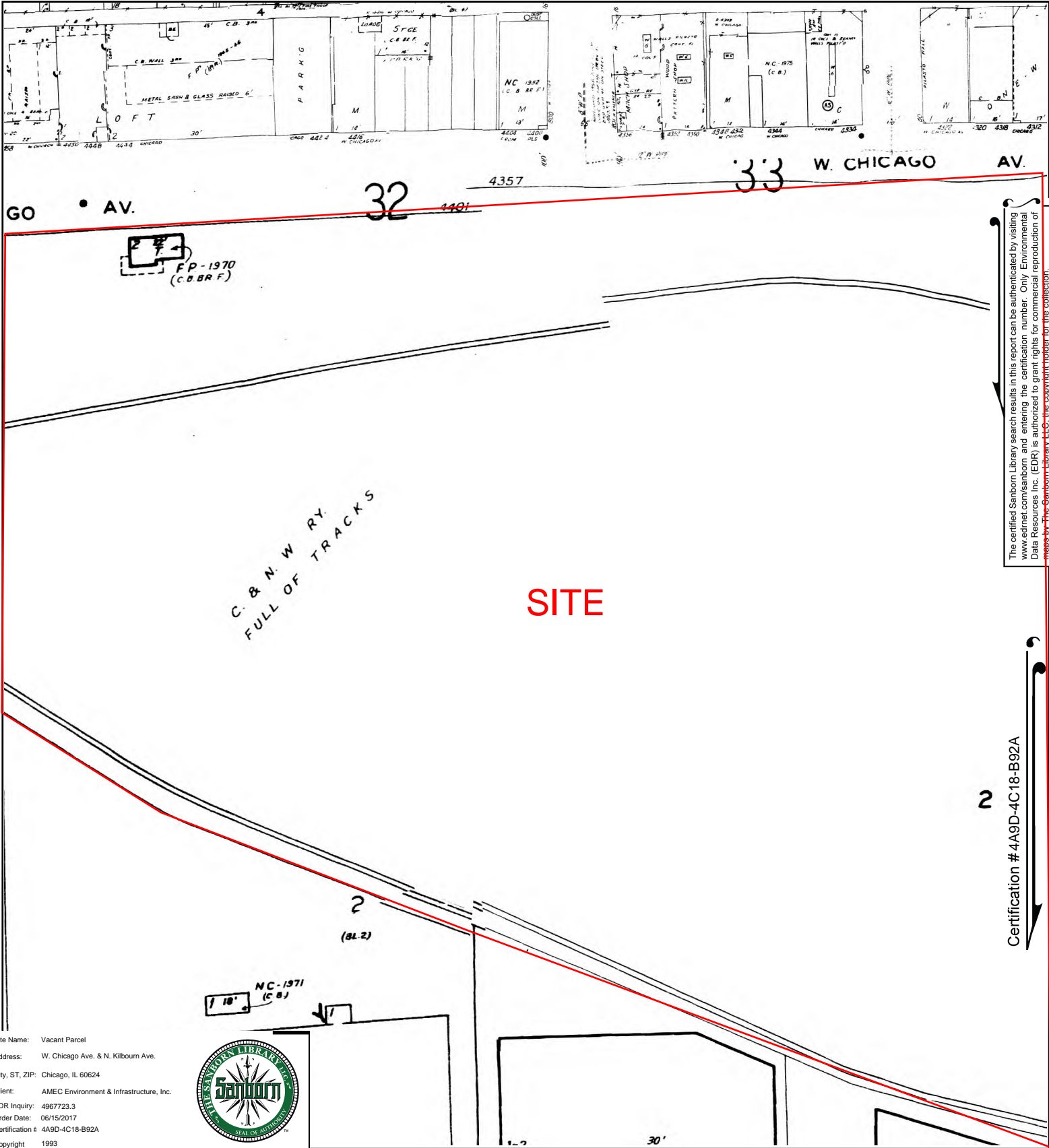


This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 135
 Volume 18, Sheet 51





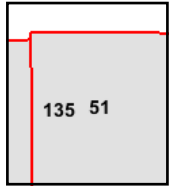
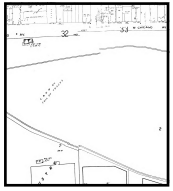
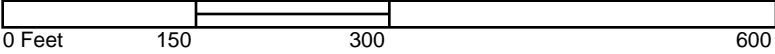
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC; site copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/15/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1993

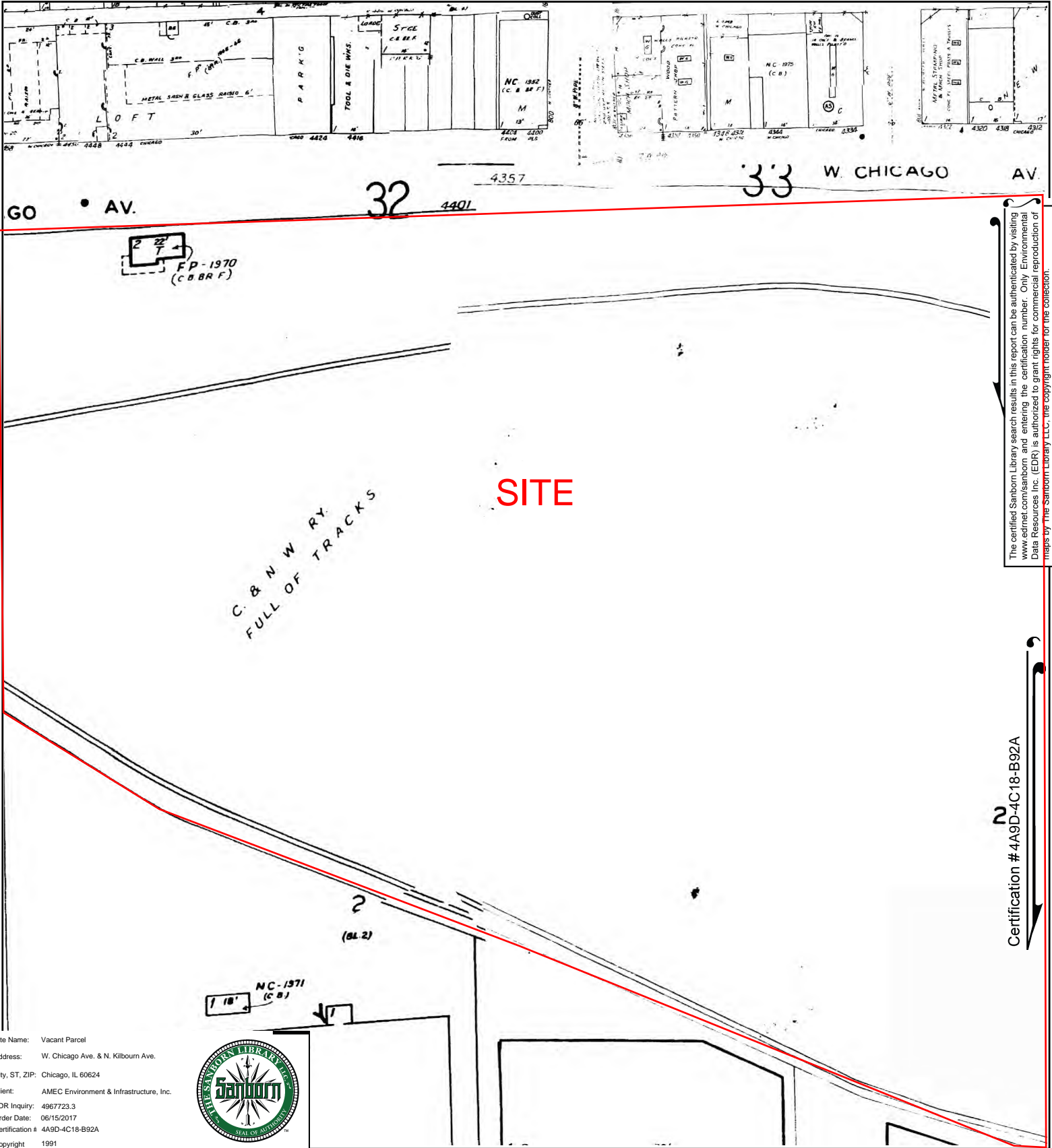


This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 51
 Volume 18, Sheet 135





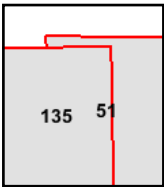
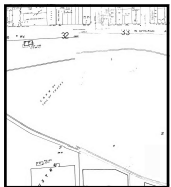
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

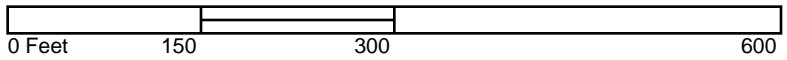
Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/15/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1991

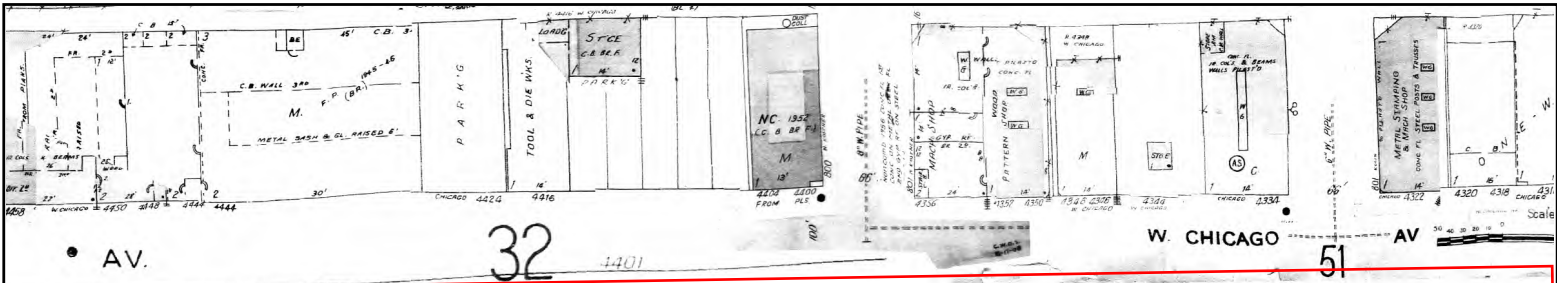


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 135
 Volume 18, Sheet 51





2 22' T
FP-1970
(C B R F)

WEIGHTED LINES INDICATE MASONRY EXTERIOR WALLS OR INTERIOR FIRE WALLS IN NON-RESIDENTIAL BUILDINGS

YELLOW COLOR IS OMITTED IN DESIGNATING FRAME AND VENEREED RESIDENTIAL BUILDINGS IN KEEPING WITH CURRENT MAPPING PRACTICE

C. & N. W. RY.
FULL OF TRACKS

SITE

2
(BL 2)

NC-1971
(C B)
18'

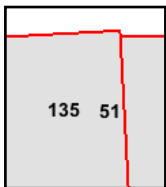
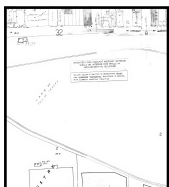
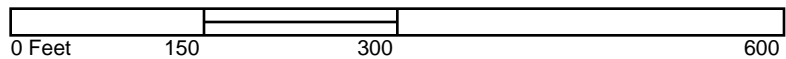


Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/15/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1988

The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library, LLC, the copyright holder for the collection.

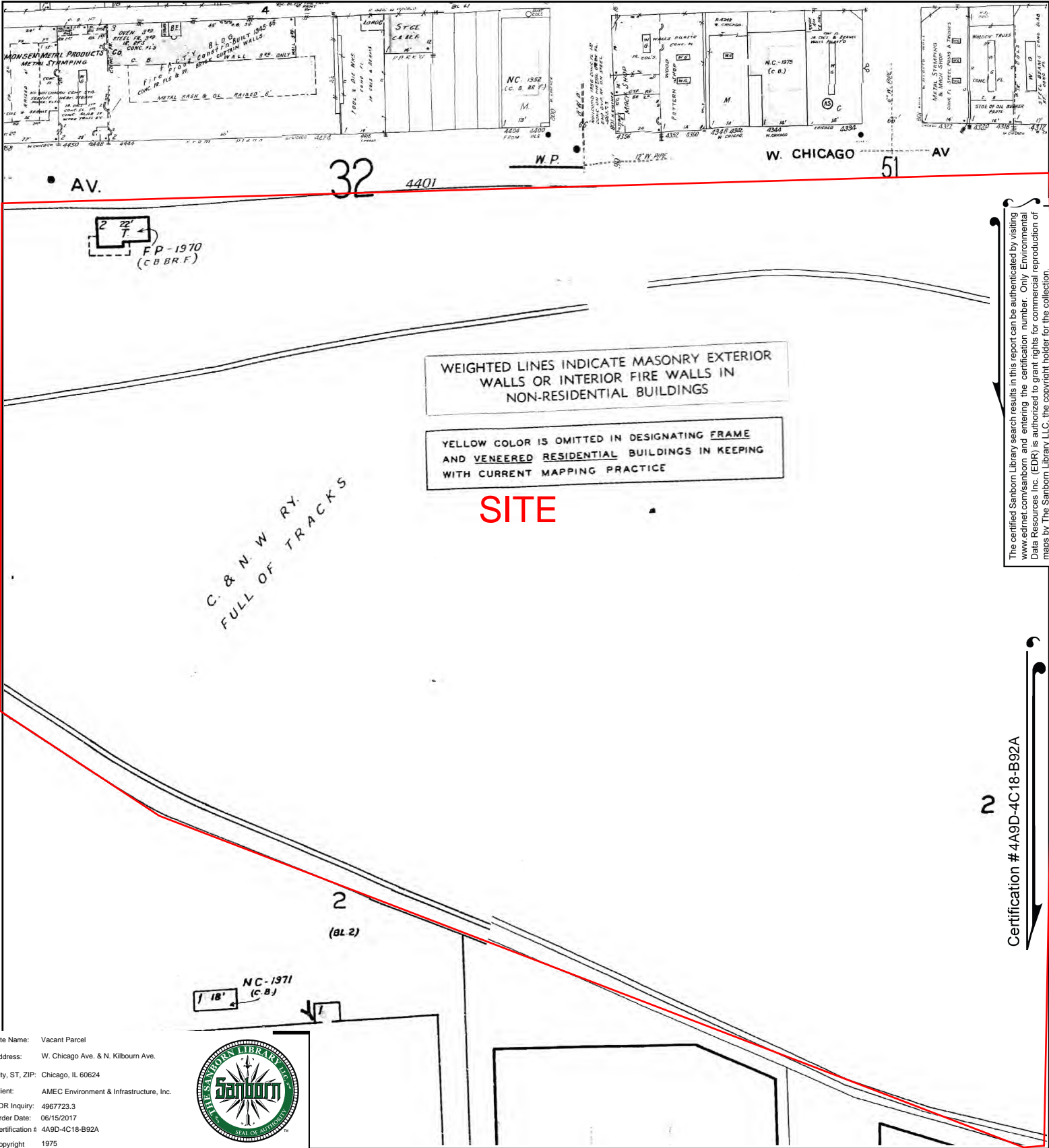
Certification # 4A9D-4C18-B92A

This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 135
 Volume 18, Sheet 51





WEIGHTED LINES INDICATE MASONRY EXTERIOR WALLS OR INTERIOR FIRE WALLS IN NON-RESIDENTIAL BUILDINGS

YELLOW COLOR IS OMITTED IN DESIGNATING FRAME AND VENERED RESIDENTIAL BUILDINGS IN KEEPING WITH CURRENT MAPPING PRACTICE

SITE

C. & N. W. RY.
FULL OF TRACKS

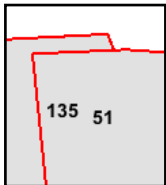
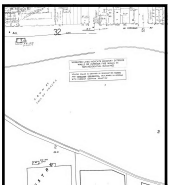
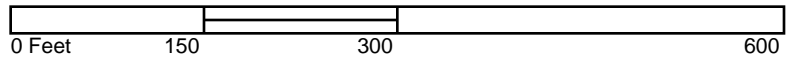
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/15/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1975

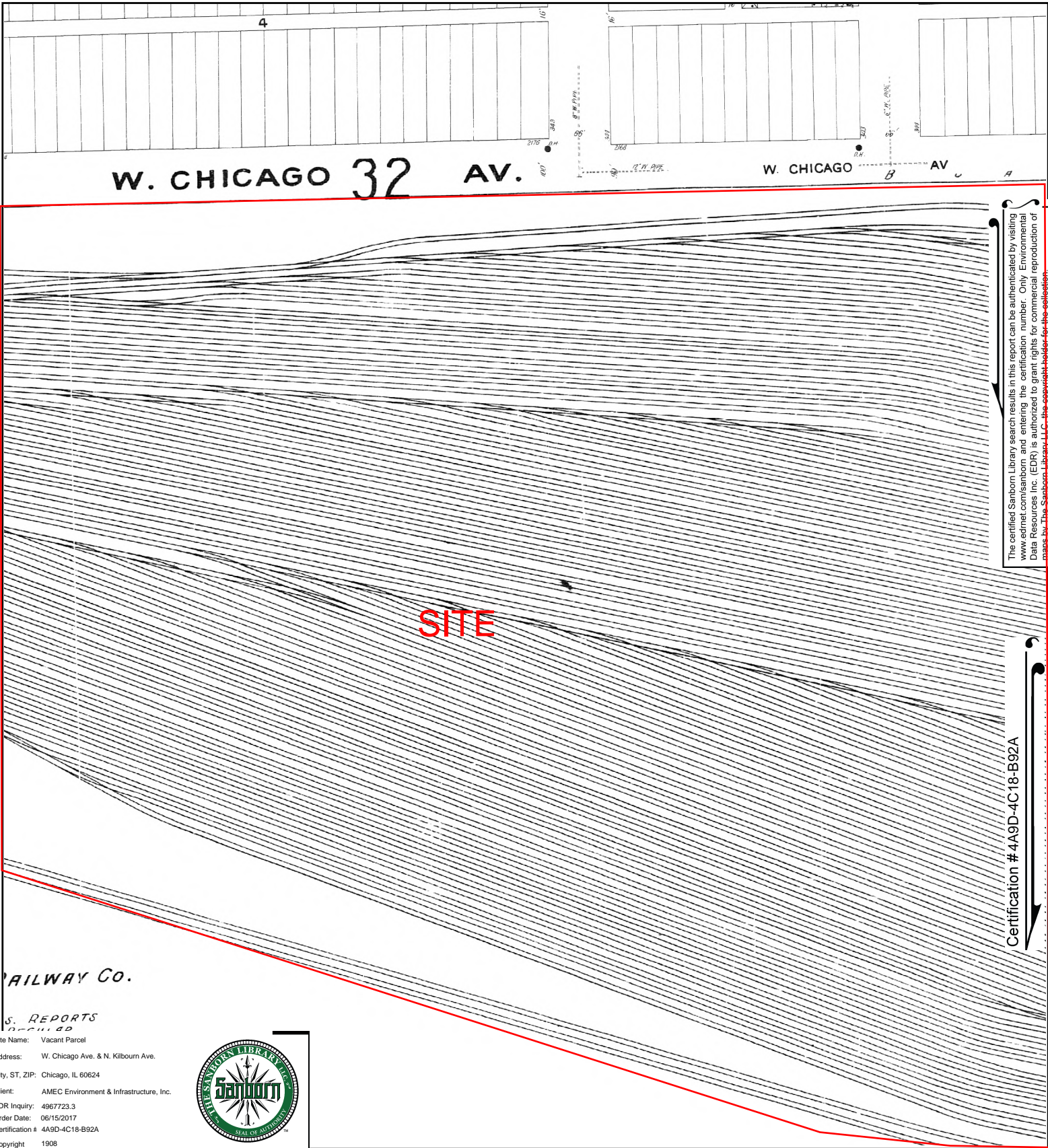


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



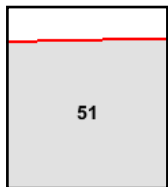
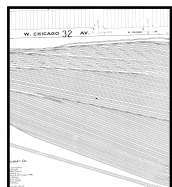
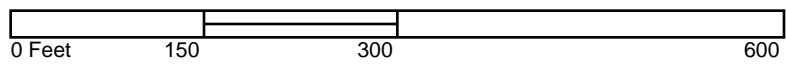
Volume 18, Sheet 51
 Volume 18, Sheet 135





The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library, LLC. The copyright holder for this collection.

This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 51



Vacant Parcel

W. Chicago Ave. & N. Kilbourn Ave.

Chicago, IL 60624

Inquiry Number: 4967723.3

June 26, 2017

Certified Sanborn® Map Report



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

06/26/17

Site Name:

Vacant Parcel
W. Chicago Ave. & N. Kilbourn
Chicago, IL 60624
EDR Inquiry # 4967723.3

Client Name:

AMEC Environment & Infrastructure, Inc.
8745 West Higgins Rd
Chicago, IL 60631
Contact: Mary Jank



The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AMEC Environment & Infrastructure, Inc. were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # 4A9D-4C18-B92A
PO # 3205171606
Project City of Chicago 2FM
Maps Provided:

2004	1896
2002	
1993	
1991	
1988	
1975	
1950	
1908	



Sanborn® Library search results

Certification #: 4A9D-4C18-B92A

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- Library of Congress
- University Publications of America
- EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

AMEC Environment & Infrastructure, Inc. (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

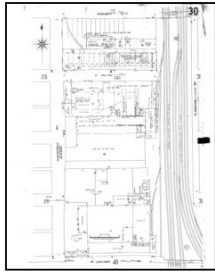
EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

Sanborn Sheet Key

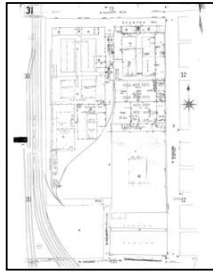
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



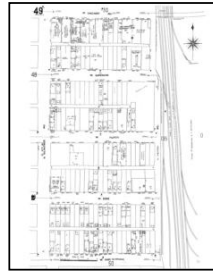
2004 Source Sheets



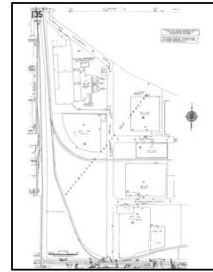
Volume 18, Sheet 30
2004



Volume 18, Sheet 31
2004

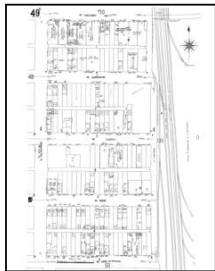


Volume 18, Sheet 49
2004

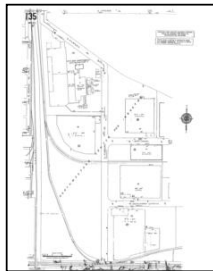


Volume 18, Sheet 135
2004

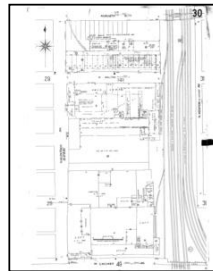
2002 Source Sheets



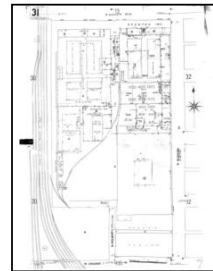
Volume 18, Sheet 49
2002



Volume 18, Sheet 135
2002

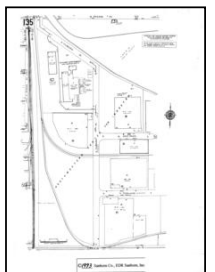


Volume 18, Sheet 30
2002

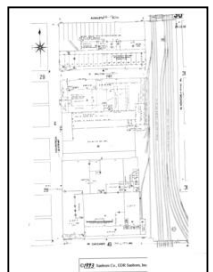


Volume 18, Sheet 31
2002

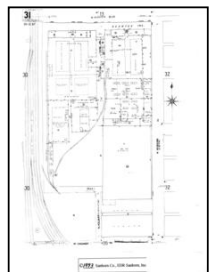
1993 Source Sheets



Volume 18, Sheet 135
1993



Volume 18, Sheet 30
1993

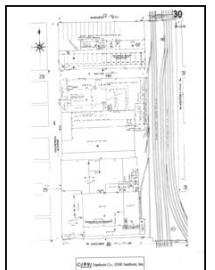


Volume 18, Sheet 31
1993

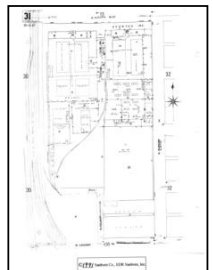


Volume 18, Sheet 49
1993

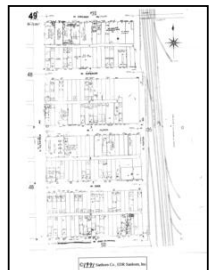
1991 Source Sheets



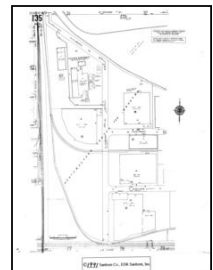
Volume 18, Sheet 30
1991



Volume 18, Sheet 31
1991



Volume 18, Sheet 49
1991



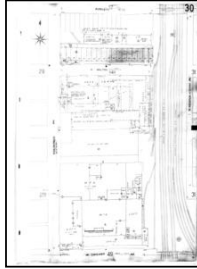
Volume 18, Sheet 135
1991

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



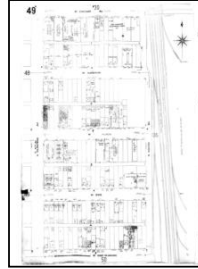
1988 Source Sheets



Volume 18, Sheet 30
1988



Volume 18, Sheet 31
1988



Volume 18, Sheet 49
1988



Volume 18, Sheet 135
1988

1975 Source Sheets



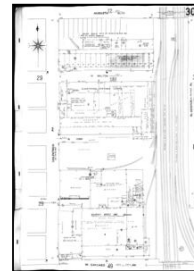
Volume 18, Sheet 31
1975



Volume 18, Sheet 49
1975

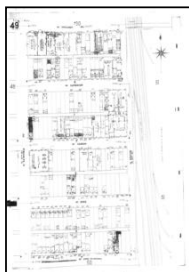


Volume 18, Sheet 135
1975

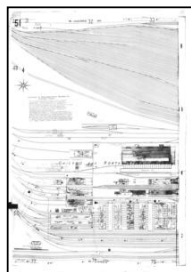


Volume 18, Sheet 30
1975

1950 Source Sheets



Volume 18, Sheet 49
1950



Volume 18, Sheet 51
1950

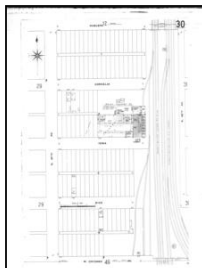


Volume 18, Sheet 30
1950

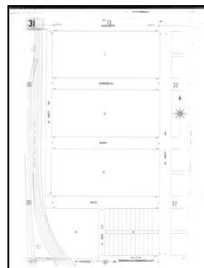


Volume 18, Sheet 31
1950

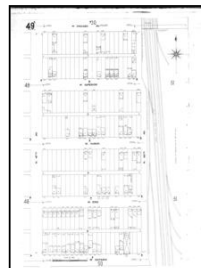
1908 Source Sheets



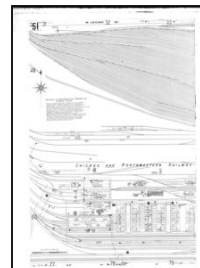
Volume 18, Sheet 30
1908



Volume 18, Sheet 31
1908



Volume 18, Sheet 49
1908



Volume 18, Sheet 51
1908

Sanborn Sheet Key

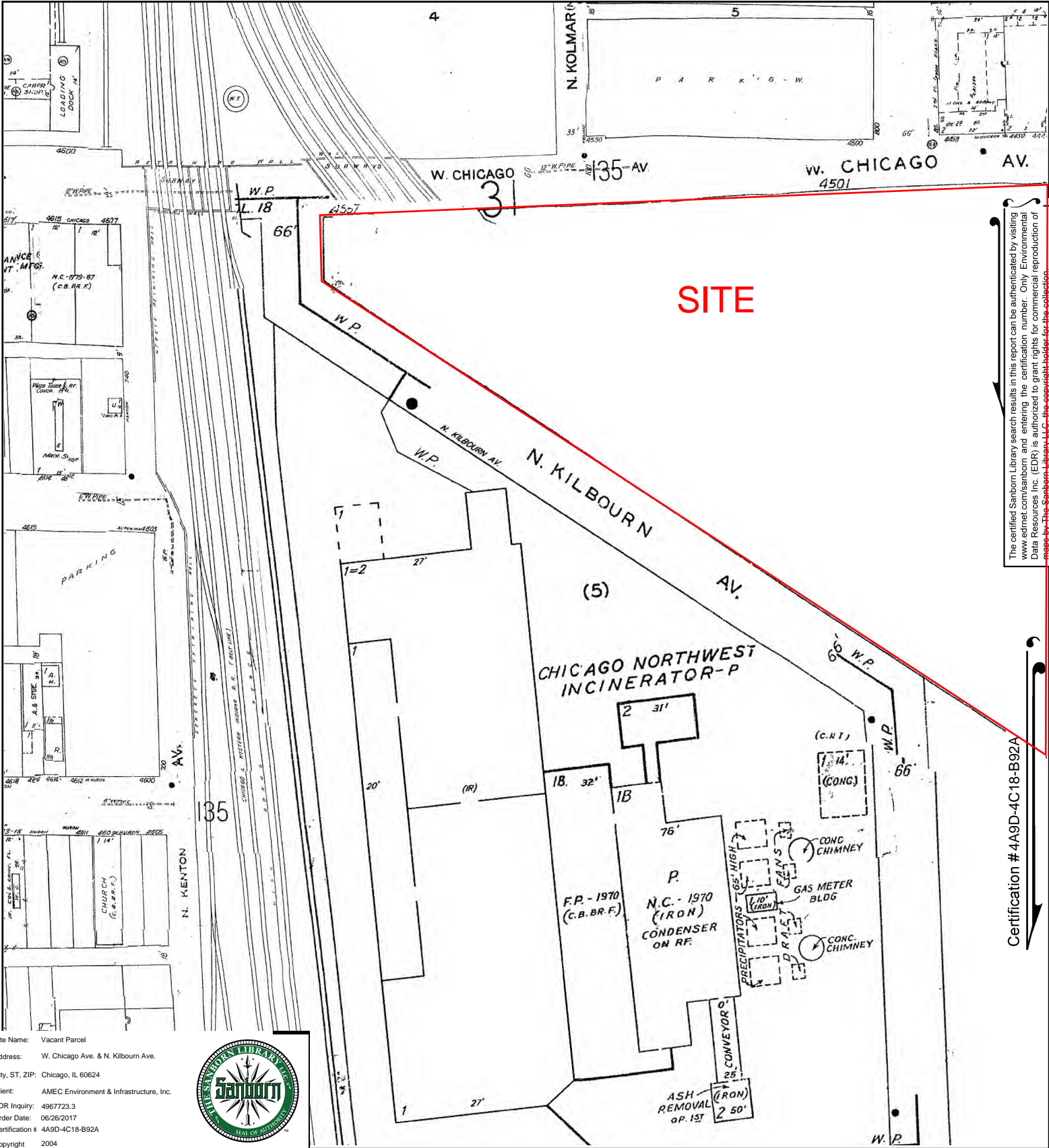
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



1896 Source Sheets



Volume B, Sheet 13
1896



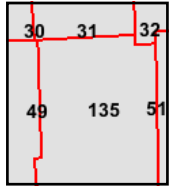
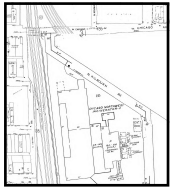
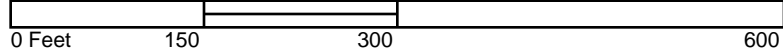
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2004

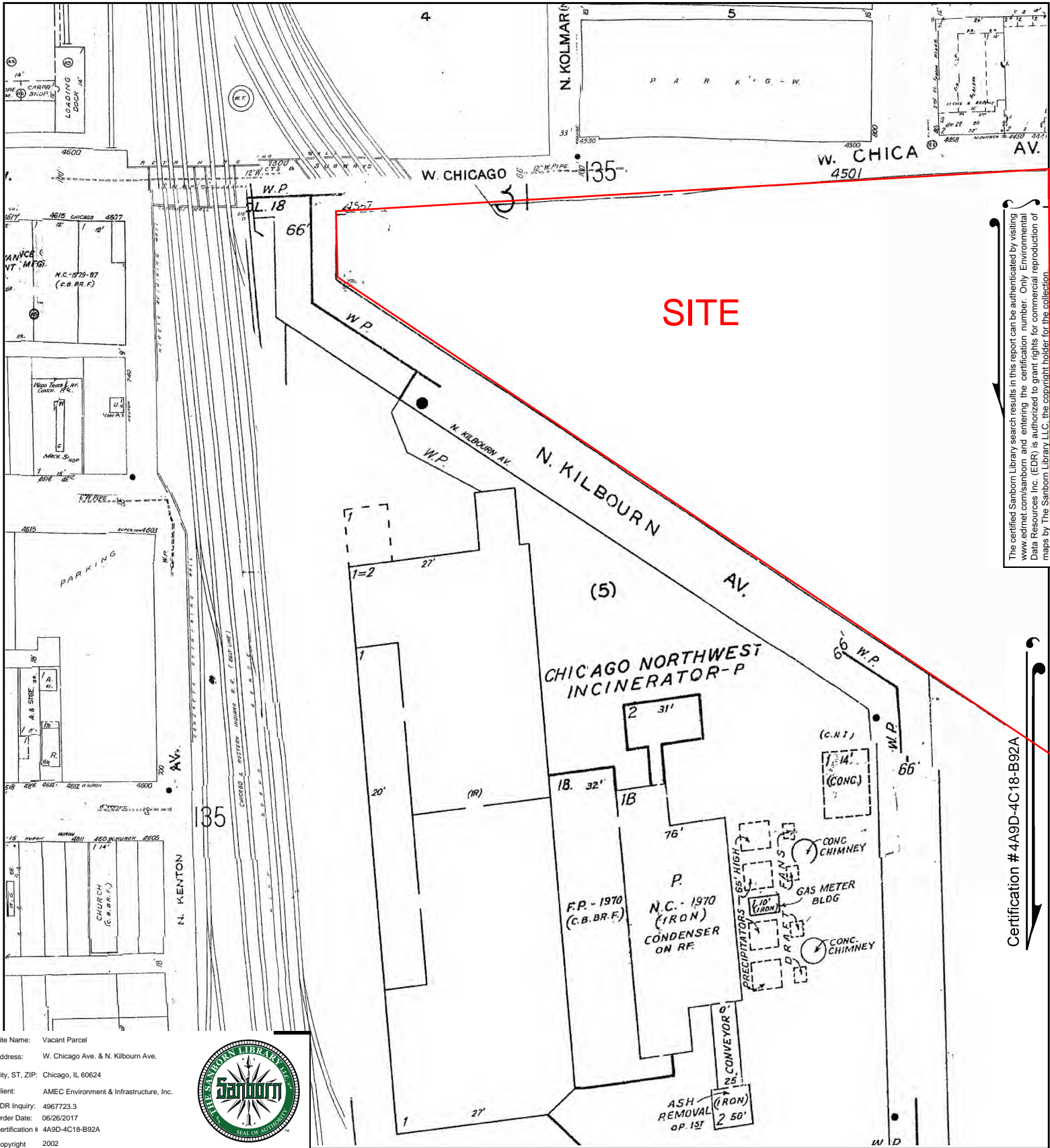


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



- Volume 18, Sheet 135
- Volume 18, Sheet 49
- Volume 18, Sheet 31
- Volume 18, Sheet 30





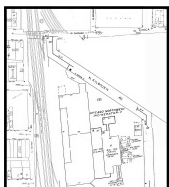
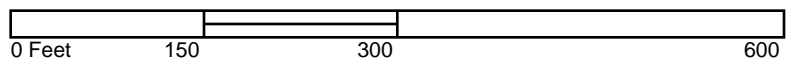
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2002



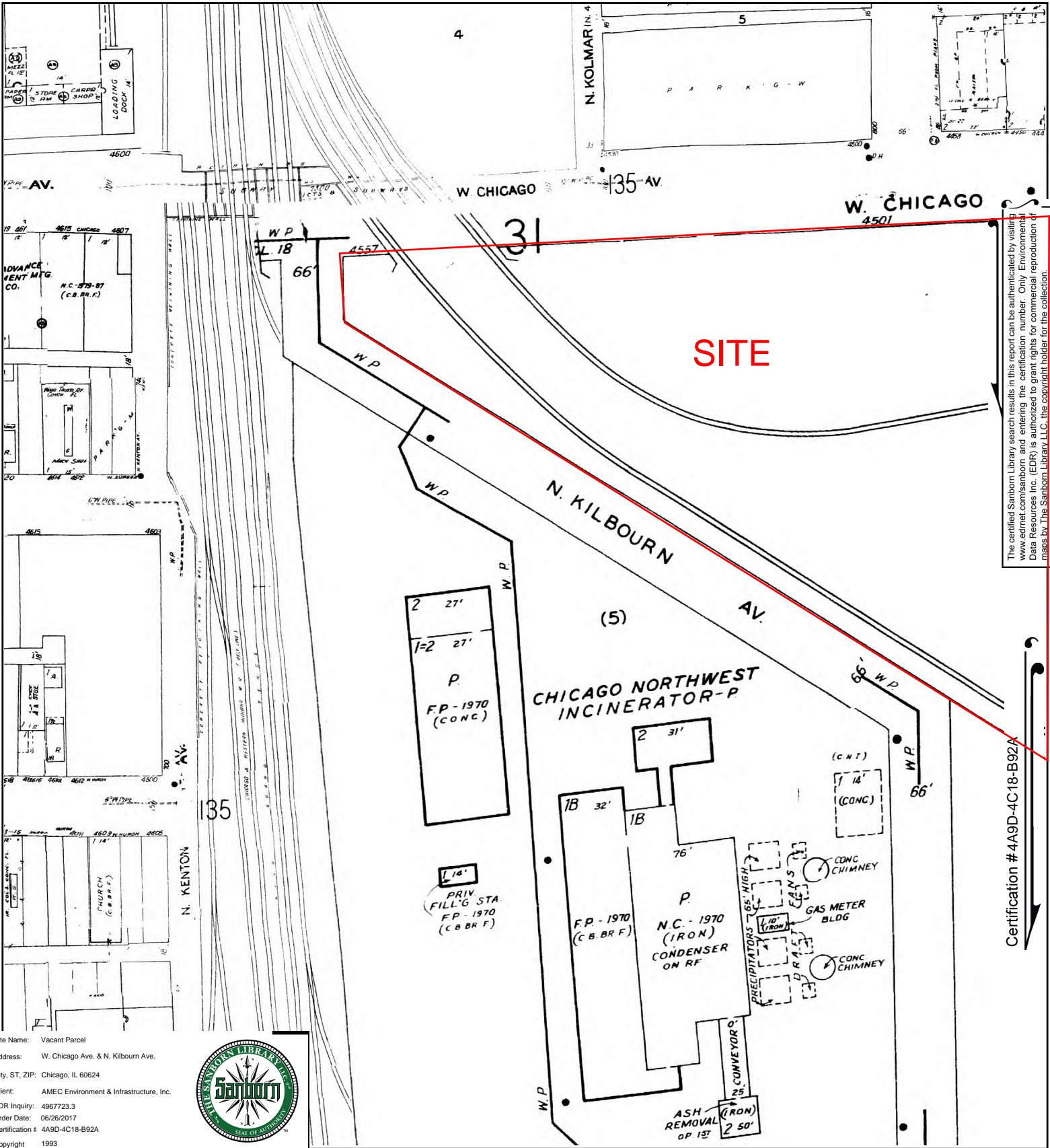
This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



30	31	32
49	135	51

Volume 18, Sheet 31
 Volume 18, Sheet 30
 Volume 18, Sheet 135
 Volume 18, Sheet 49





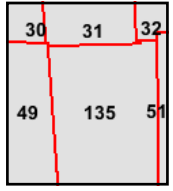
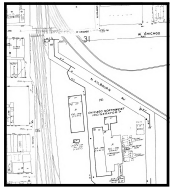
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

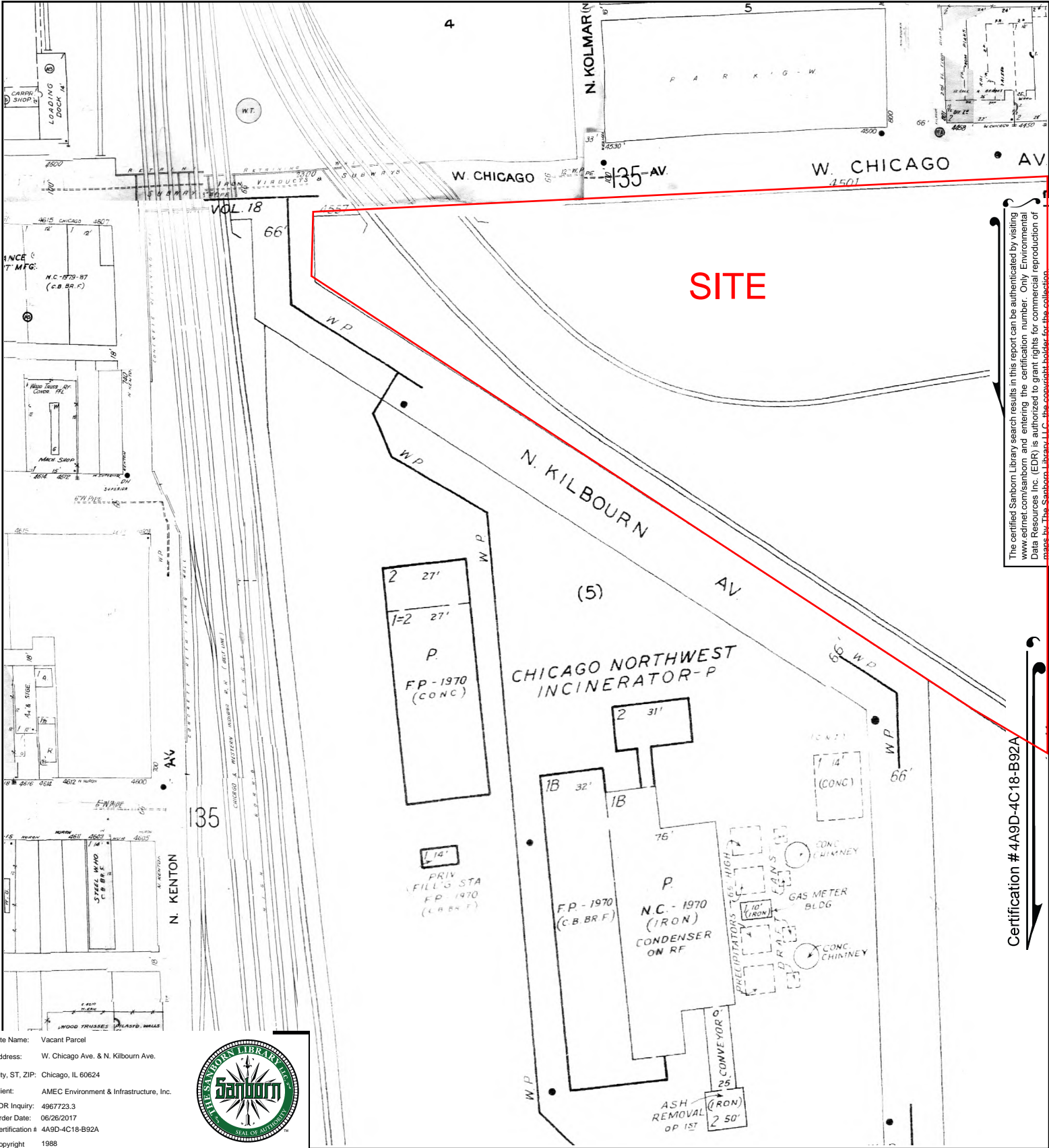
Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1993



This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 49
 Volume 18, Sheet 31
 Volume 18, Sheet 30
 Volume 18, Sheet 135



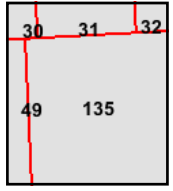
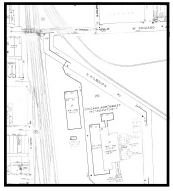
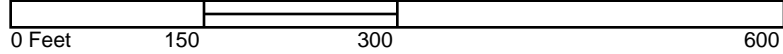
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1988

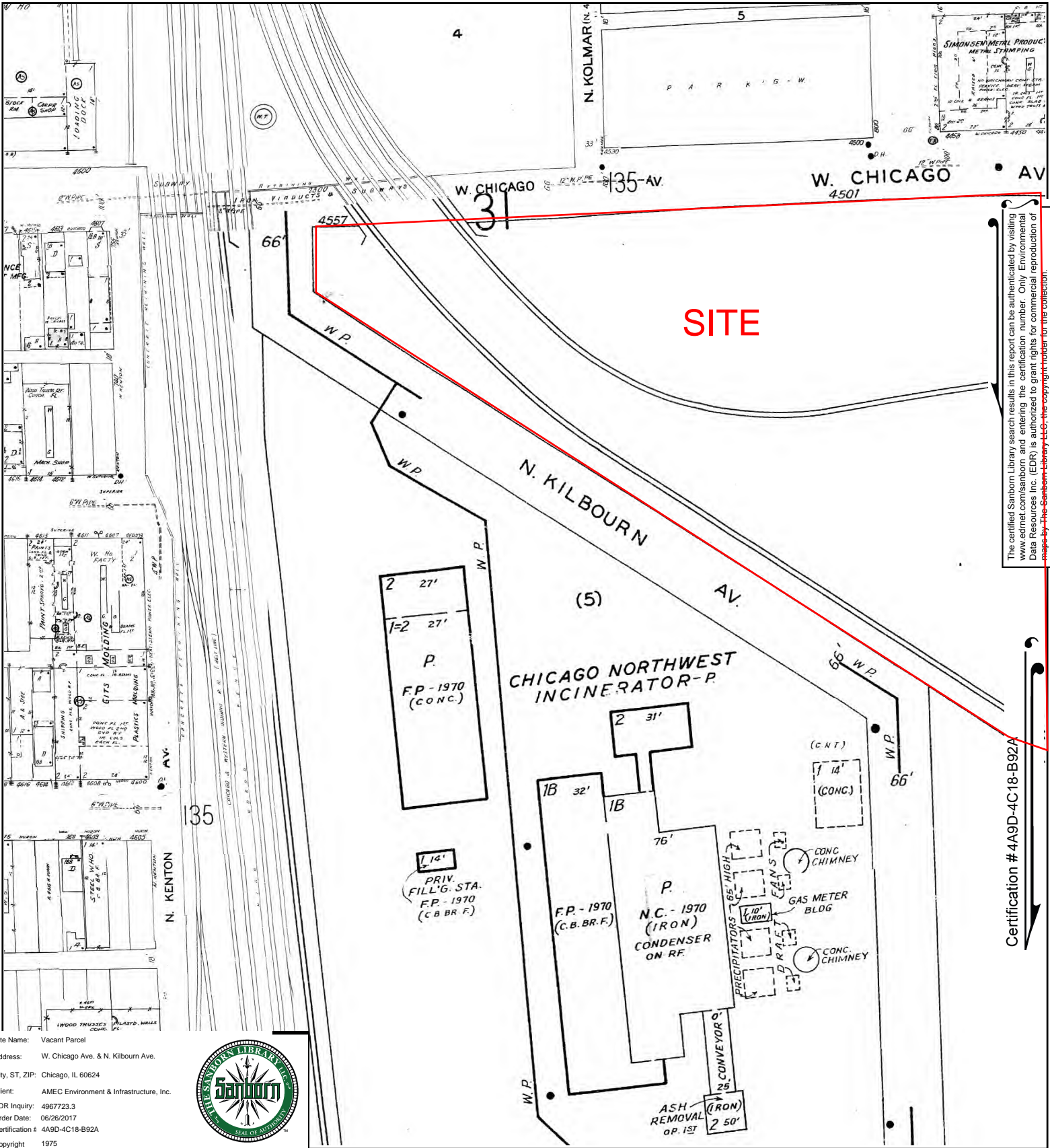


This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 135
 Volume 18, Sheet 49
 Volume 18, Sheet 31
 Volume 18, Sheet 30





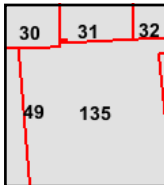
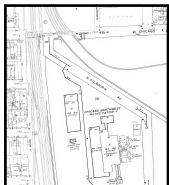
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC; the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1975

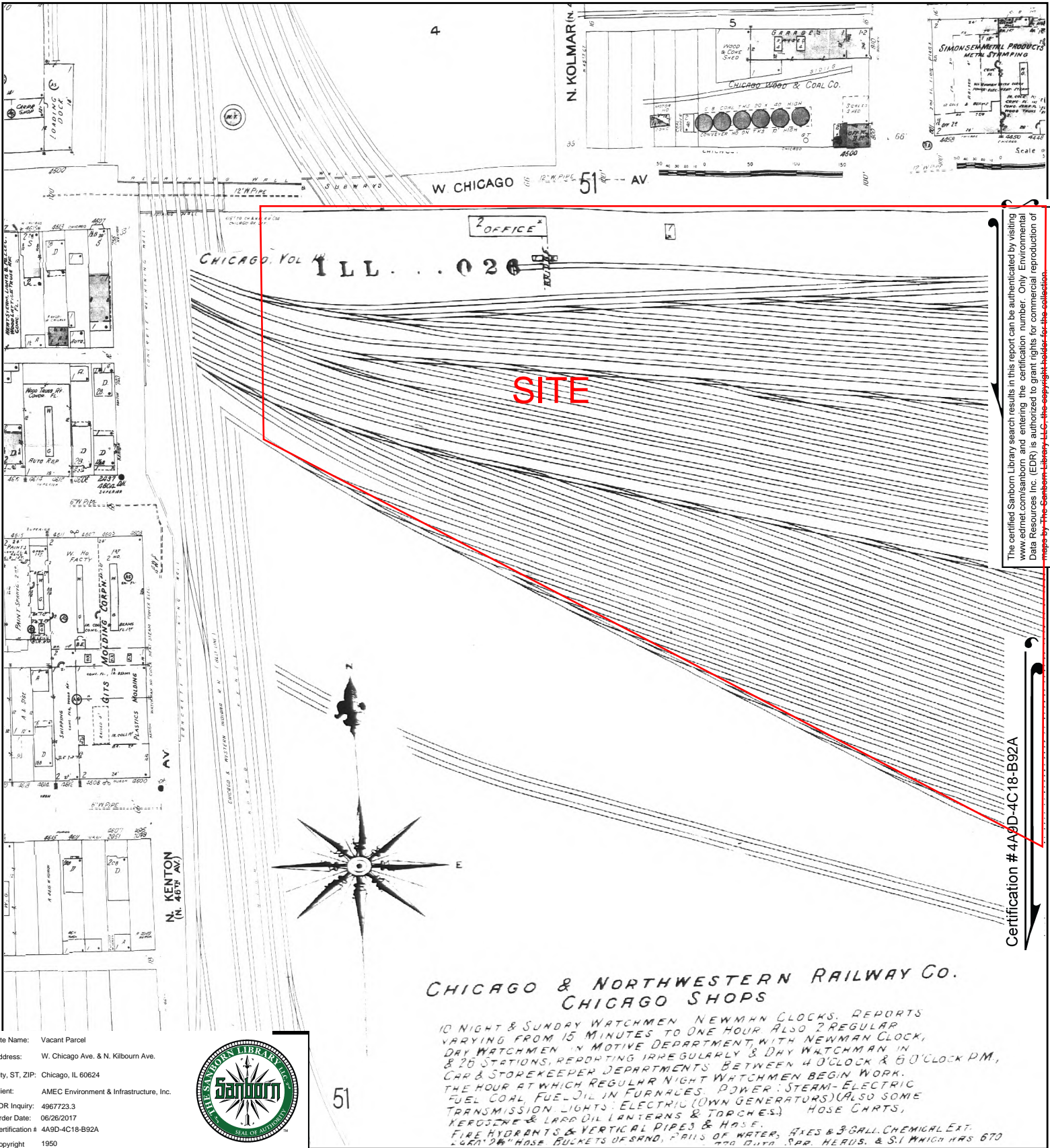


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 30
 Volume 18, Sheet 135
 Volume 18, Sheet 49
 Volume 18, Sheet 31





The certified Sanborn Library search results in this report can be authenticated by visiting www.edr.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC, the copyright holder for the collection.

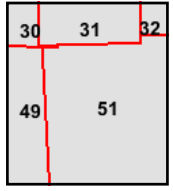
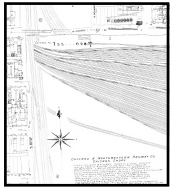
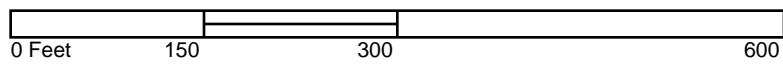
Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1950



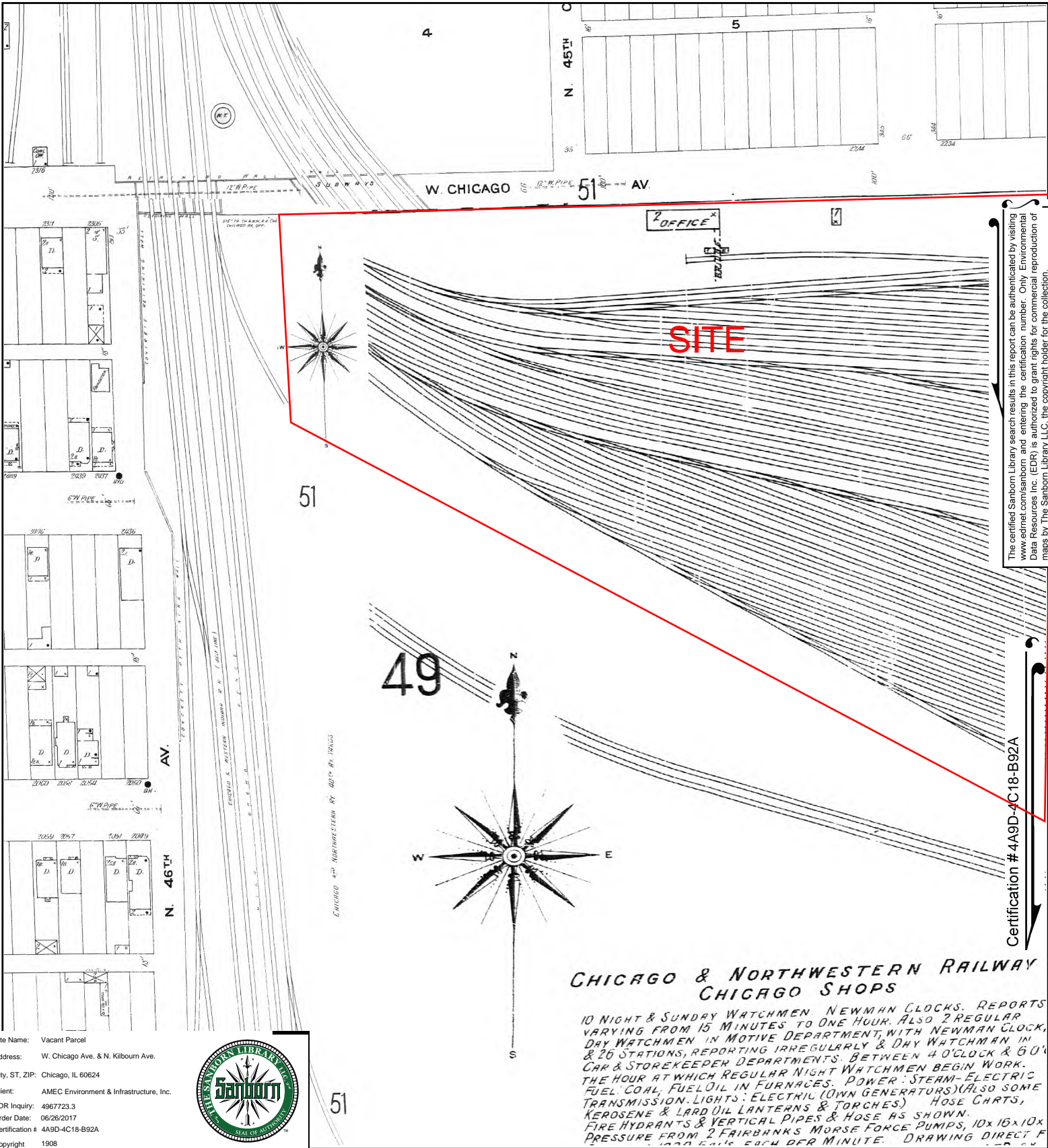
51

This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 31
 Volume 18, Sheet 30
 Volume 18, Sheet 51
 Volume 18, Sheet 49





The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1908

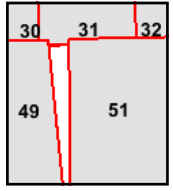
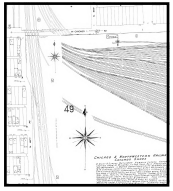
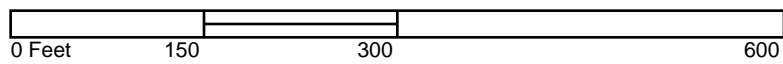


51

CHICAGO & NORTHWESTERN RAILWAY CHICAGO SHOPS

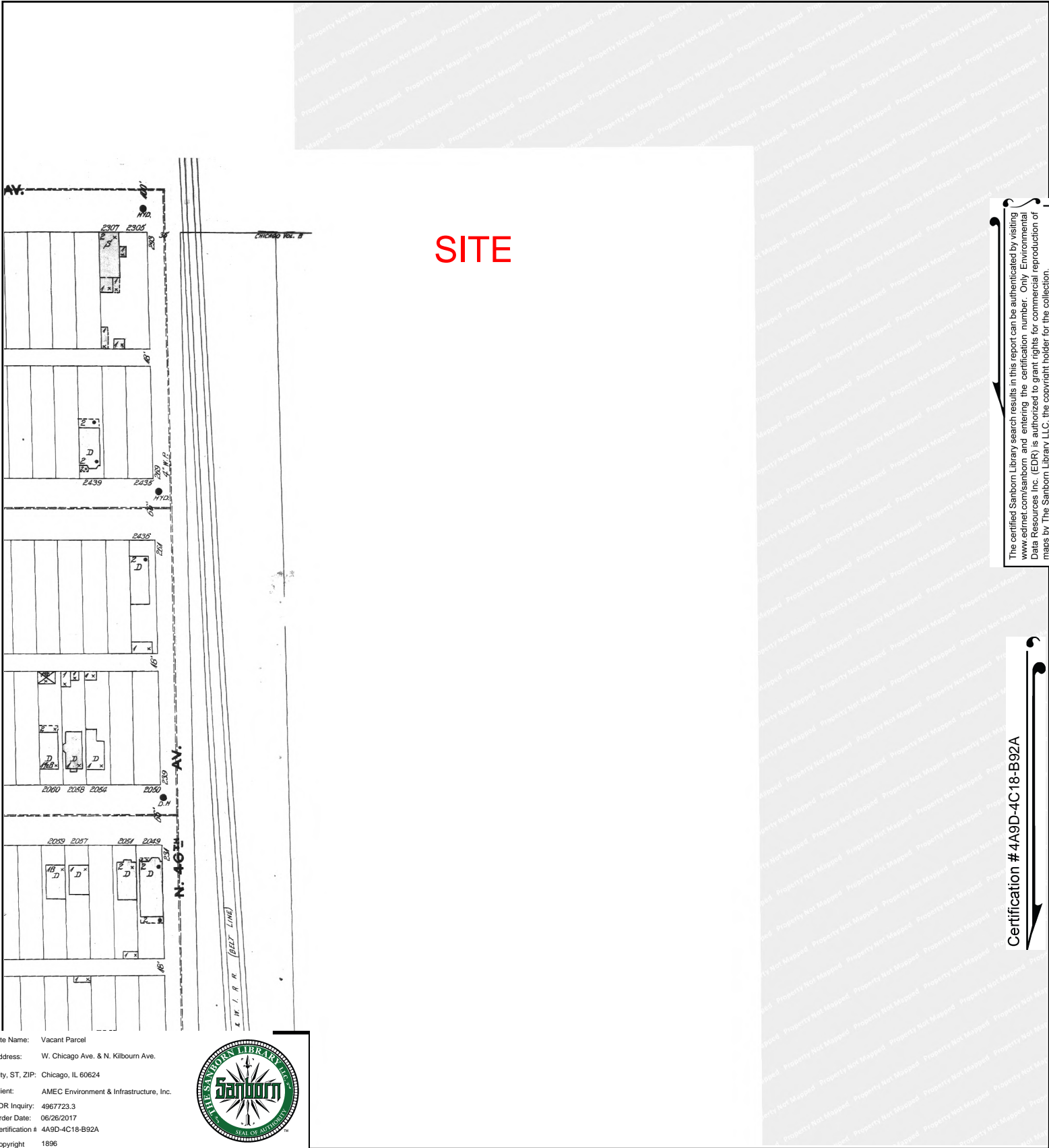
10 NIGHT & SUNDAY WATCHMEN. NEWMAN CLOCKS. REPORTS VARYING FROM 15 MINUTES TO ONE HOUR. ALSO 2 REGULAR DAY WATCHMEN IN MOTIVE DEPARTMENT, WITH NEWMAN CLOCK, & 26 STATIONS, REPORTING IRREGULARLY & DAY WATCHMAN IN CAR & STOREKEEPER DEPARTMENTS. BETWEEN 4 O'CLOCK & 6 O' THE HOUR AT WHICH REGULAR NIGHT WATCHMEN BEGIN WORK. FUEL: COAL, FUEL OIL IN FURNACES. POWER: STEAM-ELECTRIC TRANSMISSION. LIGHTS: ELECTRIC (OWN GENERATORS) (ALSO SOME KEROSENE & LARD OIL LANTERNS & TORCHES). HOSE CARTS, FIRE HYDRANTS & VERTICAL PIPES & HOSE AS SHOWN. PRESSURE FROM 2 FAIRBANKS MORSE FORCE PUMPS, 10x16x10x PRESSURE FROM 1000 GAL. EACH PER MINUTE. DRAWING DIRECT F...

This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



- Volume 18, Sheet 51
- Volume 18, Sheet 49
- Volume 18, Sheet 31
- Volume 18, Sheet 30





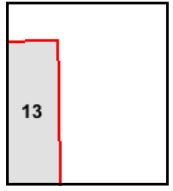
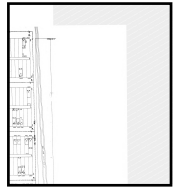
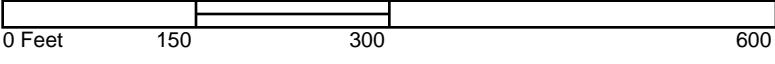
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1896



This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume B, Sheet 13



Vacant Parcel

W. Chicago Ave. & N. Kilbourn Ave.

Chicago, IL 60624

Inquiry Number: 4967723.3

June 26, 2017

Certified Sanborn® Map Report



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

06/26/17

Site Name:

Vacant Parcel
W. Chicago Ave. & N. Kilbourn
Chicago, IL 60624
EDR Inquiry # 4967723.3

Client Name:

AMEC Environment & Infrastructure, Inc.
8745 West Higgins Rd
Chicago, IL 60631
Contact: Mary Jank



The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AMEC Environment & Infrastructure, Inc. were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # 4A9D-4C18-B92A
PO # 3205171606
Project City of Chicago 2FM
Maps Provided:

2004	1896
2002	
1993	
1991	
1988	
1975	
1950	
1908	



Sanborn® Library search results

Certification #: 4A9D-4C18-B92A

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- Library of Congress
- University Publications of America
- EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

AMEC Environment & Infrastructure, Inc. (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

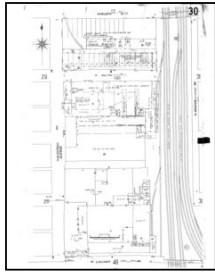
EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

Sanborn Sheet Key

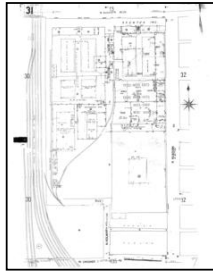
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



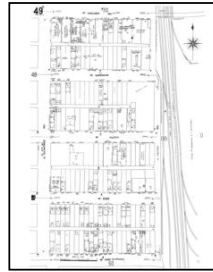
2004 Source Sheets



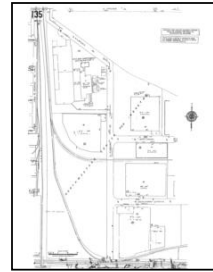
Volume 18, Sheet 30
2004



Volume 18, Sheet 31
2004

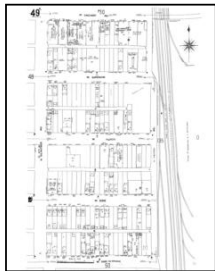


Volume 18, Sheet 49
2004

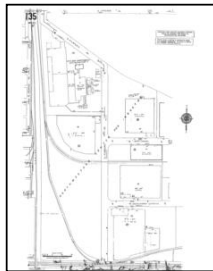


Volume 18, Sheet 135
2004

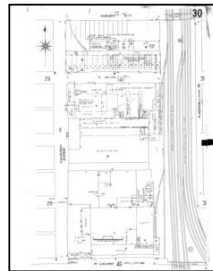
2002 Source Sheets



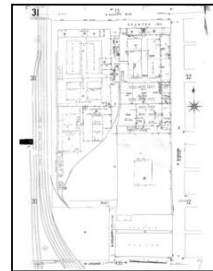
Volume 18, Sheet 49
2002



Volume 18, Sheet 135
2002

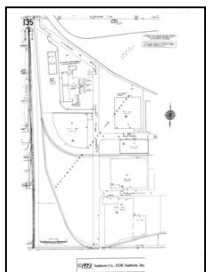


Volume 18, Sheet 30
2002

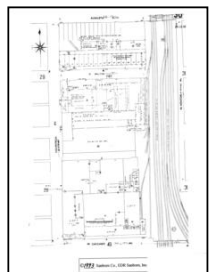


Volume 18, Sheet 31
2002

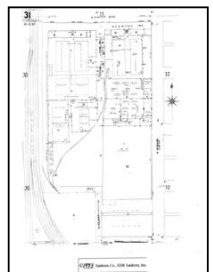
1993 Source Sheets



Volume 18, Sheet 135
1993



Volume 18, Sheet 30
1993

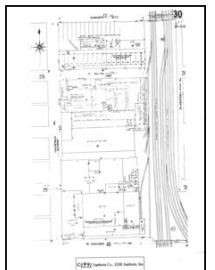


Volume 18, Sheet 31
1993

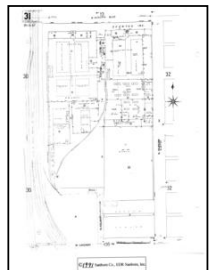


Volume 18, Sheet 49
1993

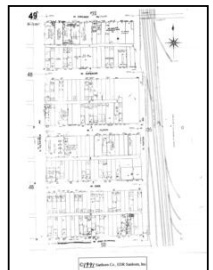
1991 Source Sheets



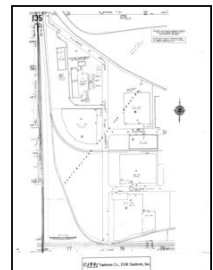
Volume 18, Sheet 30
1991



Volume 18, Sheet 31
1991



Volume 18, Sheet 49
1991



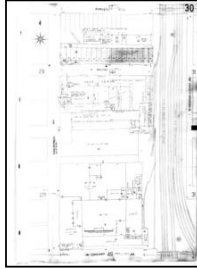
Volume 18, Sheet 135
1991

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



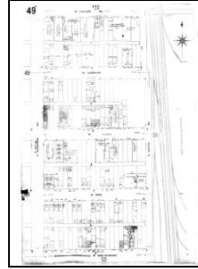
1988 Source Sheets



Volume 18, Sheet 30
1988



Volume 18, Sheet 31
1988



Volume 18, Sheet 49
1988



Volume 18, Sheet 135
1988

1975 Source Sheets



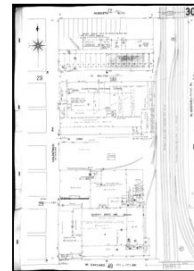
Volume 18, Sheet 31
1975



Volume 18, Sheet 49
1975

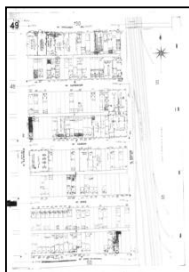


Volume 18, Sheet 135
1975

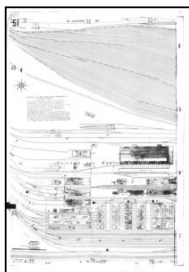


Volume 18, Sheet 30
1975

1950 Source Sheets



Volume 18, Sheet 49
1950



Volume 18, Sheet 51
1950

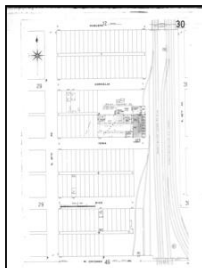


Volume 18, Sheet 30
1950

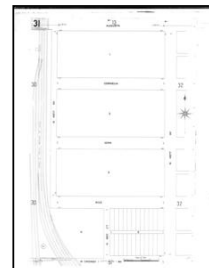


Volume 18, Sheet 31
1950

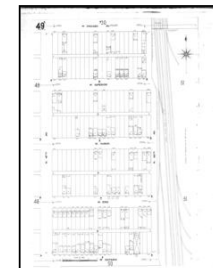
1908 Source Sheets



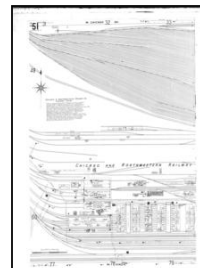
Volume 18, Sheet 30
1908



Volume 18, Sheet 31
1908



Volume 18, Sheet 49
1908



Volume 18, Sheet 51
1908

Sanborn Sheet Key

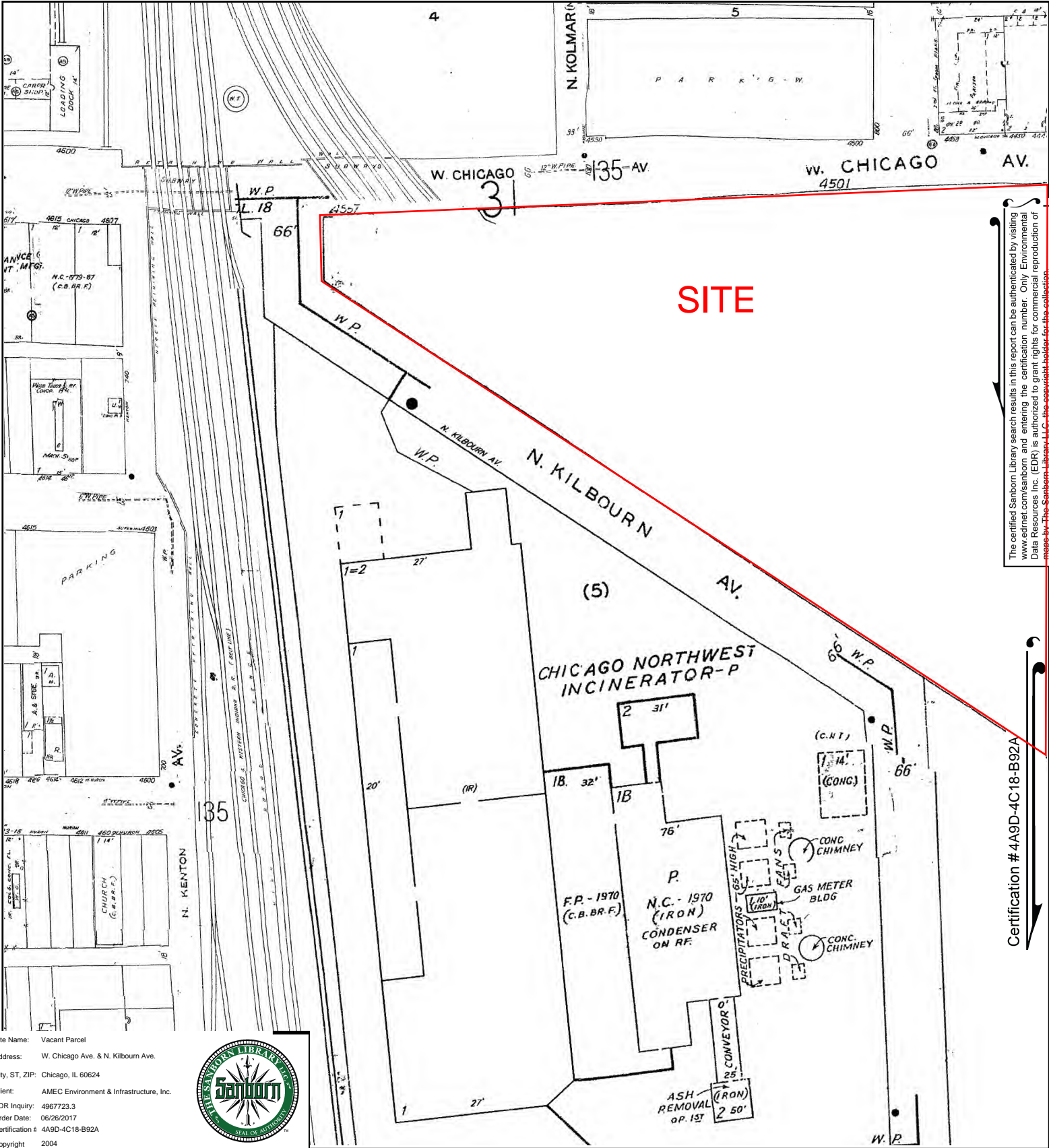
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



1896 Source Sheets



Volume B, Sheet 13
1896



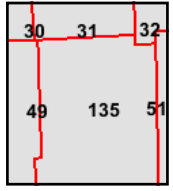
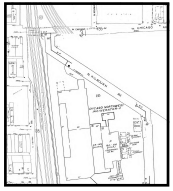
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2004

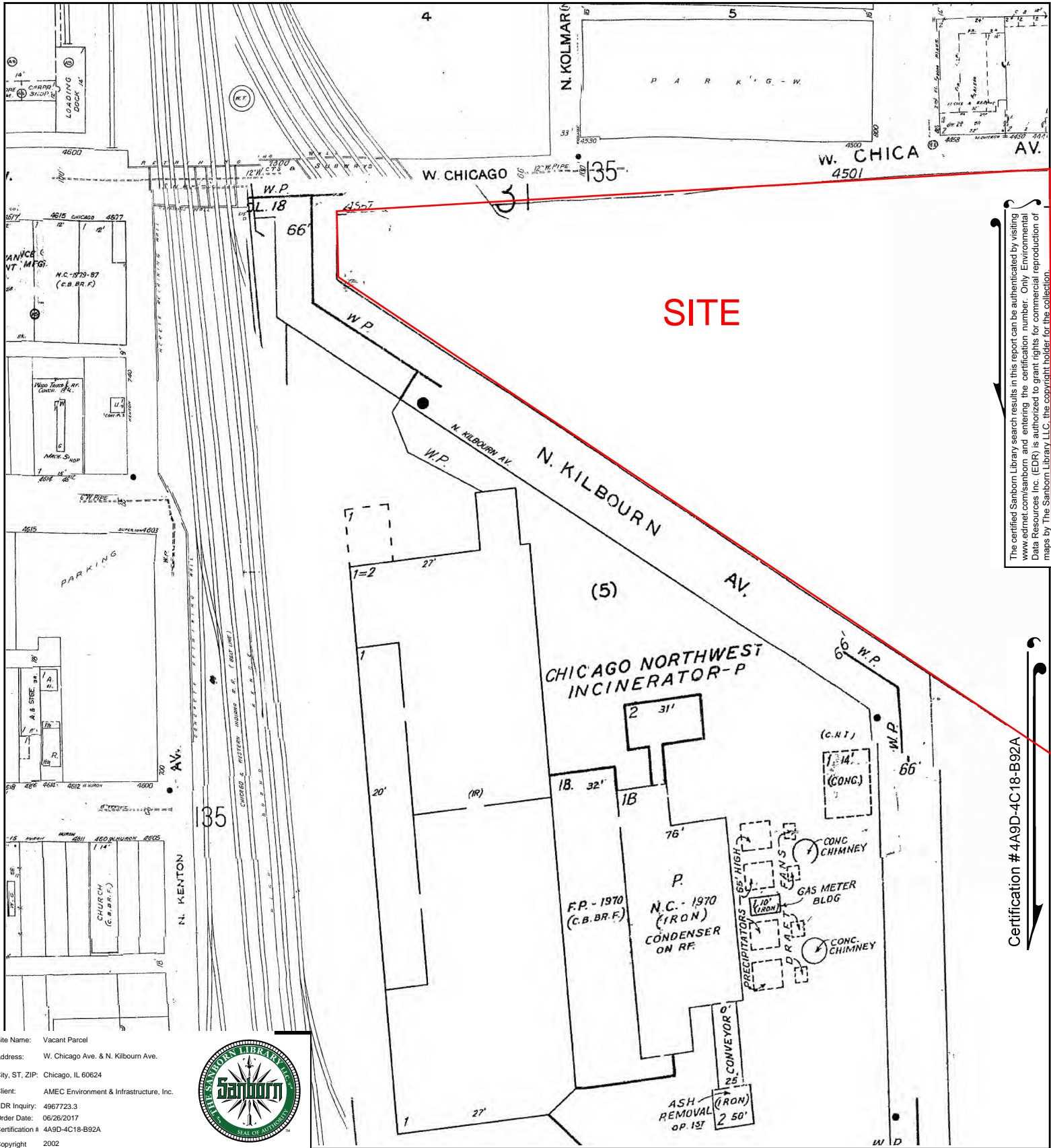


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



- Volume 18, Sheet 135
- Volume 18, Sheet 49
- Volume 18, Sheet 31
- Volume 18, Sheet 30





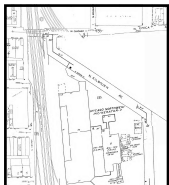
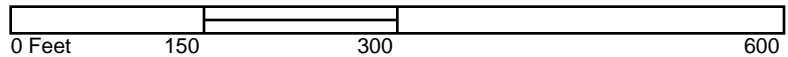
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2002



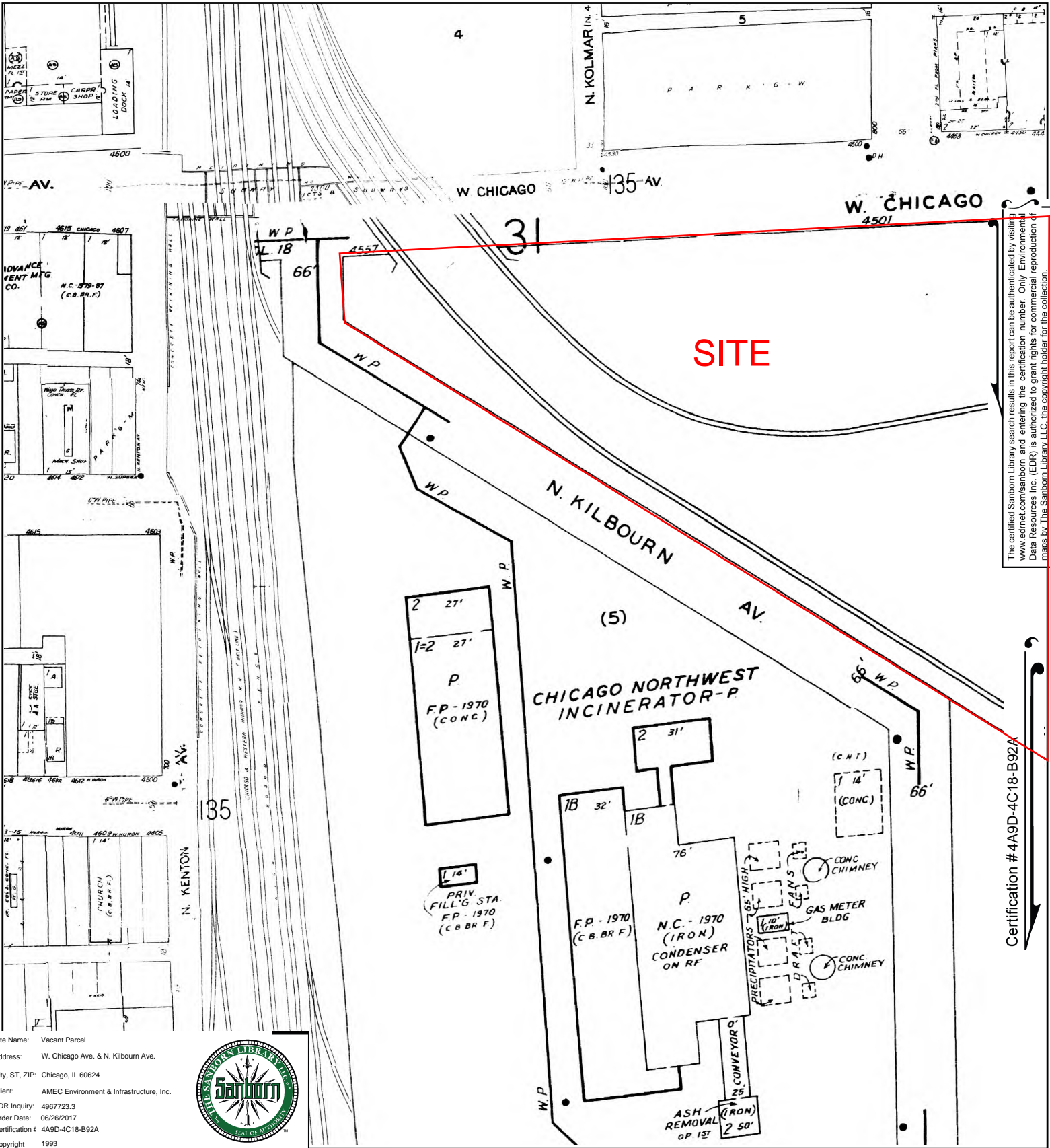
This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



30	31	32
49	135	51

Volume 18, Sheet 31
 Volume 18, Sheet 30
 Volume 18, Sheet 135
 Volume 18, Sheet 49





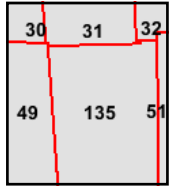
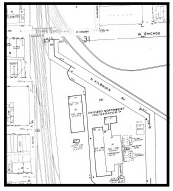
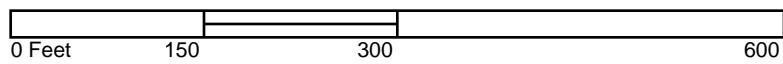
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1993

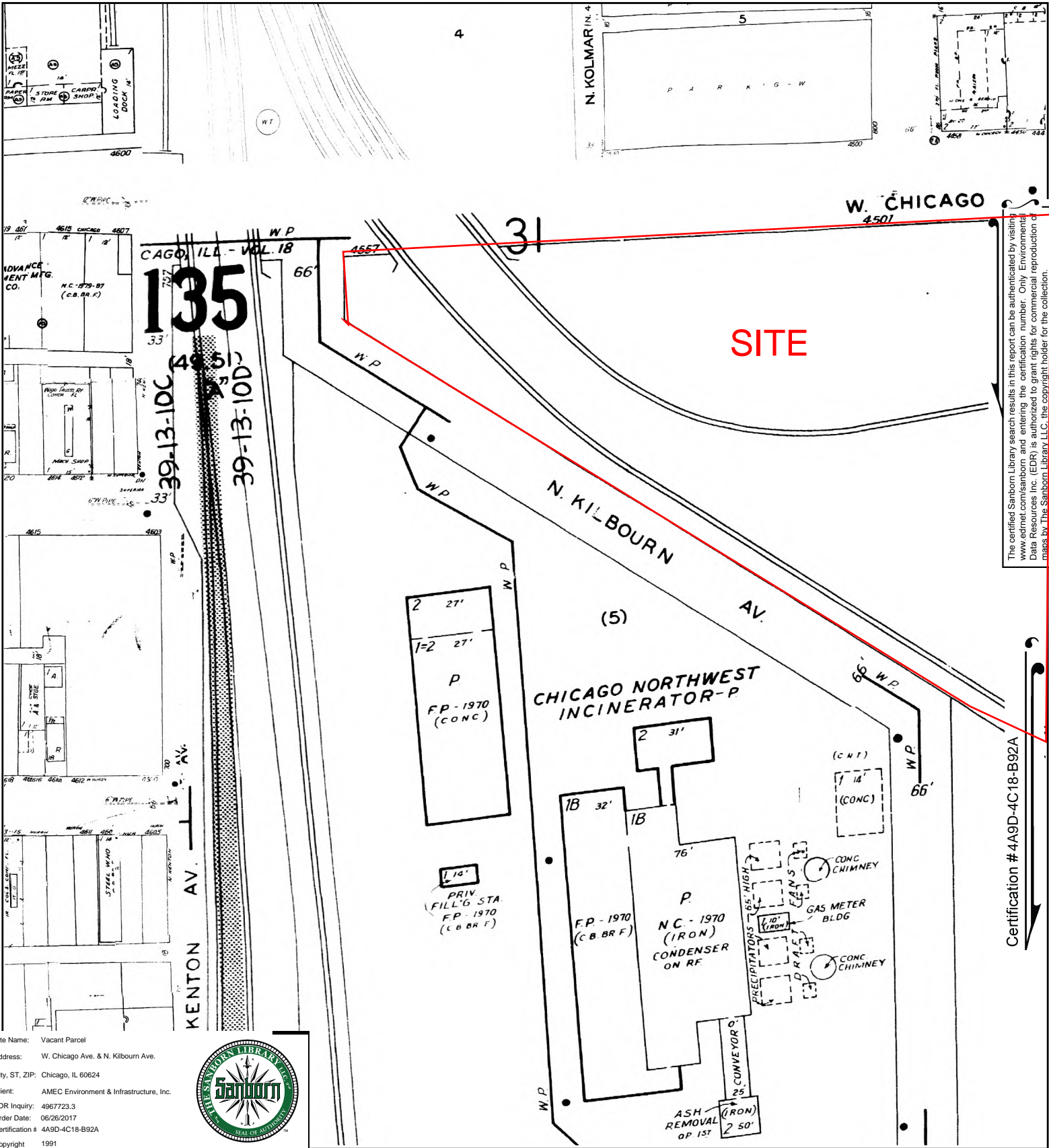


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 49
 Volume 18, Sheet 31
 Volume 18, Sheet 30
 Volume 18, Sheet 135





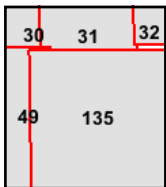
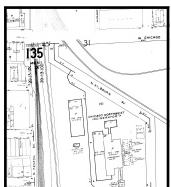
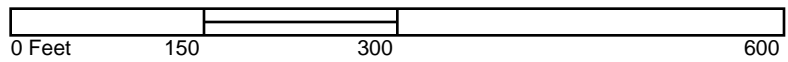
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1991

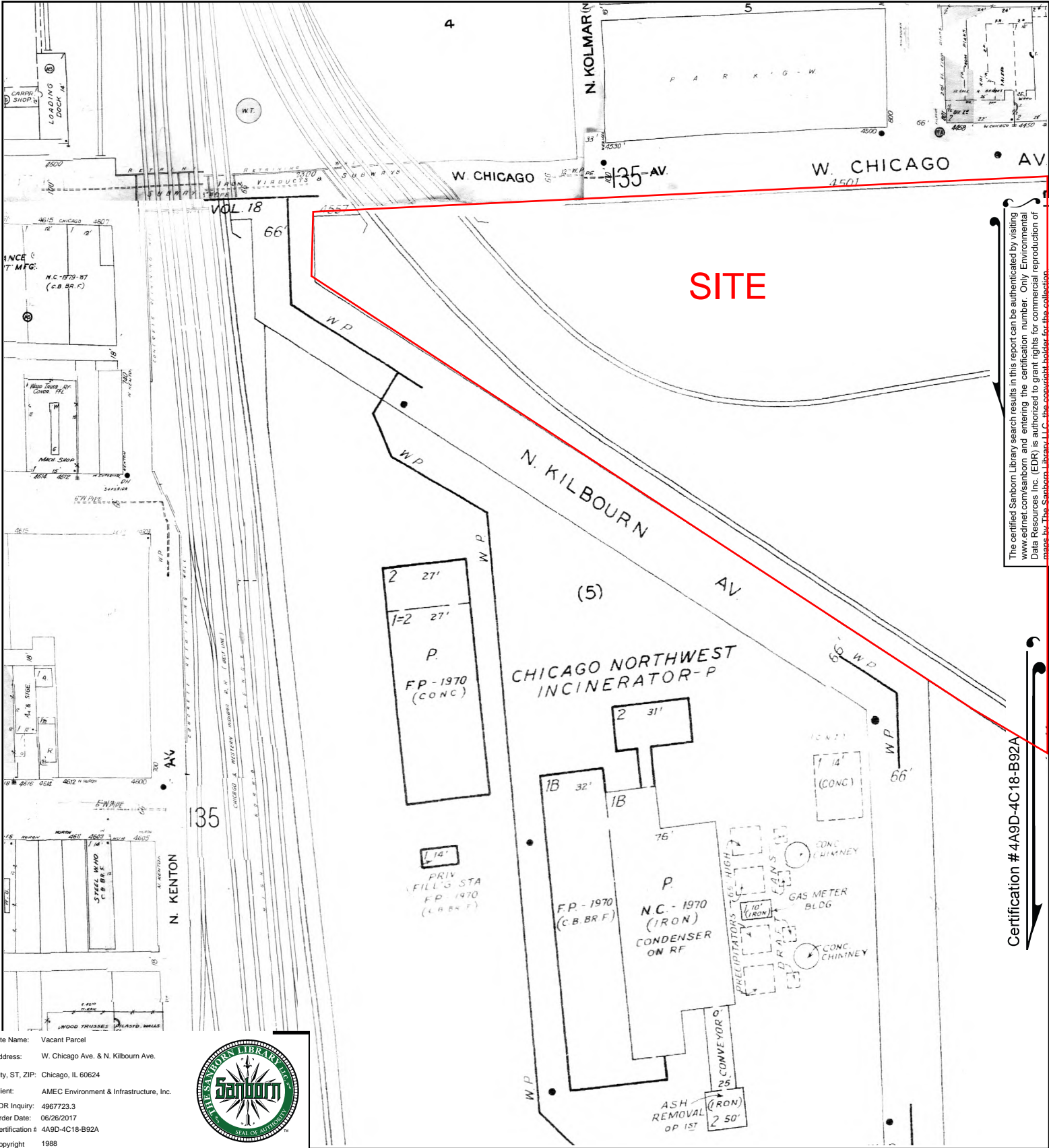


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 135
 Volume 18, Sheet 49
 Volume 18, Sheet 31
 Volume 18, Sheet 30

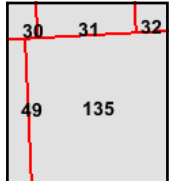
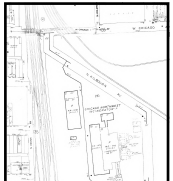
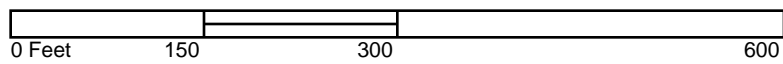




The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

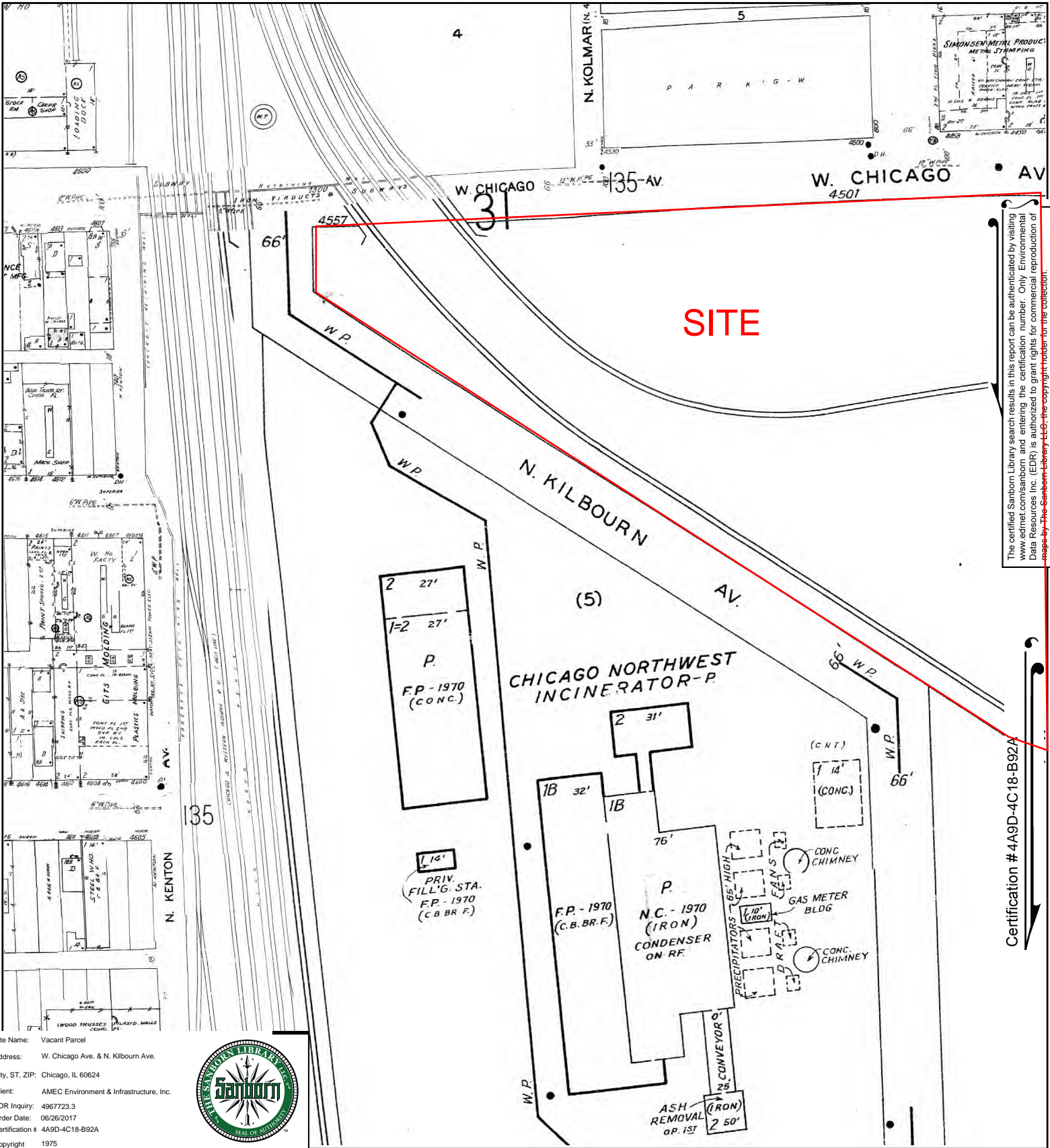
Certification # 4A9D-4C18-B92A

This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



- Volume 18, Sheet 135
- Volume 18, Sheet 49
- Volume 18, Sheet 31
- Volume 18, Sheet 30





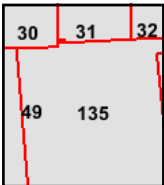
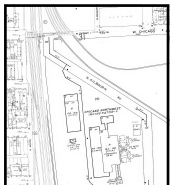
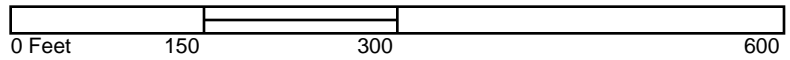
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC; the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1975

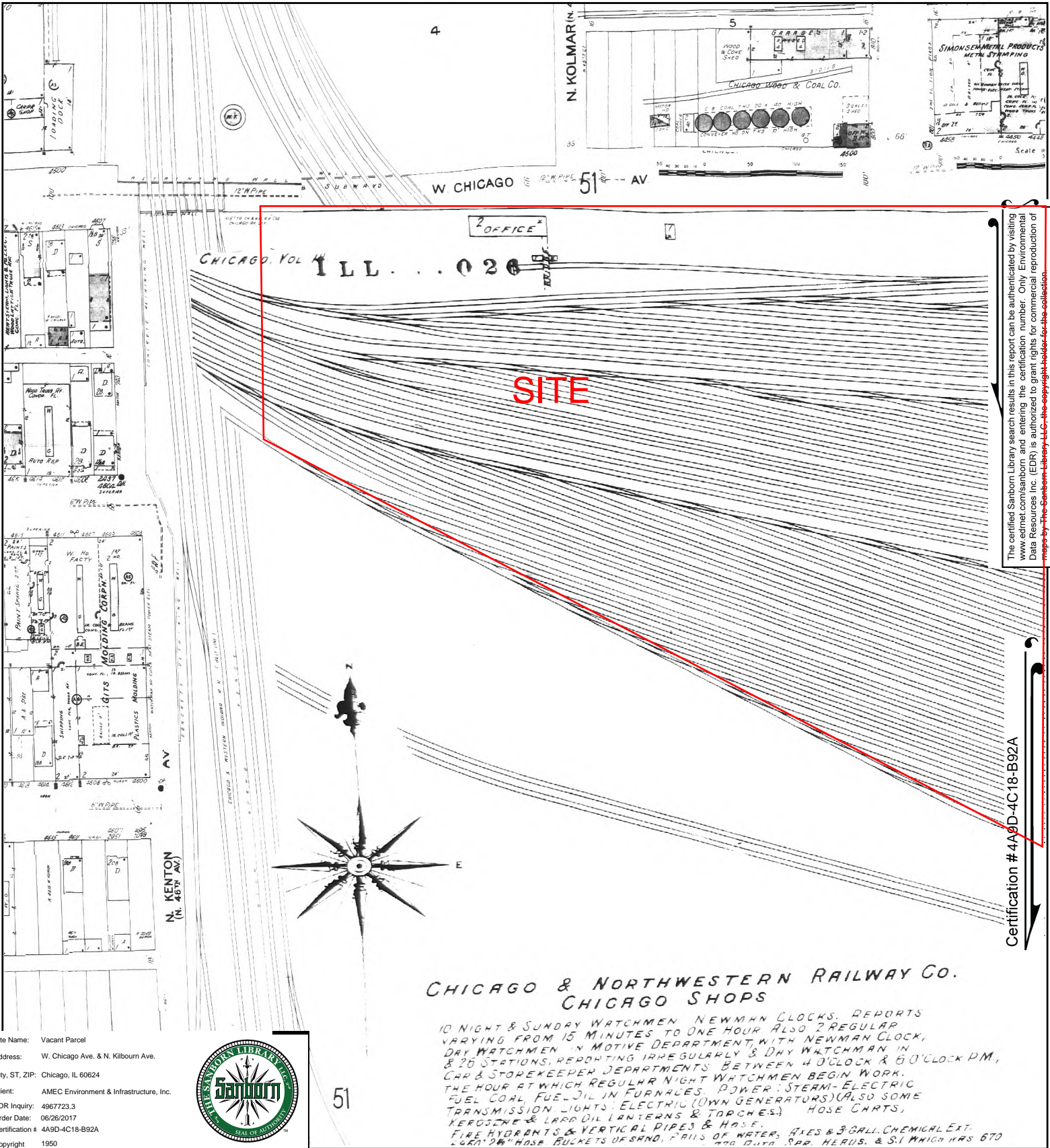


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 30
 Volume 18, Sheet 135
 Volume 18, Sheet 49
 Volume 18, Sheet 31





The certified Sanborn Library search results in this report can be authenticated by visiting www.edrmet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of images by The Sanborn Library LLC, the copyright holder for the collection.

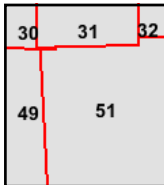
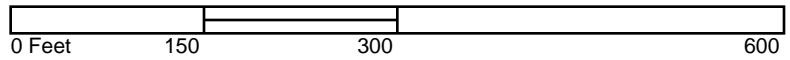
Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1950



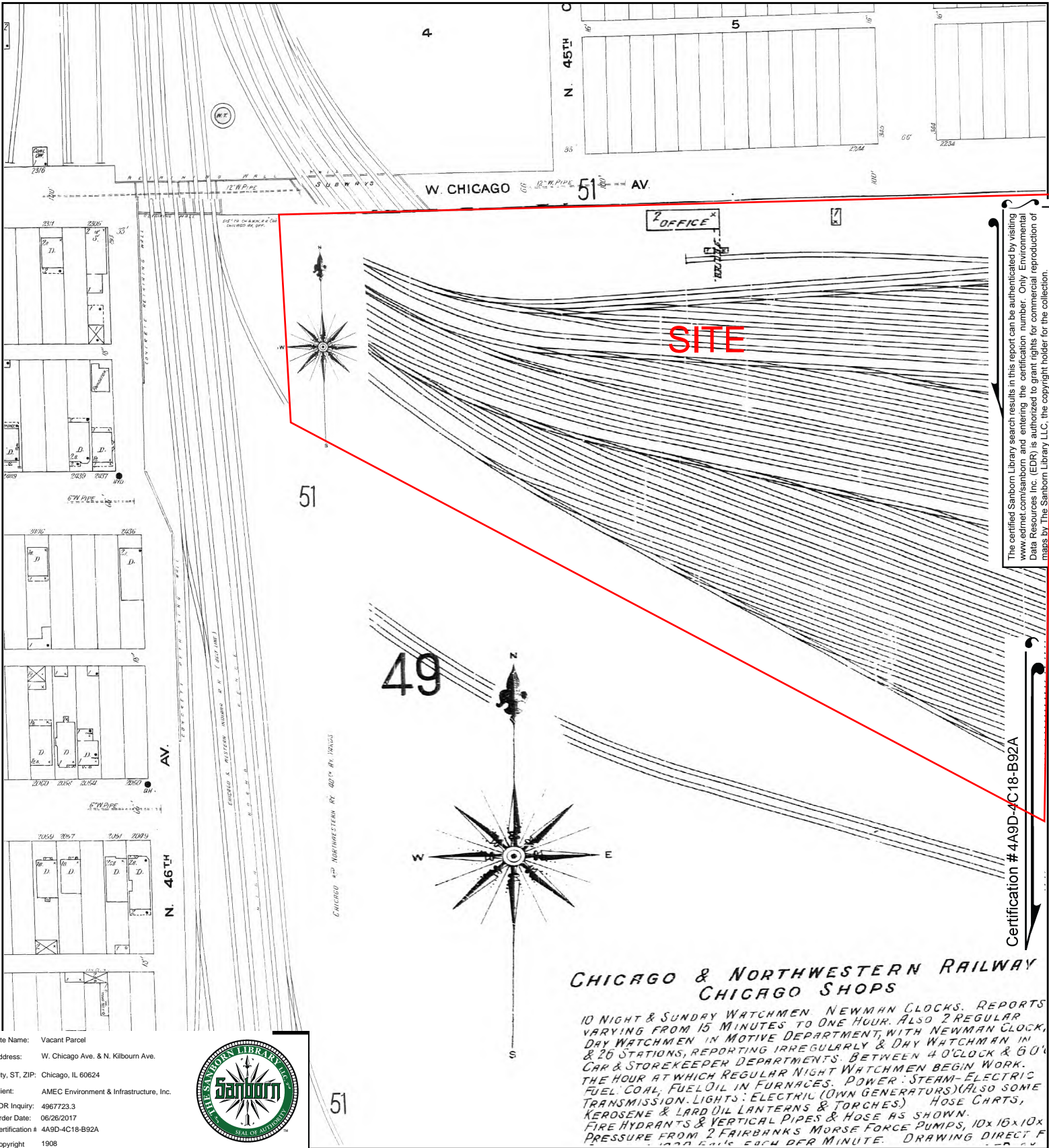
51

This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 31
 Volume 18, Sheet 30
 Volume 18, Sheet 51
 Volume 18, Sheet 49

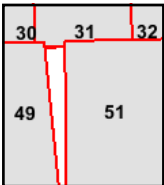
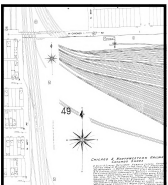
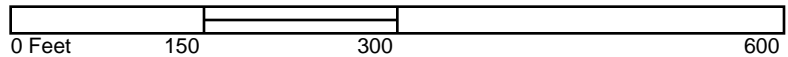




Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1908

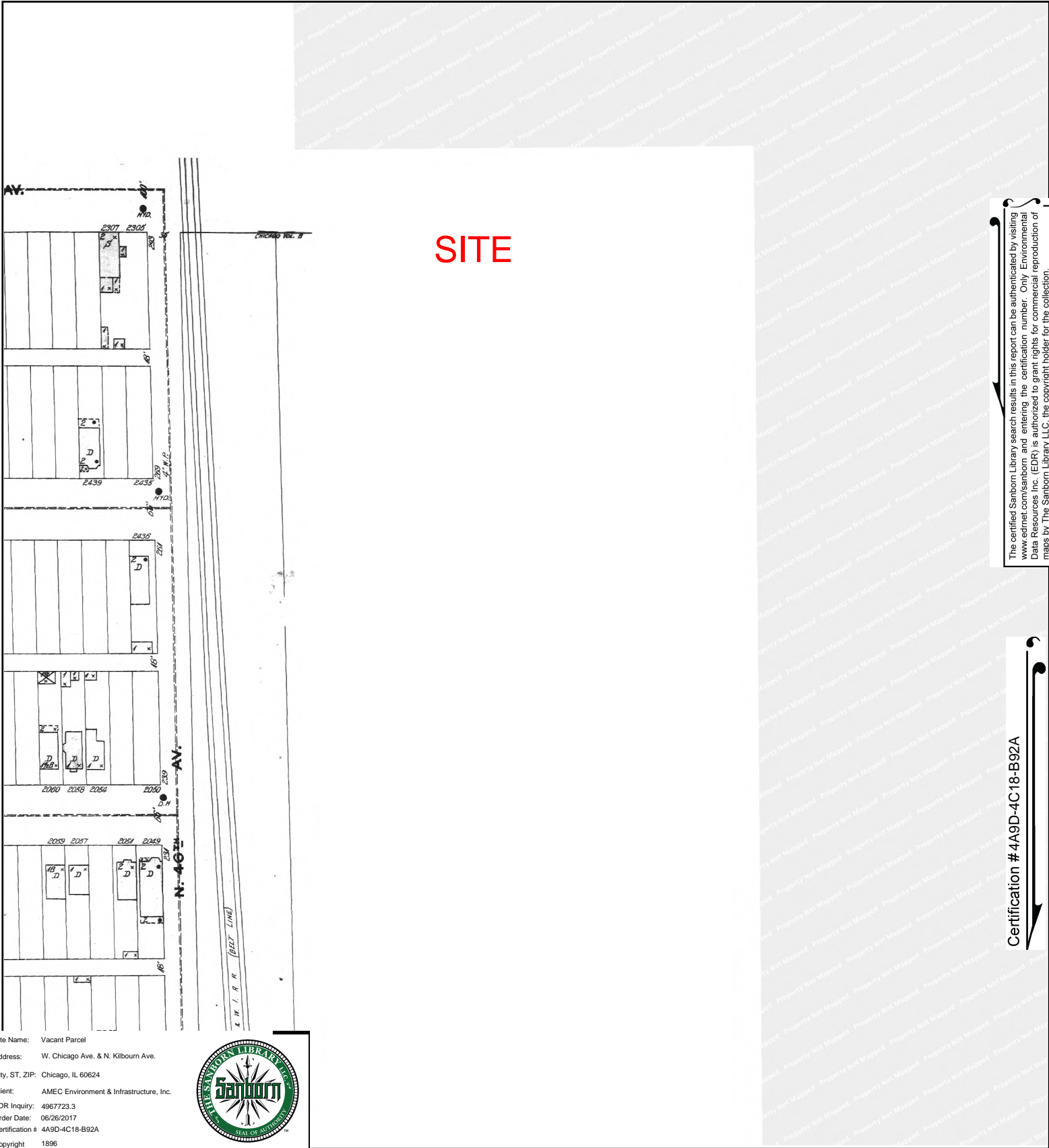


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 51
 Volume 18, Sheet 49
 Volume 18, Sheet 31
 Volume 18, Sheet 30





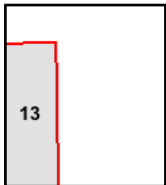
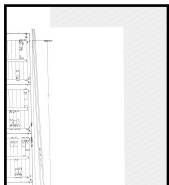
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1896



This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume B, Sheet 13



Vacant Parcel

W. Chicago Ave. & N. Kilbourn Ave.

Chicago, IL 60624

Inquiry Number: 4967723.3

June 26, 2017

Certified Sanborn® Map Report



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

Certified Sanborn® Map Report

06/26/17

Site Name:

Vacant Parcel
W. Chicago Ave. & N. Kilbourn
Chicago, IL 60624
EDR Inquiry # 4967723.3

Client Name:

AMEC Environment & Infrastructure, Inc.
8745 West Higgins Rd
Chicago, IL 60631
Contact: Mary Jank



The Sanborn Library has been searched by EDR and maps covering the target property location as provided by AMEC Environment & Infrastructure, Inc. were identified for the years listed below. The Sanborn Library is the largest, most complete collection of fire insurance maps. The collection includes maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow, and others. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by the Sanborn Library LLC, the copyright holder for the collection. Results can be authenticated by visiting www.edrnet.com/sanborn.

The Sanborn Library is continually enhanced with newly identified map archives. This report accesses all maps in the collection as of the day this report was generated.

Certified Sanborn Results:

Certification # 4A9D-4C18-B92A
PO # 3205171606
Project City of Chicago 2FM
Maps Provided:

2004	1896
2002	
1993	
1991	
1988	
1975	
1950	
1908	



Sanborn® Library search results

Certification #: 4A9D-4C18-B92A

The Sanborn Library includes more than 1.2 million fire insurance maps from Sanborn, Bromley, Perris & Browne, Hopkins, Barlow and others which track historical property usage in approximately 12,000 American cities and towns. Collections searched:

- Library of Congress
- University Publications of America
- EDR Private Collection

The Sanborn Library LLC Since 1866™

Limited Permission To Make Copies

AMEC Environment & Infrastructure, Inc. (the client) is permitted to make up to FIVE photocopies of this Sanborn Map transmittal and each fire insurance map accompanying this report solely for the limited use of its customer. No one other than the client is authorized to make copies. Upon request made directly to an EDR Account Executive, the client may be permitted to make a limited number of additional photocopies. This permission is conditioned upon compliance by the client, its customer and their agents with EDR's copyright policy; a copy of which is available upon request.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT. Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission.

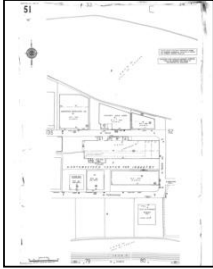
EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

Sanborn Sheet Key

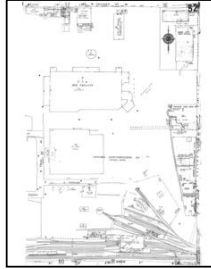
This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



2004 Source Sheets

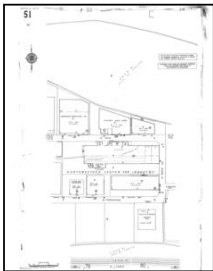


Volume 18, Sheet 51
2004

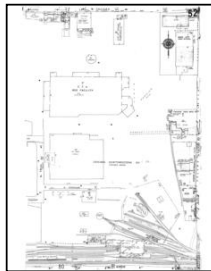


Volume 18, Sheet 52
2004

2002 Source Sheets

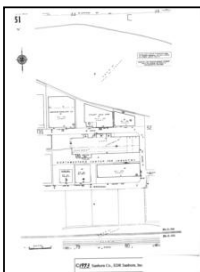


Volume 18, Sheet 51
2002

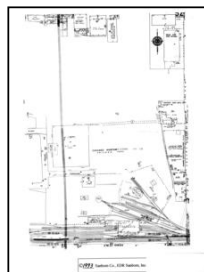


Volume 18, Sheet 52
2002

1993 Source Sheets



Volume 18, Sheet 51
1993

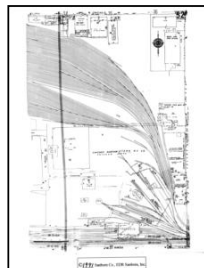


Volume 18, Sheet 52
1993

1991 Source Sheets



Volume 18, Sheet 51
1991



Volume 18, Sheet 52
1991

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



1988 Source Sheets

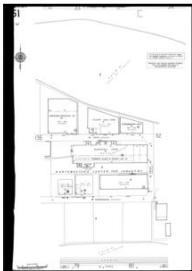


Volume 18, Sheet 51
1988



Volume 18, Sheet 52
1988

1975 Source Sheets

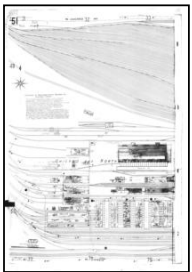


Volume 18, Sheet 51
1975

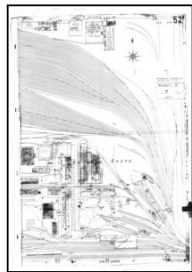


Volume 18, Sheet 52
1975

1950 Source Sheets

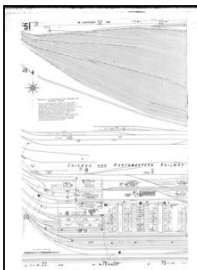


Volume 18, Sheet 51
1950

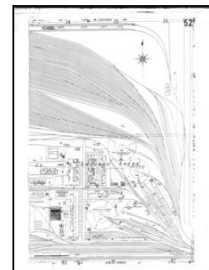


Volume 18, Sheet 52
1950

1908 Source Sheets



Volume 18, Sheet 51
1908



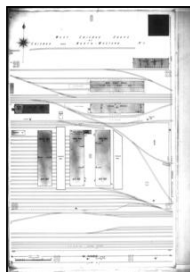
Volume 18, Sheet 52
1908

Sanborn Sheet Key

This Certified Sanborn Map Report is based upon the following Sanborn Fire Insurance map sheets.



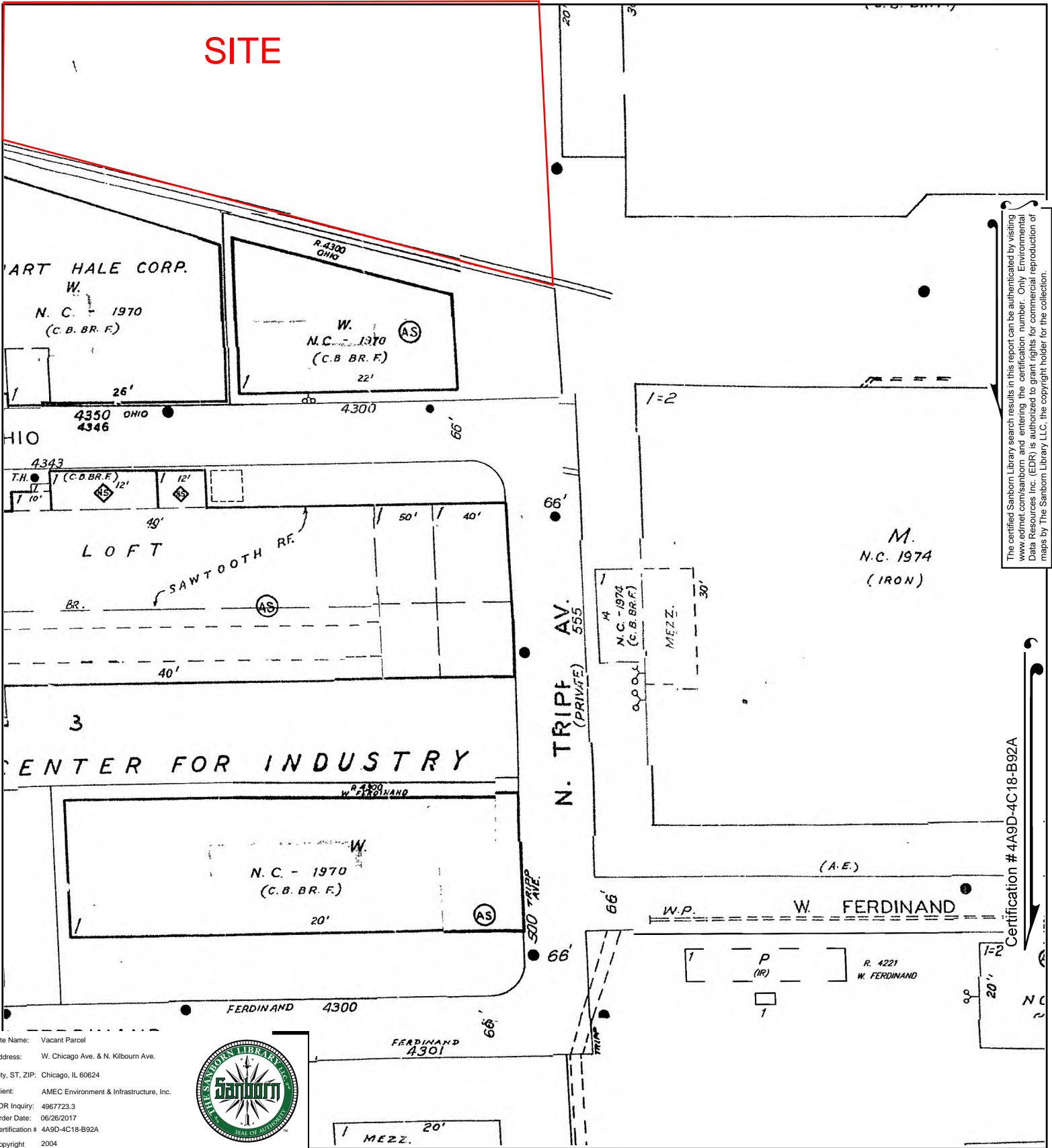
1896 Source Sheets



Volume B, Sheet 21
1896



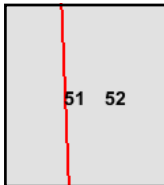
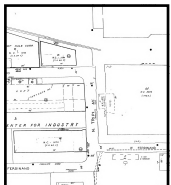
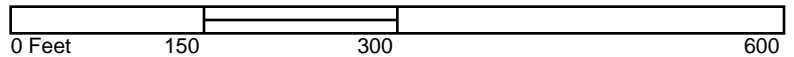
Volume B, Sheet 22
1896



Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2004



This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.

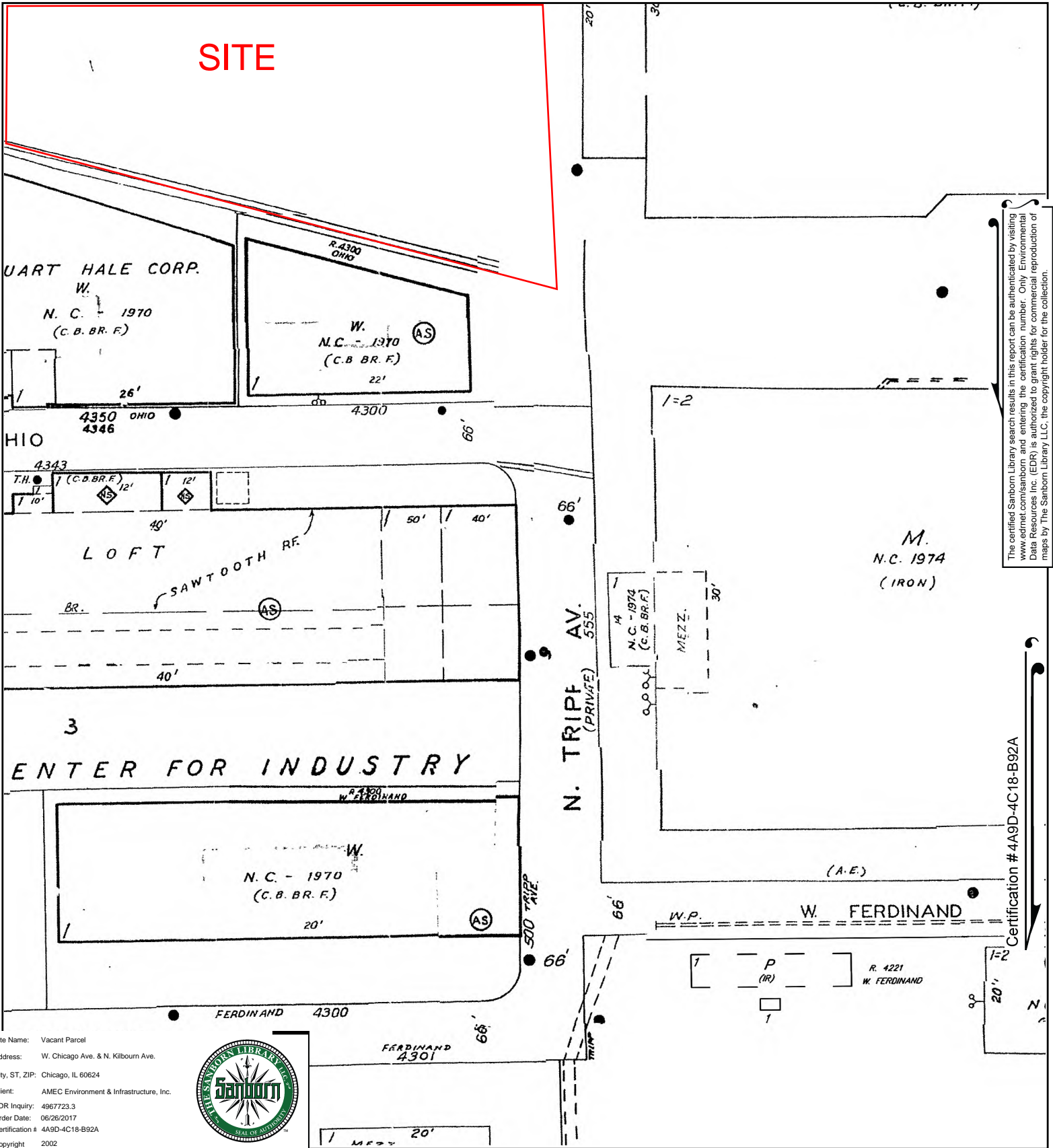


Volume 18, Sheet 52
 Volume 18, Sheet 51

The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A





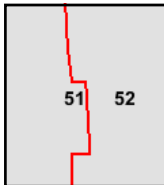
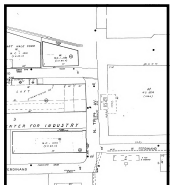
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 2002

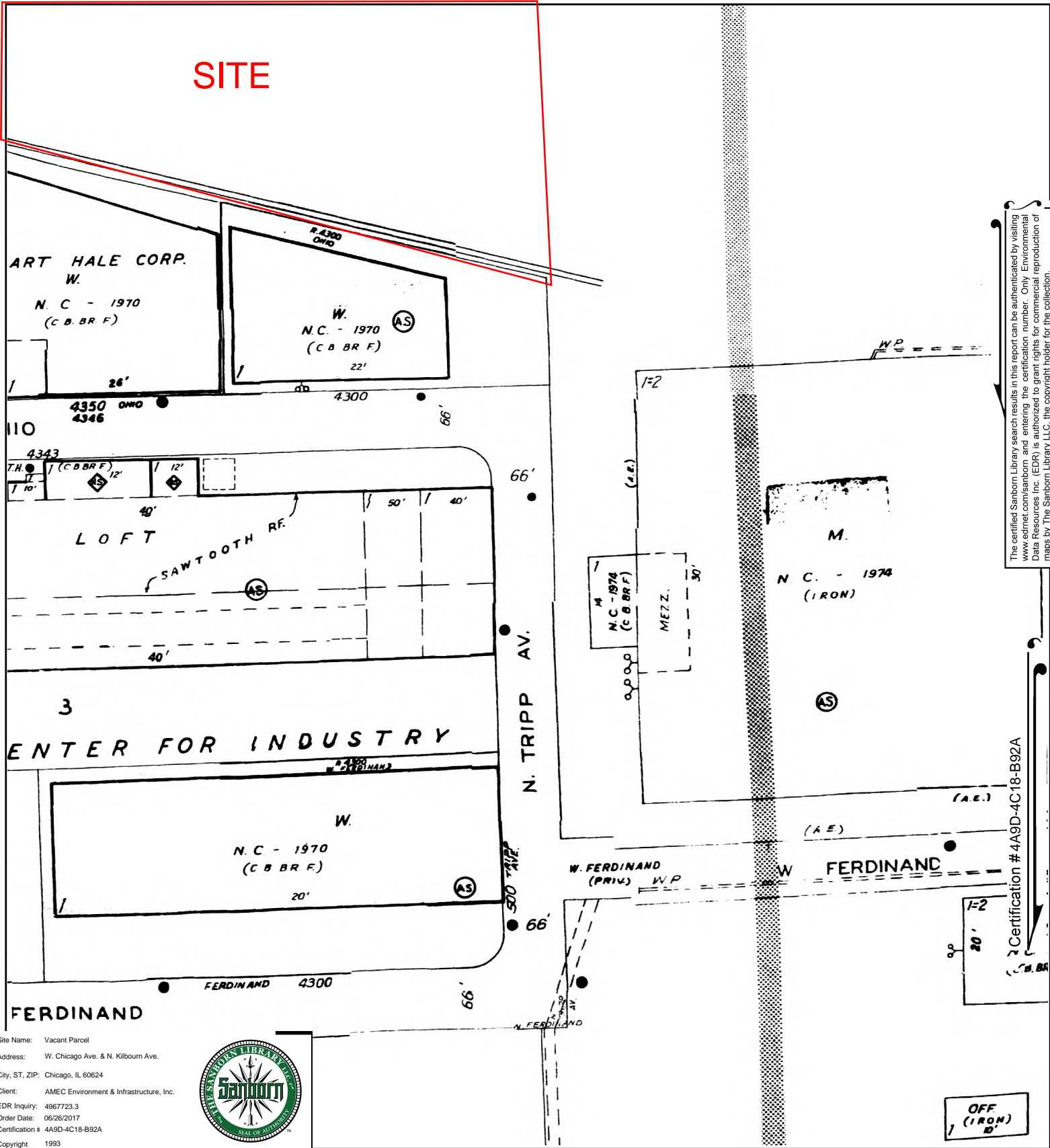


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 52
 Volume 18, Sheet 51





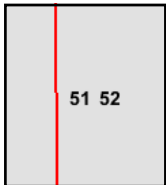
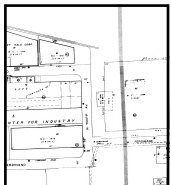
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

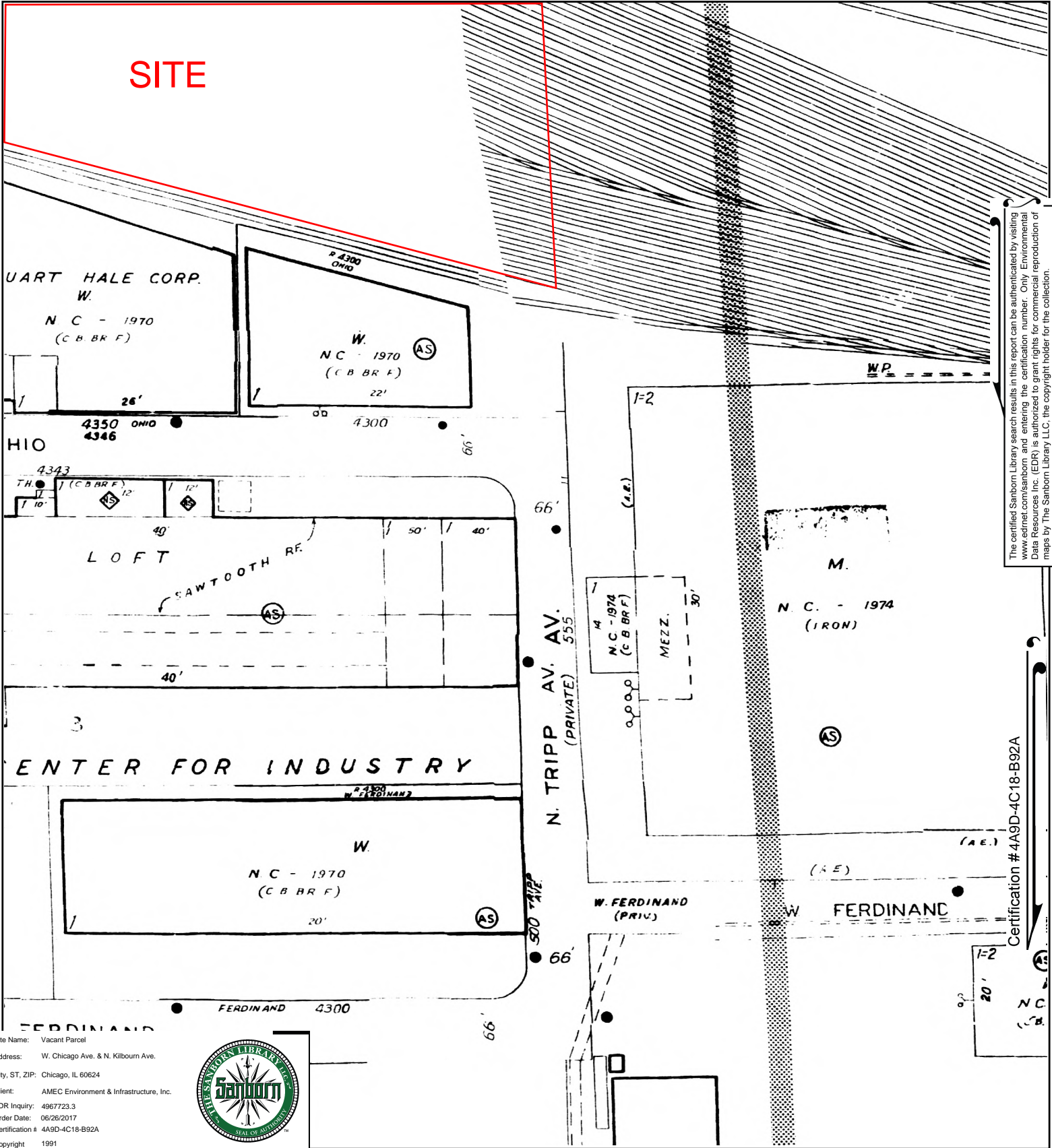
Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1993



This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 52
 Volume 18, Sheet 51



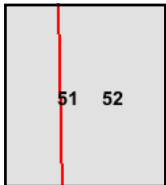
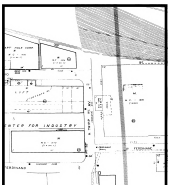
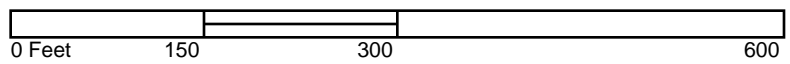
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification #4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1991



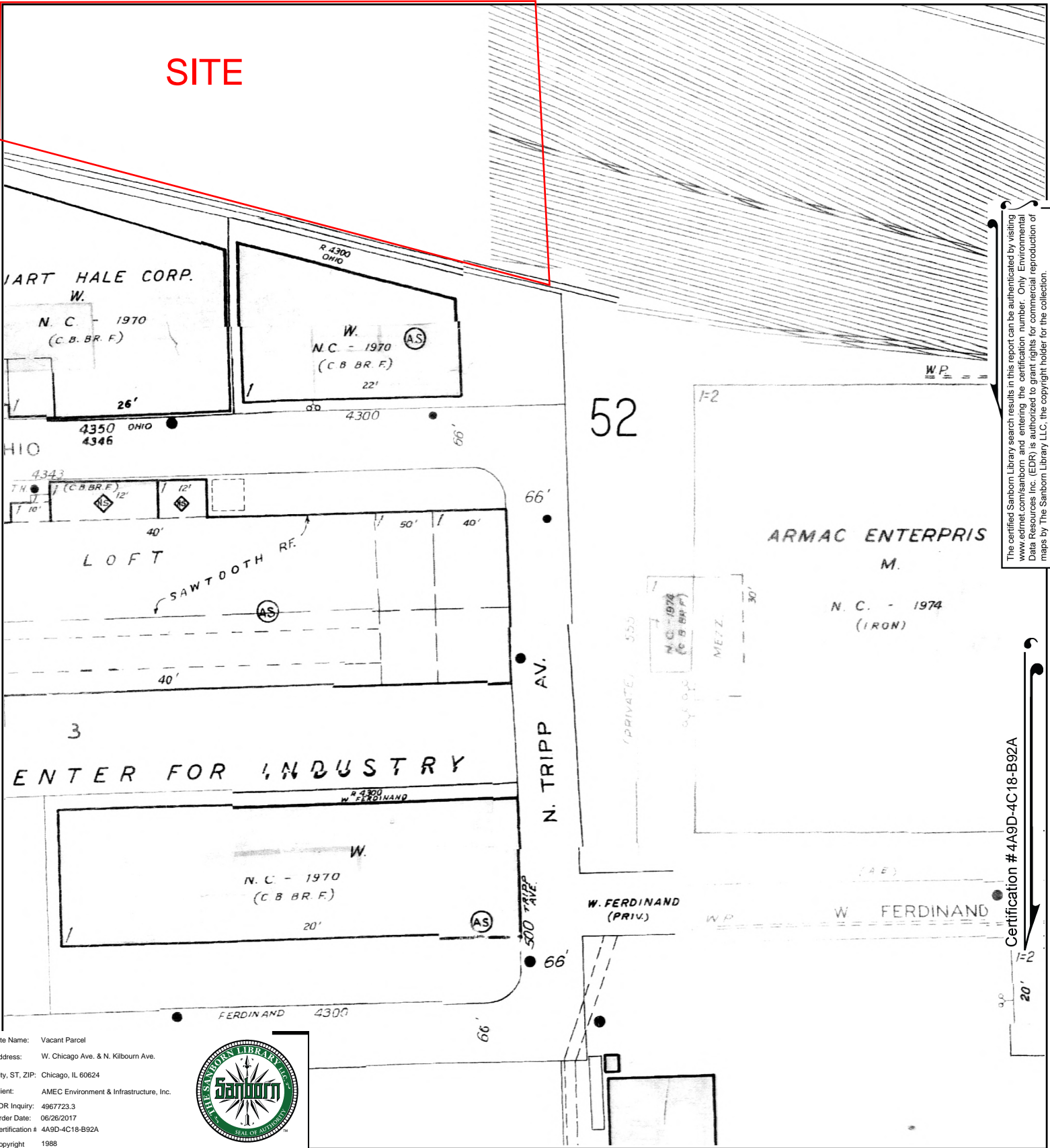
This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 52
 Volume 18, Sheet 51



SITE



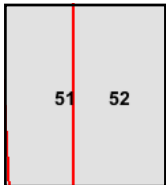
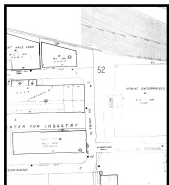
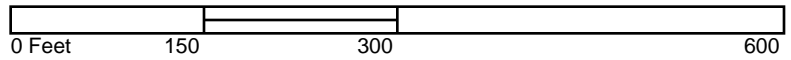
The certified Sanborn Library search results in this report can be authenticated by visiting www.edr.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1988

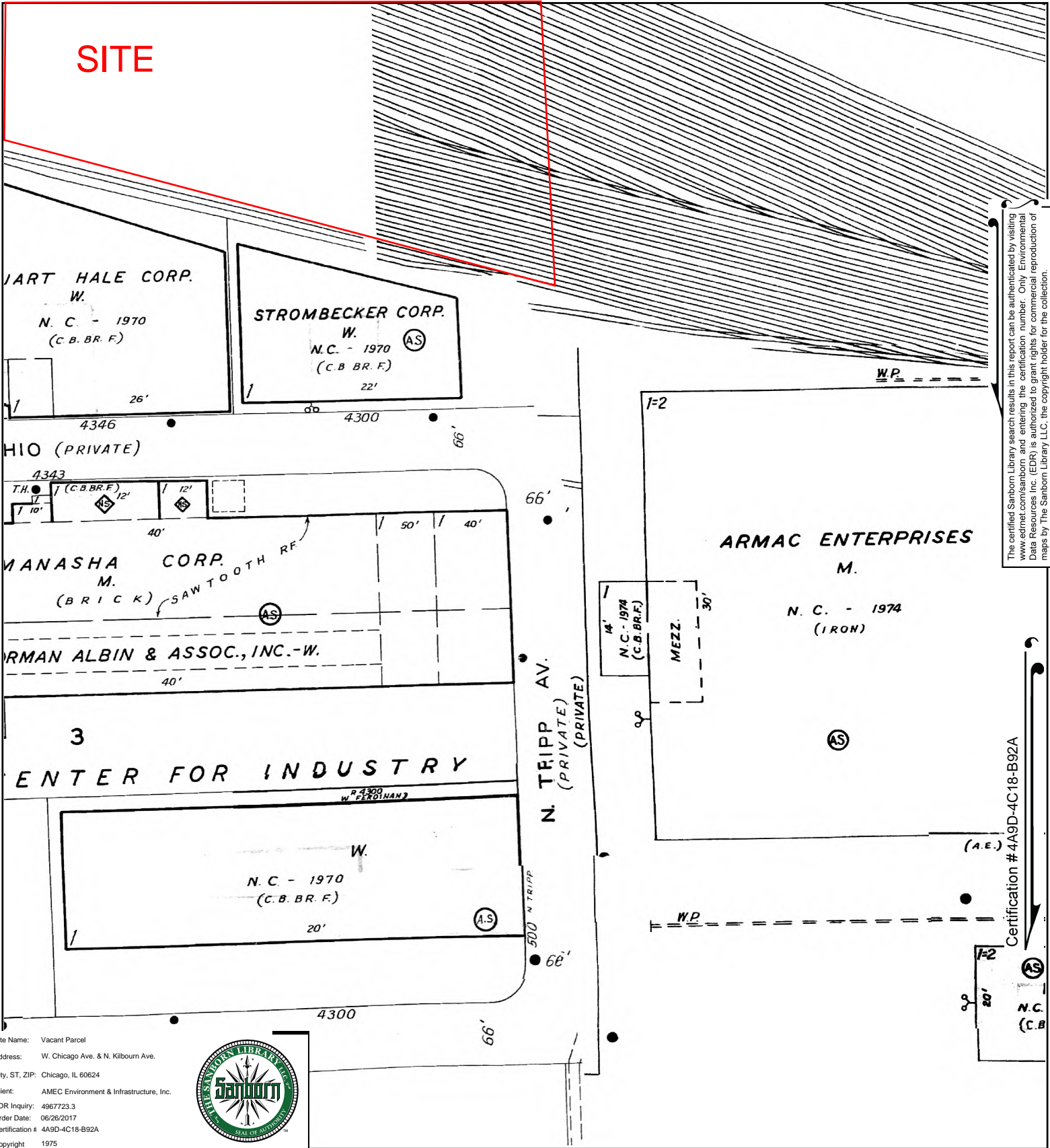


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 52
 Volume 18, Sheet 51





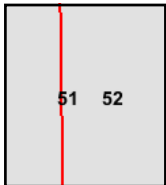
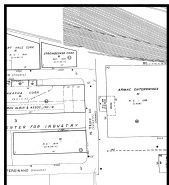
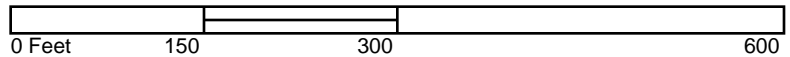
The certified Sanborn Library search results in this report can be authenticated by visiting www.edr.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1975

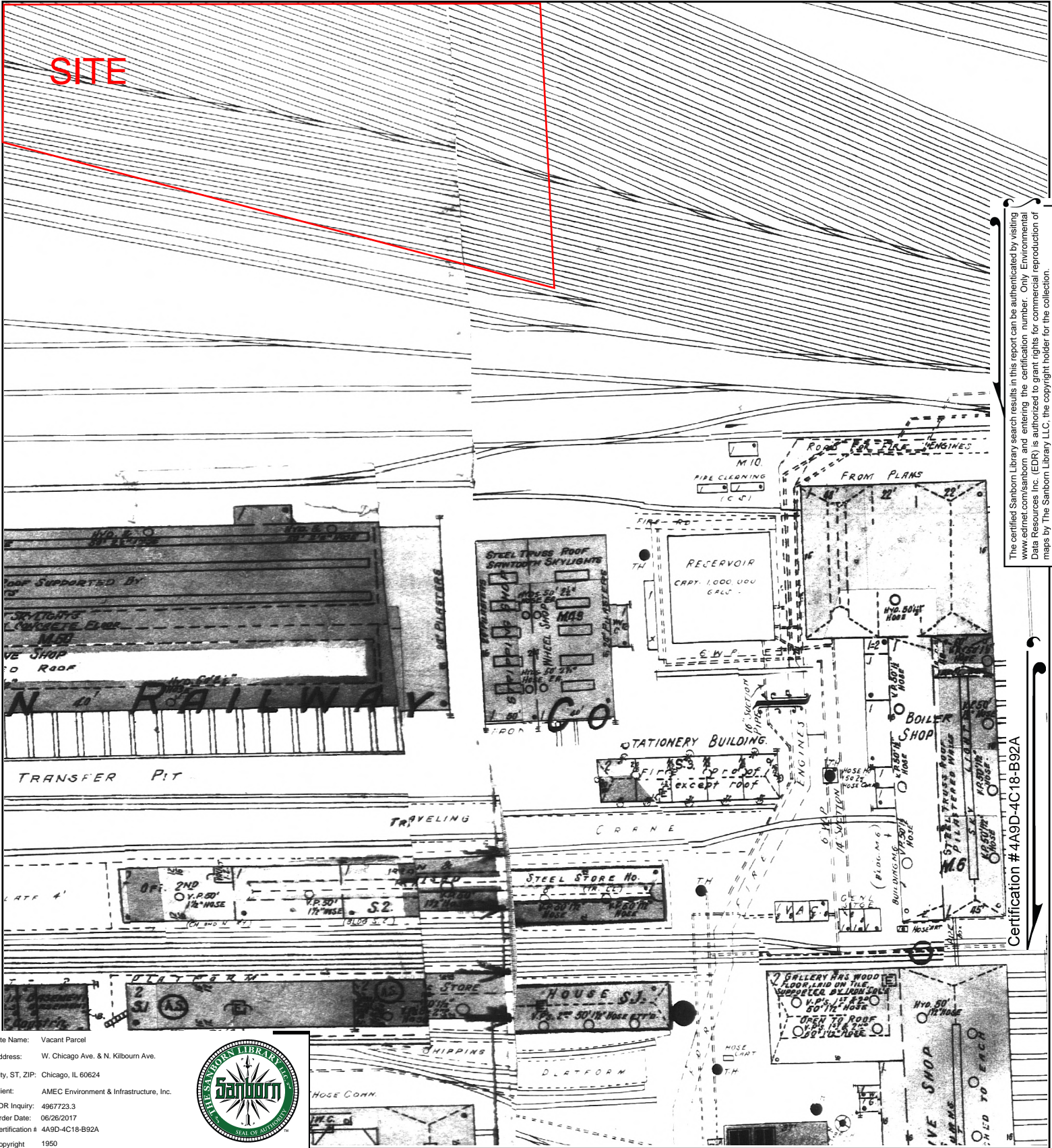


This Certified Sanborn Map combines the following sheets. Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 52
 Volume 18, Sheet 51





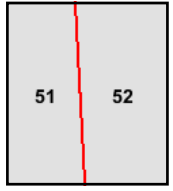
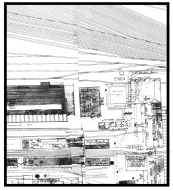
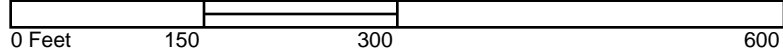
The certified Sanborn Library search results in this report can be authenticated by visiting www.edr.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification # 4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1950

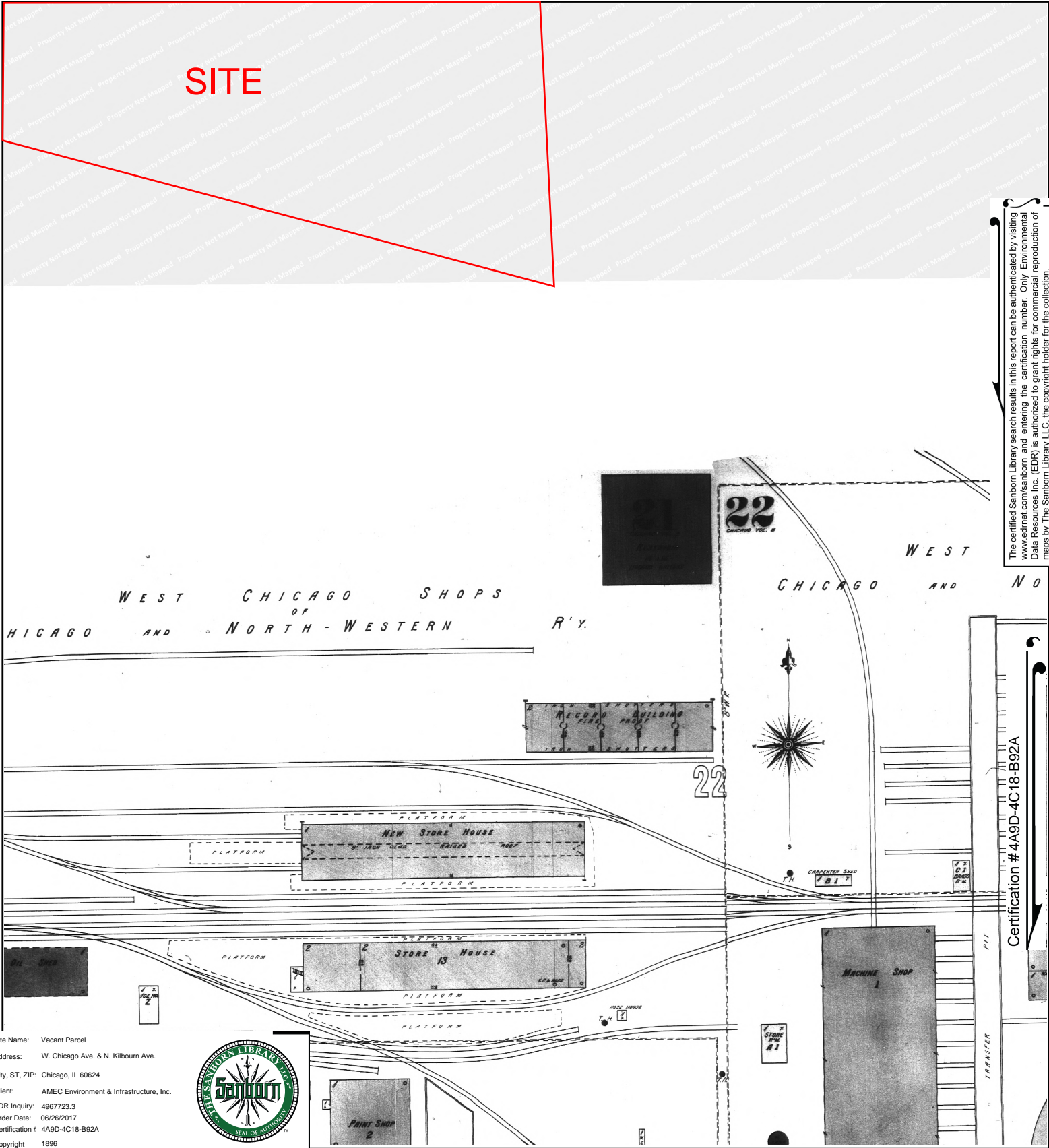


This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



Volume 18, Sheet 52
 Volume 18, Sheet 51





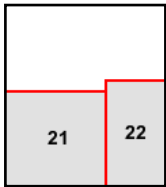
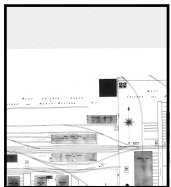
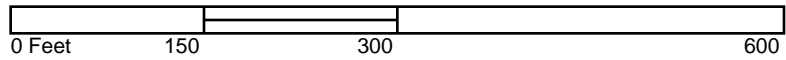
The certified Sanborn Library search results in this report can be authenticated by visiting www.edrnet.com/sanborn and entering the certification number. Only Environmental Data Resources Inc. (EDR) is authorized to grant rights for commercial reproduction of maps by The Sanborn Library LLC, the copyright holder for the collection.

Certification #4A9D-4C18-B92A

Site Name: Vacant Parcel
 Address: W. Chicago Ave. & N. Kilbourn Ave.
 City, ST, ZIP: Chicago, IL 60624
 Client: AMEC Environment & Infrastructure, Inc.
 EDR Inquiry: 4967723.3
 Order Date: 06/26/2017
 Certification # 4A9D-4C18-B92A
 Copyright 1896



This Certified Sanborn Map combines the following sheets.
 Outlined areas indicate map sheets within the collection.



Volume B, Sheet 22
 Volume B, Sheet 21





APPENDIX D

City Directories

Vacant Parcel

4301 W. Chicago Avenue
Chicago, IL 60624

Inquiry Number: 4976023.1
June 26, 2017

The EDR-City Directory Abstract

TABLE OF CONTENTS

SECTION

Executive Summary

Findings

City Directory Images

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OR DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc. or its affiliates is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

EXECUTIVE SUMMARY

DESCRIPTION

Environmental Data Resources, Inc.'s (EDR) City Directory Abstract is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's City Directory Abstract includes a search and abstract of available city directory data. For each address, the directory lists the name of the corresponding occupant at five year intervals.

Business directories including city, cross reference and telephone directories were reviewed, if available, at approximately five year intervals for the years spanning 1923 through 2014. This report compiles information gathered in this review by geocoding the latitude and longitude of properties identified and gathering information about properties within 147 feet of the target property.

A summary of the information obtained is provided in the text of this report.

RECORD SOURCES

EDR's Digital Archive combines historical directory listings from sources such as Cole Information and Dun & Bradstreet. These standard sources of property information complement and enhance each other to provide a more comprehensive report.

EDR is licensed to reproduce certain City Directory works by the copyright holders of those works. The purchaser of this EDR City Directory Report may include it in report(s) delivered to a customer. Reproduction of City Directories without permission of the publisher or licensed vendor may be a violation of copyright.

Data by

infoUSA[®]

Copyright©2008
All Rights Reserved

RESEARCH SUMMARY

The following research sources were consulted in the preparation of this report. An "X" indicates where information was identified in the source and provided in this report.

<u>Year</u>	<u>Source</u>	<u>TP</u>	<u>Adjoining</u>	<u>Text Abstract</u>	<u>Source Image</u>
2014	EDR Digital Archive	-	-	-	-
2010	EDR Digital Archive	-	-	-	-
2005	Haines Company Inc.	X	-	X	-
1999	Haines & Company	X	-	X	-
1993	Illinois Bell	-	-	-	-
1986	Illinois Bell Telephone	-	-	-	-
1981	Reuben H. Donnelley Telephone	-	-	-	-
1976	Illinois Bell Telephone	-	-	-	-
1971	The Reuben H. Donnelley Corporation Telephone	-	-	-	-
1966	The Reuben H. Donnelley Telephone Directory Company	-	-	-	-

EXECUTIVE SUMMARY

<u>Year</u>	<u>Source</u>	<u>TP</u>	<u>Adjoining</u>	<u>Text Abstract</u>	<u>Source Image</u>
1961	Illinois Bell Telephone	-	-	-	-
1957	Illinois Bell Telephone	-	-	-	-
1951	Illinois Bell Telephone	-	-	-	-
1949	Illinois Bell Telephone	-	-	-	-
1947	Illinois Bell Telephone	-	-	-	-
1941	The Reuben H. Donelley Corporation	-	-	-	-
1932	Illinois Bell Telephone	-	-	-	-
1931	Illinois Bell Telephone	-	-	-	-
1928	R. L. Polk & Co.	-	-	-	-
1923	R. L. Polk & Co.	-	-	-	-

FINDINGS

TARGET PROPERTY INFORMATION

ADDRESS

4301 W. Chicago Avenue
Chicago, IL 60624

FINDINGS DETAIL

Target Property research detail.

Chicago

4301 Chicago

<u>Year</u>	<u>Uses</u>	<u>Source</u>
2005	AUTHORITY	Haines Company Inc.
	CHGOTRANSIT	Haines Company Inc.
1999	XXXX	Haines & Company

FINDINGS

ADJOINING PROPERTY DETAIL

The following Adjoining Property addresses were researched for this report. Detailed findings are provided for each address.

No Addresses Found

FINDINGS

TARGET PROPERTY: ADDRESS NOT IDENTIFIED IN RESEARCH SOURCE

The following Target Property addresses were researched for this report, and the addresses were not identified in the research source.

Address Researched

4301 W. Chicago Avenue

Address Not Identified in Research Source

2014, 2010, 1993, 1986, 1981, 1976, 1971, 1966, 1961, 1957, 1951, 1949, 1947, 1941, 1932, 1931, 1928, 1923



APPENDIX E

Title Search Information

Vacant Parcel

4301 W. Chicago Ave
CHICAGO, IL 60651

Inquiry Number: 5109170.5
November 17, 2017

EDR Environmental Lien and AUL Search

EDR Environmental Lien and AUL Search

The EDR Environmental Lien and AUL Search Report provides results from a search of available current land title records for environmental cleanup liens and other activity and use limitations, such as engineering controls and institutional controls.

A network of professional, trained researchers, following established procedures, uses client supplied address information to:

- search for parcel information and/or legal description;
- search for ownership information;
- research official land title documents recorded at jurisdictional agencies such as recorders' offices, registries of deeds, county clerks' offices, etc.;
- access a copy of the deed;
- search for environmental encumbering instrument(s) associated with the deed;
- provide a copy of any environmental encumbrance(s) based upon a review of key words in the instrument(s) (title, parties involved, and description); and
- provide a copy of the deed or cite documents reviewed.

Thank you for your business.

Please contact EDR at 1-800-352-0050
with any questions or comments.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OR DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc. or its affiliates is prohibited without prior written permission.

EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

EDR Environmental Lien and AUL Search

TARGET PROPERTY INFORMATION

ADDRESS

4301 W. Chicago Ave
Vacant Parcel
CHICAGO, IL 60651

RESEARCH SOURCE

Source 1:

Cook County Recorder
Cook, IL

PROPERTY INFORMATION

Deed 1:

Type of Deed: Special Warranty Deed
Title is vested in: BK Chicago Avenue, LLC
Title received from: Chicago Avenue Development LLC
Deed Dated: 10/12/2000
Deed Recorded: 10/13/2000
Book: NA
Page: NA
Volume: NA
Instrument: 00803802
Docket: NA
Land Record Comments: see exhibit
Miscellaneous Comments: NA

Legal Description: see exhibit

Legal Current Owner: BK Chicago Avenue, LLC

Parcel # / Property Identifier: 16-10-200-061-0000

Comments: see exhibit

ENVIRONMENTAL LIEN

Environmental Lien: Found Not Found

OTHER ACTIVITY AND USE LIMITATIONS (AULs)

AULs: Found Not Found

Deed Exhibit 1

00803802

6674/0143 49 001 Page 1 of 15
2000-10-13 16:30:26
Cook County Recorder 49.50



THIS INSTRUMENT WAS
PREPARED BY AND

AFTER RECORDING PLEASE
RETURN TO:

Marcia W. Sullivan, Esq.
Katten Muchin Zavis
525 West Monroe Street
Suite 1600
Chicago, IL 60661

(The Above Space for Recorder's Use Only)

SPECIAL WARRANTY DEED

THIS INDENTURE, made this 12th day of October, 2000, between **Chicago Avenue Development, L.L.C.**, an Illinois limited liability company, 9700 West Bryn Mawr Avenue, Rosemont, Illinois, created and existing under and by virtue of the laws of the State of Illinois and duly authorized to transact business in the State of Illinois, Grantor, and **BK Chicago Avenue, L.L.C.**, an Illinois limited liability company, 9700 West Bryn Mawr Avenue, Rosemont, Illinois, and **Chia LLC**, an Illinois limited liability company, 5060 North River Road, Schiller Park, Illinois 60176 (each a "Grantee" and together "Grantees").

WITNESSETH, that the Grantor, for and in consideration of the sum of TEN and 00/100 Dollars and in hand paid and pursuant to the authority of the Managing Members of said limited liability company, by these presents does WARRANT, REMISE, RELEASE, ALIEN AND CONVEY unto each Grantee a fifty percent (50%) undivided interest, as tenants in common, FOREVER, in all the following described real estate, situated in the County of Cook and State of Illinois known and described as follows, to wit:

SEE EXHIBIT A ATTACHED HERETO AND MADE A PART HEREOF

Property Address: 4301 West Chicago Avenue
Chicago, Illinois 60651

Permanent Index No.: 16-10-200-061

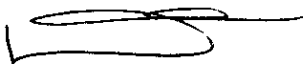
1st AMERICAN TITLE order # CC 200251
181000
JR

Together with all and singular the hereditaments and appurtenances thereunto belonging, or in anywise appertaining, and the reversion and reversions, remainder and remainders, rents, issues and profits thereof, and all the estate, right, title, interest, claim or demand whatsoever, of the party of the first part, either in law or equity, of, in and to the above described premises, with the hereditaments and appurtenances: TO HAVE AND TO HOLD the said premises as above described, with the appurtenances, unto the Grantees, their successors and assigns forever.

And the Grantor, for itself, and its successors, does covenant, promise and agree, to and with the Grantees, their successors and assigns, that it has not done or suffered to be done, anything whereby the said premises hereby granted are, or may be in any manner incumbered or charged, except as herein recited; and that it WILL WARRANT AND DEFEND, the said premises, against all persons lawfully claiming, or to claim the same, by, through or under it, but not otherwise, subject to: 2000 taxes and subsequent year taxes which are not yet due and payable and the Permitted Exceptions as set forth in Exhibit B.

IN WITNESS WHEREOF, Grantor has caused its name to be signed to these presents by its Managers the 12th day of October, 2000.

Chicago Avenue Development, L.L.C.,
an Illinois limited liability company

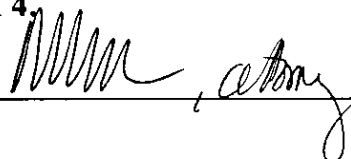
By: 
Name: David R. Kahnweiler
Its: Manager

By: _____
Name: Thomas D. Grusecki
Its: Manager

00803802

**EXEMPT UNDER REAL ESTATE TRANSFER TAX ACT SECTION 4, PARAGRAPH E AND
COOK COUNTY ORDINANCE 95.104, PARAGRAPH 4.**

DATE: October 12, 2000

By: 

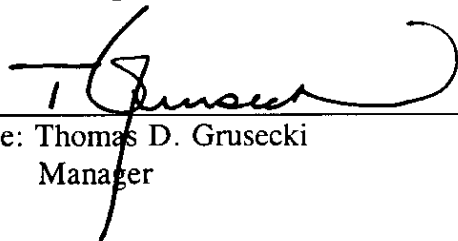
Together with all and singular the hereditaments and appurtenances thereunto belonging, or in anywise appertaining, and the reversion and reversions, remainder and remainders, rents, issues and profits thereof, and all the estate, right, title, interest, claim or demand whatsoever, of the party of the first part, either in law or equity, of, in and to the above described premises, with the hereditaments and appurtenances: TO HAVE AND TO HOLD the said premises as above described, with the appurtenances, unto the Grantees, their successors and assigns forever.

And the Grantor, for itself, and its successors, does covenant, promise and agree, to and with the Grantees, their successors and assigns, that it has not done or suffered to be done, anything whereby the said premises hereby granted are, or may be in any manner incumbered or charged, except as herein recited; and that it WILL WARRANT AND DEFEND, the said premises, against all persons lawfully claiming, or to claim the same, by, through or under it, but not otherwise, subject to: 2000 taxes and subsequent year taxes which are not yet due and payable and the Permitted Exceptions as set forth in Exhibit B.

IN WITNESS WHEREOF, Grantor has caused its name to be signed to these presents by its Managers the 12th day of October, 2000.

Chicago Avenue Development, L.L.C.,
an Illinois limited liability company

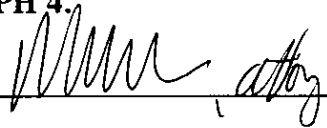
By: _____
Name: David R. Kahnweiler
Its: Manager

By: 
Name: Thomas D. Grusecki
Its: Manager

00803502

EXEMPT UNDER REAL ESTATE TRANSFER TAX ACT SECTION 4, PARAGRAPH E AND
COOK COUNTY ORDINANCE 95.104, PARAGRAPH 4.

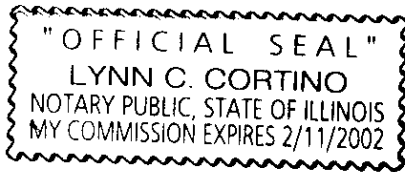
DATE: October 12, 2000

By:  _____

State of Illinois)
County of ^{DuPage} Cook) SS.

I, the undersigned, a Notary Public, in and for the County and State aforesaid, DO HEREBY CERTIFY, that **David R. Kahnweiler**, personally known to me to be a Manager of **Chicago Avenue Development, L.L.C.**, and personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that as such Manager, he signed and delivered the said instrument pursuant to the authority given by the members of said limited liability company, as his free and voluntary act, and as the free and voluntary act and deed of said limited liability company, for the uses and purposes therein set forth.

Given under my hand and seal this 12 day of October, 2000.



Lynn C. Cortino

Notary Public

00803802

State of Illinois)
County of Cook) SS.

I, the undersigned, a Notary Public, in and for the County and State aforesaid, DO HEREBY CERTIFY, that **Thomas D. Grusecki**, personally known to me to a Manager of **Chicago Avenue Development, L.L.C.**, and personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that as such Manager, he signed and delivered the said instrument pursuant to the authority given by the members of said limited liability company, as his free and voluntary act, and as the free and voluntary act and deed of said limited liability company, for the uses and purposes therein set forth.

Given under my hand and seal this _____ day of October, 2000.

Notary Public

State of Illinois)
) SS.
County of Cook)

I, the undersigned, a Notary Public, in and for the County and State aforesaid, DO HEREBY CERTIFY, that **David R. Kahnweiler**, personally known to me to be a Manager of **Chicago Avenue Development, L.L.C.**, and personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that as such Manager, he signed and delivered the said instrument pursuant to the authority given by the members of said limited liability company, as his free and voluntary act, and as the free and voluntary act and deed of said limited liability company, for the uses and purposes therein set forth.

Given under my hand and seal this _____ day of October, 2000.

Notary Public

00803802

State of Illinois)
) SS.
County of Cook)

I, the undersigned, a Notary Public, in and for the County and State aforesaid, DO HEREBY CERTIFY, that **Thomas D. Grusecki**, personally known to me to be a Manager of **Chicago Avenue Development, L.L.C.**, and personally known to me to be the same persons whose names are subscribed to the foregoing instrument, appeared before me this day in person and severally acknowledged that as such Manager, he signed and delivered the said instrument pursuant to the authority given by the members of said limited liability company, as his free and voluntary act, and as the free and voluntary act and deed of said limited liability company, for the uses and purposes therein set forth.

Given under my hand and seal this 12th day of October, 2000.

Anne M. Gentile

Notary Public



EXHIBIT A
LEGAL DESCRIPTION

4301 West Chicago Avenue Chicago, IL 60651 PIN: 16-10-200-061

PARCEL 1:

THAT PART OF THE NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT A POINT ON THE WEST LINE OF NORTH PULASKI ROAD (BEING THE WEST LINE OF THE EAST 33.00 FEET OF THE NORTH EAST 1/4 OF SECTION 10 AFORESAID) SAID POINT BEING ON A LINE DRAWN 970.00 FEET SOUTH OF AND PARALLEL WITH THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH EAST 1/4 OF SECTION 10); THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG SAID PARALLEL LINE 313.92 FEET; THENCE SOUTH 0 DEGREES 14 MINUTES 49 SECONDS WEST, 104.05 FEET; THENCE SOUTH 6 DEGREES 33 MINUTES 01 SECONDS EAST, 257.53 FEET OF THE SOUTH LINE OF THE NORTH 1379.90 FEET OF THE SAID NORTH EAST 1/4 OF SECTION 10; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG SAID SOUTH LINE 335.22 FEET OF THE INTERSECTION OF A CIRCLE CONVEX NORTHEASTERLY, HAVING A RADIUS OF 566.44 FEET AND BEING 40.00 FEET NORTHEASTERLY OF AND CONCENTRIC WITH THE NORTHEASTERLY LINE OF LOT 2 IN FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED MAY 21, 1984 AS DOCUMENT 27109459; THENCE NORTHWESTERLY ALONG THE ARC OF SAID CIRCLE 188.32 FEET (THE CHORD OF WHICH BEARS NORTH 73 DEGREES 59 MINUTES 08 SECONDS WEST FOR 187.45 FEET) TO THE POINT OF TANGENCY THEREOF; THENCE NORTH 83 DEGREES 30 MINUTES 35 SECONDS WEST PARALLEL WITH THE NORTHERLY LINE OF SAID LOT 2 EXTENDED NORTHWESTERLY IN AFORESAID FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT 625.11 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE WESTERLY MOST NORTHERLY LINE OF LOT 1 IN AFORESAID FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE NORTH 74 DEGREES 25 MINUTES 26 SECONDS WEST ALONG SAID PARALLEL LINE 229.02 FEET TO THE INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE WESTERLY MOST NORTHERLY LINE OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT 21532046; THENCE NORTH 74 DEGREES 22 MINUTES 11 SECONDS WEST ALONG SAID PARALLEL LINE 71.41 FEET TO THE POINT OF BEGINNING OF THE TRACT HEREIN DESCRIBED; THENCE NORTH 0 DEGREES 13 MINUTES 54 SECONDS EAST, ALONG A LINE DRAWN 1743.23 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF THE AFORESAID NORTH EAST 1/4 OF SECTION 10, A DISTANCE OF 711.97 FEET TO A POINT WHICH IS 465.01 FEET SOUTH OF THE NORTH LINE OF THE AFORESAID NORTH EAST 1/4 OF SECTION 10 AS MEASURED ALONG SAID PARALLEL LINE; THENCE NORTHWESTERLY 130.22 FEET ALONG THE ARC OF A CIRCLE, TANGENT TO THE LAST DESCRIBED LINE, CONVEX NORTHEASTERLY, HAVING A RADIUS OF 100.00 FEET, AND WHOSE CHORD BEARS NORTH 37 DEGREES 04 MINUTES 27 SECONDS WEST, 121.21 FEET TO A POINT OF TANGENCY; THENCE NORTH 74 DEGREES 22 MINUTES 48 SECONDS WEST, 556.92 FEET; THENCE WESTERLY 136.22 FEET ALONG THE ARC OF A CIRCLE, TANGENT TO THE LAST DESCRIBED LINE, CONVEX NORTHERLY, HAVING A RADIUS OF 500.00 FEET, AND WHOSE CHORD BEARS NORTH 82 DEGREES 11 MINUTES 06 SECONDS WEST, 135.80 FEET TO A POINT OF TANGENCY; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST, ALONG A LINE DRAWN 200.00 FEET SOUTH OF AND PARALLEL WITH THE AFORESAID NORTH LINE OF THE NORTH EAST 1/4 AND THE NORTH WEST 1/4 OF SECTION 10, A DISTANCE OF 232.80 FEET; THENCE NORTH 0 DEGREES 13 MINUTES 54 SECONDS EAST, 150.00 FEET ALONG A LINE DRAWN PARALLEL WITH THE AFORESAID EAST LINE OF THE NORTH EAST 1/4 OF SECTION 10 AND PASSING THROUGH A POINT ON THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE WHICH IS 2721.08 FEET WESTERLY OF THE EAST LINE OF THE NORTH EAST 1/4 OF SECTION 10 AFORESAID, AS MEASURED ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG SAID SOUTH LINE, 1255.22 FEET TO THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED AS DOCUMENT 20302748; THENCE SOUTH 0 DEGREES 02 MINUTES 14 SECONDS EAST, ALONG SAID EAST LINE, 69.47 FEET TO AN ANGLE POINT IN SAID NORTH KILBOURN AVENUE; THENCE SOUTH 55 DEGREES 36 MINUTES 59 SECONDS EAST, ALONG THE NORTHERLY LINE OF THE AFORESAID NORTH KILBOURN AVENUE, 782.245 FEET TO A NORTHEASTERLY CORNER OF NORTH KILBOURN AVENUE

00603802

42.00 FEET NORTH EAST OF AND PARALLEL WITH THE NORTHERLY LINE OF LOT 16 IN SAID NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE SOUTH 74 DEGREES 22 MINUTES 11 SECONDS EAST, ALONG SAID PARALLEL LINE, 605.00 FEET TO THE HEREINABOVE DESCRIBED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS. EXCEPTING THEREFROM THE FOLLOWING:

THAT PART OF THE NORTH WEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH WEST 1/4 OF SECTION 10), WITH THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED OCTOBER 26, 1967 AS DOCUMENT 20302748; THENCE SOUTH 89 DEGREES 59 MINUTES 25 SECONDS EAST ALONG THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE 249.53 FEET TO THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING EASTERLY ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE 329.67 FEET; THENCE SOUTH 0 DEGREES 02 MINUTES 47 SECONDS EAST, 260.00 FEET; THENCE NORTH 64 DEGREES 40 MINUTES 37 SECONDS WEST, 364.855 FEET TO A POINT ON A LINE DRAWN THROUGH THE POINT OF BEGINNING AND PARALLEL TO THE EAST LINE OF THE PARCEL OF LAND HEREIN DESCRIBED AND ALSO BEING DISTANT 104.00 FEET SOUTH OF SAID POINT OF BEGINNING; THENCE NORTH 0 DEGREES 02 MINUTES 47 SECONDS WEST ALONG SAID PARALLEL LINE 104.00 FEET TO THE HEREINABOVE DESIGNATED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS.

PARCEL 2:

THAT PART OF THE NORTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH WEST 1/4 OF SECTION 10), WITH THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED OCTOBER 26, 1967 AS DOCUMENT 20302748; THENCE SOUTH 89 DEGREES 59 MINUTES 25 SECONDS EAST ALONG THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE 249.53 FEET TO THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING EASTERLY ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE 329.67 FEET; THENCE SOUTH 0 DEGREES 02 MINUTES 47 SECONDS EAST, 260.00 FEET; THENCE NORTH 64 DEGREES 40 MINUTES 37 SECONDS WEST, 364.855 FEET TO A POINT ON A LINE DRAWN THROUGH THE POINT OF BEGINNING AND PARALLEL TO THE EAST LINE OF THE PARCEL OF LAND HEREIN DESCRIBED AND ALSO BEING DISTANT 104.00 FEET SOUTH OF SAID POINT OF BEGINNING; THENCE NORTH 0 DEGREES 02 MINUTES 47 SECONDS WEST ALONG SAID PARALLEL LINE 104.00 FEET TO THE HEREINABOVE DESIGNATED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS.

00803802

(BEING THE NORTH WEST CORNER OF LOT 14 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT 21532046); THENCE SOUTH 55 DEGREES 38 MINUTES 13 SECONDS EAST, ALONG THE NORTHERLY LINE OF SAID LOT 14, A DISTANCE OF 137.55 FEET; THENCE NORTH 34 DEGREES 21 MINUTES 47 SECONDS EAST, 42.00 FEET; THENCE SOUTH 55 DEGREES 38 MINUTES 13 SECONDS EAST, ALONG A LINE DRAWN 42.00 FEET NORTH EAST OF AND PARALLEL WITH THE MOST NORTHERLY LINE OF SAID LOT 14, A DISTANCE OF 81.34 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42 FEET NORTH EAST OF AND PARALLEL WITH THE NORTHERLY LINE OF LOTS 14 AND 15 IN SAID NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE SOUTH 65 DEGREES 24 MINUTES 31 SECONDS EAST, ALONG SAID PARALLEL LINE, 875.26 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN

PARCEL 3:

EASEMENT AS GRANTED IN DOCUMENT DATED AUGUST 15, 1991 AND RECORDED AUGUST 19, 1991 AS DOCUMENT 91421653 FOR THE BENEFIT OF PARCEL 1 IN FAVOR OF RAIL-IT, OVER THE FOLLOWING DESCRIBED PROPERTY:

A STRIP OF LAND 35.13 FEET WIDE THE CENTER LINE OF WHICH IS DEFINED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE WEST LINE OF THE EAST 25.00 FEET (AS MEASURED AT RIGHT ANGLES TO THE EAST LINE THEREOF) OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT, BEING A SUBDIVISION OF PART OF THE NORTH 1/2 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THIRD THIRD PRINCIPAL MERIDIAN, WITH THE NORTHERLY LINE OF SAID LOT 16; THENCE NORTHWESTERLY ALONG A LINE FORMING AN ANGLE OF 42 DEGREES 41 MINUTES 39 SECONDS WITH SAID NORTHERLY LINE OF LOT 16 AS MEASURED FROM THE WEST TO THE NORTHWEST FOR A DISTANCE OF 61.94 FEET TO THE TERMINUS POINT OF SAID CENTER LINE SAID POINT BEING THE INTERSECTION OF A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE AFORESAID NORTHERLY LINE OF SAID LOT 16, AND A LINE DRAWN 1743.23 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF THE NORTH EAST 1/4 OF AFORESAID SECTION 10, IN COOK COUNTY, ILLINOIS.

PARCEL 4:

EASEMENT FOR THE BENEFIT OF PARCEL 1 CREATED BY DOCUMENT DATED SEPTEMBER 2, 1969 AND RECORDED SEPTEMBER 17, 1969 AS DOCUMENT 20961619 AND ASSIGNED TO RAIL-IT BY DOCUMENT DATED AUGUST 15, 1991 AND RECORDED AUGUST 19, 1991 AS DOCUMENT 91421655 OVER THE FOLLOWING PROPERTY TO WIT:

THE EAST 50.00 FEET (AS MEASURED AT RIGHT ANGLES TO THE EAST LINE THEREOF) OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT, BEING A SUBDIVISION OF PART OF THE NORTH 1/2 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, IN COOK COUNTY, ILLINOIS.

00803802

EXHIBIT B
PERMITTED EXCEPTIONS

First American Title #CC200251
Property: 4301 West Chicago Avenue
Chicago, IL 60651
PIN: 16-10-200-061

00803802

[GENERAL TAXES FOR THE YEAR 2000 ARE NOT YET ASCERTAINABLE OR PAYABLE.

TAX NO.: 16-10-200-061 VOL. NO.: 551

2. MORTGAGE, ASSIGNMENT OF RENTS AND LEASES AND SECURITY AGREEMENT DATED SEPTEMBER 15, 1998 AND RECORDED SEPTEMBER 18, 1998 AS DOCUMENT NUMBER 98837297 MADE BY CHICAGO AVENUE DEVELOPMENT L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY TO LASALLE NATIONAL BANK TO SECURE A NOTE FOR \$3,332,660.00 AND THE TERMS AND CONDITIONS THEREOF.

FIRST AMENDMENT TO LOAN DOCUMENTS RECORDED AUGUST 16, 2000 AS DOCUMENT 00630051.

3. FINANCING STATEMENT EVIDENCING AN INDEBTEDNESS FROM CHICAGO AVENUE DEVELOPMENT, L.L.C., DEBTOR, TO LASALLE NATIONAL BANK, SECURED PARTY, FILED ON SEPTEMBER 18, 1998 AS NUMBER 98 U 9839.

4. EASEMENT IN, UPON, UNDER, ACROSS AND UNDERNEATH THE TRACKS OF THE RAILWAY COMPANY AT CHICAGO, MORE PARTICULARLY DESCRIBED AS FOLLOWS:

A STRIP OF LAND 20 FEET WIDE, EXTENDING ACROSS THE EAST 1/2 OF THE NORTHWEST 1/4 AND A PART OF THE EAST 1/2 OF THE SOUTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13 EAST OF THE THIRD PRINCIPAL MERIDIAN, SAID STRIP OF LAND BEING 10 FEET WIDE ON EITHER SIDE OF A CENTER LINE DRAWN PARALLEL WITH THE EAST LINE OF THE NORTHWEST 1/4 OF SAID SECTION 10 AND EXTENDING FROM THE NORTH LINE OF WEST KINZIE STREET (BEING ALSO THE SOUTH LINE OF THE PROPERTY OF THE CHICAGO AND NORTHWESTERN RAILWAY COMPANY) THROUGH A POINT IN THE SOUTH LINE OF THE NORTHWEST 1/4 OF SAID SECTION 10 WHICH POINT IS DISTANT 669.88 FEET WEST OF THE SOUTHEAST CORNER THEREOF AND RUNNING THENCE NORTH TO THE NORTH LINE OF SECTION 10 AFORESAID, SUBJECT TO CHICAGO AVENUE TO INSTALL, MAINTAIN AND USE A SANITARY SEWER.

ALL AS CONTAINED IN GRANT MADE BY CHICAGO AND NORTH WESTERN RAILWAY COMPANY, A CORPORATION OF WISCONSIN, TO THE CITY OF CHICAGO, ILLINOIS, DATED FEBRUARY 28, 1952 AND RECORDED MARCH 28, 1952 AS DOCUMENT 15305732 AND SUBJECT TO THE CONDITIONS AND RESTRICTIONS CONTAINED THEREIN.

5. INFORMATION AND DISCLOSURES IN ENVIRONMENTAL DISCLOSURE DOCUMENT FOR TRANSFER OF REAL PROPERTY RECORDED AUGUST 19, 1991 AS DOCUMENT 91421657.

6. RIGHTS OF THE PUBLIC OR QUASI PUBLIC UTILITIES, IF ANY, UNDER UNRECORDED LICENSE AGREEMENTS IN FAVOR OF COMMONWEALTH EDISON OVER THE SOUTHWESTERLY PORTION OF THE LAND AND THE NORTHWESTERLY PORTION OF THE LAND TO MAINTAIN AND REPAIR POLES AND WIRES TOGETHER WITH THE RIGHT OF ACCESS THERETO AS FOLLOWS: (A) LICENSE NUMBER 98001 ITEM NUMBER 93344 DATED MAY 29, 1968 AND AMENDMENT DATED MARCH 27, 1986, (B) LICENSE NUMBER 98001 ITEM 93407 DATED AUGUST 20, 1969, (C) GROUP W. CABLE ASSOCIATION LICENSE NUMBER 98927 DATED DECEMBER 4, 1984 ALL AS DISCLOSED BY SURVEY MADE BY NATIONAL SURVEY SERVICE INC., DATED AUGUST 03, 2000 AS ORDER NUMBER N-123451.

7. DELETED

8. TERMS, CONDITIONS AND PROVISIONS OF THE DOCUMENTS CREATING THE EASEMENTS DESCRIBED IN SCHEDULE C, TOGETHER WITH THE RIGHTS OF THE ADJOINING OWNERS IN AND TO THE CONCURRENT USE OF SAID EASEMENTS.

9. RESERVATION IN FAVOR OF CHICAGO AND NORTHWESTERN RAILWAY COMPANY, A CORPORATION OF WISCONSIN, OF EXISTING SPUR TRACT NO. 291 AND POWER LINES AND EASEMENTS THEREOF AS CONTAINED IN DEED RECORDED AS DOCUMENT 20961619.

(AFFECTS PARCEL 4)

10. POSSIBLE EASEMENTS FOR SEWER LINE AND WATER LINE OVER AND UNDER THE LAND AS DISCLOSED BY PLAT OF CHICAGO SHOPS OF CHICAGO AND NORTHWESTERN RAILWAY COMPANY.

(AFFECTS PARCEL 4)

11. EASEMENT FOR PUBLIC UTILITIES AS DISCLOSED BY THE PLAT OF NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT NO. 21532046 AND AS CREATED BY GRANT MADE BY THE NORTHWESTERN MUTUAL LIFE INSURANCE COMPANY, RECORDED MARCH 25, 1970 AS DOCUMENT 21119981.

TO WIT: OVER THE NORTHERLY 10 FEET AND THE EAST 10 FEET OF THE LAND.

(AFFECTS PARCEL 4)

12. AGREEMENT OF RESTRICTIVE COVENANT DATED SEPTEMBER 15, 1998 AND RECORDED SEPTEMBER 18, 1998 AS DOCUMENT 98837295 MADE BY CHICAGO AVENUE DEVELOPMENT L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY TO KILBOURN LIMITED PARTNERSHIP, AN ILLINOIS LIMITED PARTNERSHIP.

PLAT ACT AFFIDAVIT

STATE OF ILLINOIS)
)
COUNTY OF COOK) SS.

Chicago Avenue Development, L.L.C., an Illinois limite liability company, being duly sworn on oath, states that its business address is 9700 West Bryn Mawr Avenue, Rosemont, Illinois and that the attached Deed is not in violation of 765 ILSC 205/1 for one of the following reasons:

A. Said Act is not applicable as the Grantor owns no adjoining property to the premises described in said deed;

-OR-
NOT APPLICABLE

B. The conveyance falls in one of the following exemptions as shown by the Act which became effective July 17, 1959:

- 1. The division or subdivision of the land into parcels or tracts of five acres or more in size which does not involve any new streEts or easements of access.
2. The divisions of lots or blocks of less than one acre in any recorded subdivision which does not involve any new streets or easements of access.
3. The sale or exchange of parcels of land between owners of adjoining and contiguous land.
4. The conveyance of parcels of land or interests therein for use as right of way for railroads or other public utility facilities, which does not involve any new streets or easement of access.
5. The conveyance of land owned by a railroad or other public utility which does not involve any new streets or easements of access.
6. The conveyance of land for highway or other public purposes or grants or conveyance relating tot he dedication of land for public use or instruments relating to the vacation of land impressed with a public use.
7. Conveyances made to correct descriptions in prior conveyance.

8. The sale or exchange of parcels or tracts of land existing on the date of the amendatory Act into no more than two parts and not involving any new streets or easements of access.

CIRCLE NUMBER ABOVE WHICH IS APPLICABLE TO ATTACHED DEED.

Affiant further states that he/she makes this affidavit for the purpose of inducing the Recorder of Cook County, Illinois, to accept the attached Deed for recording.

Chicago Avenue Development, L.L.C.,
an Illinois limited liability company

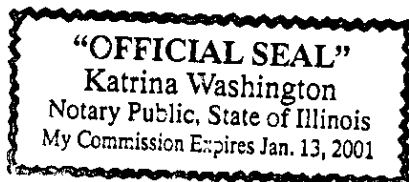
00803802

By: *David R. Kahnweiler*
Name: David R. Kahnweiler
Its: Manager

By: *Thomas D. Grusecki*
Name: Thomas D. Grusecki
Its: Manager

SUBSCRIBED and SWORN to
before me this 12th day of
October, 2000.

Katrina Washington
Notary Public



STATEMENT BY GRANTOR AND GRANTEE

The grantor or his agent affirms that, to the best of his knowledge, the name of the grantee shown on the deed or assignment of beneficial interest in a land trust is either a natural person, an Illinois corporation or a foreign corporation authorized to do business or acquire and hold title to real estate in Illinois, a partnership authorized to do business or acquire and hold title to real estate in Illinois, or other entity recognized as a person and authorized to do business or acquire and hold title to real estate under the laws of the State of Illinois.

Dated October 12, 2000

Chicago Avenue Development, L.L.C.

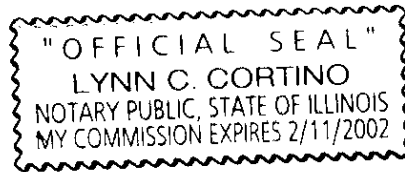
By: _____
Name: David R. Kahnweiler
Its: Manager

By: _____
Name: Thomas D. Grusecki
Its: Manager

00803802

SUBSCRIBED and SWORN to before me this 12 day of October, 2000

Lynn C. Cortino
Notary Public



The grantee or his agent affirms and verifies that the name of the grantee shown on the deed or assignment of beneficial interest in a land trust is either a natural person, an Illinois corporation or foreign corporation authorized to do business or acquire and hold title to real estate in Illinois, a partnership authorized to do business or acquire and hold title to real estate in Illinois, or other entity recognized as a person and authorized to do business or acquire and hold title to real estate under the laws of the State of Illinois.

Dated October 12, 2000

BK Chicago Avenue, L.L.C.


By: _____
Name: David R. Kahnweiler
Its: Manager

Chia LLC

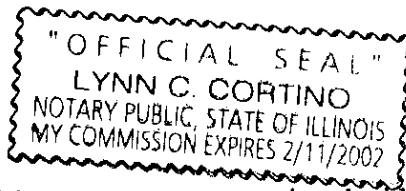
By: Northern Builders, Inc., its Manager

By: _____
Name: _____
Its: _____

SUBSCRIBED and SWORN to before
me this 12 day of October, 2000.



Notary Public



NOTE: Any person who knowingly submits a false statement concerning the identity of a grantee shall be guilty of a Class C misdemeanor for the first offense and of a Class A misdemeanor for subsequent offenses.

[Attach to deed or ABI to be recorded in Cook County, Illinois, if exempt under provisions of Section 4 of the Illinois Real Estate Transfer Tax Act.]

00803602

00803602

STATEMENT BY GRANTOR AND GRANTEE

The grantor or his agent affirms that, to the best of his knowledge, the name of the grantee shown on the deed or assignment of beneficial interest in a land trust is either a natural person, an Illinois corporation or a foreign corporation authorized to do business or acquire and hold title to real estate in Illinois, a partnership authorized to do business or acquire and hold title to real estate in Illinois, or other entity recognized as a person and authorized to do business or acquire and hold title to real estate under the laws of the State of Illinois.

Dated October 12, 2000

Chicago Avenue Development, L.L.C.

By: _____
Name: David R. Kahnweiler
Its: Manager

By: [Signature]
Name: Thomas D. Grusecki
Its: Manager

SUBSCRIBED and SWORN to before me this 12th day of October, 2000

[Signature]
Notary Public



00603802

The grantee or his agent affirms and verifies that the name of the grantee shown on the deed or assignment of beneficial interest in a land trust is either a natural person, an Illinois corporation or foreign corporation authorized to do business or acquire and hold title to real estate in Illinois, a partnership authorized to do business or acquire and hold title to real estate in Illinois, or other entity recognized as a person and authorized to do business or acquire and hold title to real estate under the laws of the State of Illinois.

Dated October 12, 2000

BK Chicago Avenue, L.L.C.

By: _____
Name: David R. Kahnweiler
Its: Manager

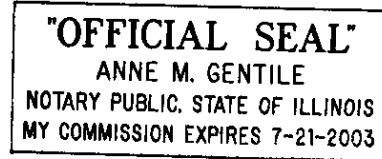
Chia LLC

By: Northern Builders, Inc., its Manager

By: [Signature]
Name: _____
Its: _____

SUBSCRIBED and SWORN to before
me this 12th day of October, 2000.

Anne M. Gentile
Notary Public



NOTE: Any person who knowingly submits a false statement concerning the identity of a grantee shall be guilty of a Class C misdemeanor for the first offense and of a Class A misdemeanor for subsequent offenses.

[Attach to deed or ABI to be recorded in Cook County, Illinois, if exempt under provisions of Section 4 of the Illinois Real Estate Transfer Tax Act.]

00603802

98837295

1009/0396 03 001 Page 1 of 24

1998-09-18 15:42:28

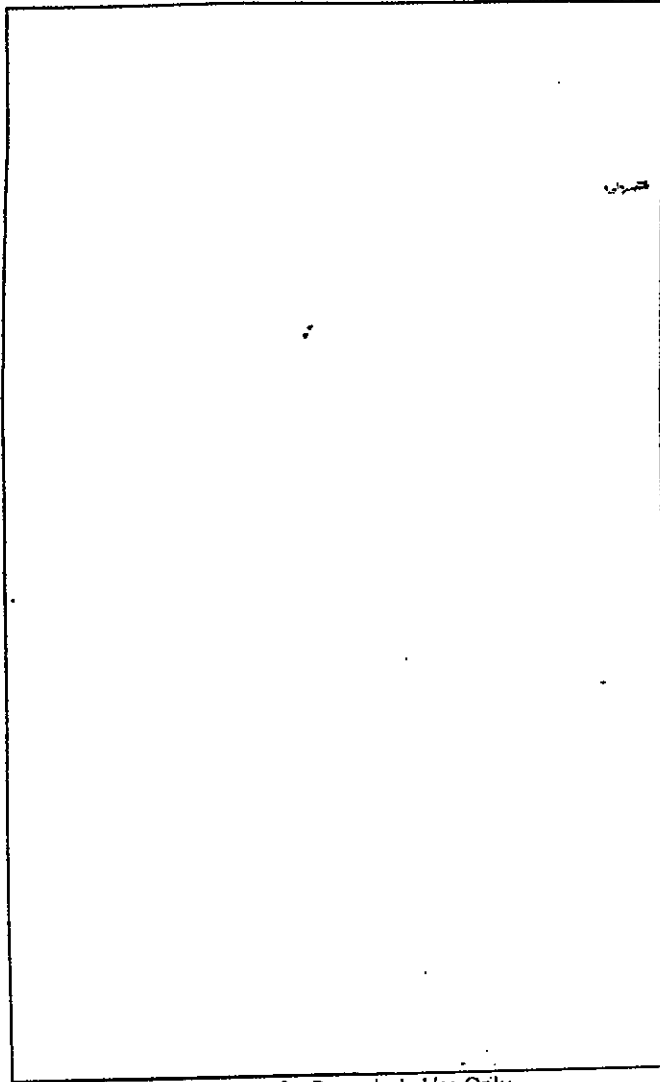
Cook County Recorder 67.50

THIS DOCUMENT WAS PREPARED
BY:

Marcia Sullivan
Katten Muchin & Zavis
525 W. Monroe Street
Suite 1600
Chicago, IL 60661-3693
(312) 902-5200

AFTER RECORDING, RETURN
DOCUMENT TO:

Barbara J. Putta
Butler, Rubin, Saltarelli & Boyd
70 W. Madison Street
Suite 1800
Chicago, IL 60602
(312) 444-9660



Above Space for Recorder's Use Only

AGREEMENT OF RESTRICTIVE COVENANT

THIS AGREEMENT OF RESTRICTIVE COVENANT ("Restrictive Covenant") made ^{and} this
15th day of September, 1998, by CHICAGO AVENUE DEVELOPMENT L.L.C., an
Illinois limited liability company (together with its Successors, an "Owner") in favor of KILBOURN
LIMITED PARTNERSHIP, an Illinois limited partnership ("Kilbourn").

1st AMERICAN TITLE order # CC-12-3592 J.L. 24
385 82

RECITALS

A. Owner is acquiring as of the date hereof fee simple title to that certain real estate located in the City of Chicago, County of Cook, State of Illinois, and legally described in Exhibit A attached hereto and made a part hereof (the "Property").

B. To induce Kilbourn to terminate the Memorandum of Purchase Agreement and Declaration of Covenants dated as of April 8, 1992 and recorded in the office of the Cook County of Deeds as Document No. 92262005 and the Purchase Agreement and Declaration of Covenants referred to therein, and in consideration therefor, Owner has agreed to execute this agreement and submit the Property to the provisions of this Restrictive Covenant.

C. The covenants, conditions and restrictions hereunder are covenants running with the land and shall be binding upon Owner and its Successors and shall survive any sale, assignment, transfer or conveyance of the Property or any portion thereof or interest therein.

D. This Restrictive Covenant is executed and recorded for the purpose of giving notice of the existence thereof.

NOW THEREFORE, for Ten Dollars and other good and valuable consideration, the receipt and sufficiency of which is hereby acknowledged, Owner, for itself and its Successors, in order to further the purposes herein expressed, hereby declares and agrees that the Property at all times is and shall be held, sold, assigned, transferred, conveyed, leased and occupied subject to the covenants, conditions and restrictions set forth herein.

1. ROYALTY PAYMENTS. In the event that the Property or any part thereof is used as a "recycling facility" or a "transfer station", as such terms are defined below, for the purpose of commercial recycling and/or waste transfer activities (including both for-profit and not-for-profit), as opposed to recycling and/or temporary waste storage of materials of the Owner of the Property or any part thereof as part of its own operations, then the following shall be applicable:

a. Owner agrees to pay to Kilbourn, or to cause Operator to pay to Kilbourn, the royalty payments (the "Royalties") described below; provided, however that Owner shall not be liable under this Agreement for the payment of Royalties or reservation of capacity by an Operator who is leasing the Property or a part thereof from Owner if (a) Owner has included a provision in the lease or other document giving such Operator possessory rights with respect to the Property (a "lease") to the effect that the Property is subject to the provisions of this Agreement of Restrictive Covenant (which shall be incorporated therein by reference with accurate recording information), and which requires, if a "recycling facility" or "transfer station" (as such terms are defined herein) is operated by Operator on the Property, that the Operator pay royalty payments and reserve capacity, and otherwise comply with the covenants, conditions and restrictions applicable to an Operator, as set forth herein, to and for the direct benefit of Kilbourn as the intended third-party creditor beneficiary of such provision of the lease, with the irrevocable right to enforce the

obligations of Operator to Kilbourn hereunder, and providing further that Kilbourn may pursue any remedies at law or in equity for default by Operator and that Operator shall be liable to Kilbourn for all damages that arise from or relate to default by Operator, as well as all costs and expenses, including attorneys' fees, incurred by Kilbourn in enforcing its remedies; and (b) in the event of default by Operator, Owner provides such information and assistance as are reasonably requested by Kilbourn in connection with such claim or suit. Royalties shall be paid quarterly to Kilbourn based upon Gross Revenues (as defined herein) and the volume of solid waste and recyclables delivered and accepted at the Facility during each calendar quarter. Each quarterly payment shall be equal to the sum of the following:

(1) 3% of the product of: (A) the Average Daily Tonnage (as defined below), or 2500 (whichever is less); (b) the Average Revenue Per Ton (as defined below); and (c) the number of Operating Days (as defined below) during such calendar quarter;

(2) 4% of the product of: (A) the Average Daily Tonnage in excess of 2500 up to a maximum of 1500 which is in excess of 2500; (B) the Average Revenue Per Ton; and (C) the number of Operating Days during such calendar quarter; and

(3) 5% of the product of: (A) the Average Daily Tonnage in excess of 4000; (B) the Average Revenue Per Ton; and (C) the number of Operating Days during such calendar quarter.

b. Definitions. The following terms used in this Restrictive Covenant shall be defined as follows:

"Affiliates" shall mean each and every corporation or other entity that is more than 50% owned or controlled, directly or indirectly, by Owner.

"Average Daily Tonnage" shall be the amount equal to (i) the total number of tons of solid waste and recyclables delivered and accepted at a Facility during a calendar quarter, divided by (ii) the number of Operating Days (as defined below) during such quarter.

"Average Revenue Per Ton" shall be the amount equal to (i) the Gross Revenues for a calendar quarter, divided by (ii) the total number of tons of solid waste and recyclables delivered to a Facility during such quarter.

"Gross Revenues" shall be defined as all revenues derived from the tipping, transfer, handling or processing of solid waste and recyclables on the Property or any portion thereof, less any fees, taxes, surcharges or host community fees imposed by any governmental entity or which are in the nature of a user or impact fee which is imposed upon the collection, transfer or disposal of solid waste or recyclables; provided, however, if and only if the revenues derived by Owner or any other person or entity which operates a Facility, including without limitation any tenant of Owner (an "Operator") and Affiliates, from the sale of recyclables processed or otherwise handled on the

Property or any portion thereof is greater than or equal to ten percent (10%) of the total revenues of the Facility, then upon such circumstance, all revenues derived by Owner and/or Operator and Affiliates from the sale of recyclables processed or otherwise handled on the Property or any portion thereof shall be included in the calculation of Gross Revenues. For purposes of determining Gross Revenues, fees for tipping, transfer, handling or processing of solid waste and/or recyclables delivered to the Facility by Affiliates shall be deemed to be no less than the Preferential Rate (as defined herein).

"Recycling facility" means a site or facility that accepts materials, including but not limited to paper, newsprint, cardboard, rags, glass, cans, and/or plastics, for "recycling" (as such term is defined below) for subsequent use in the secondary materials market.

"Recycling" means a method, technique, or process designed to remove any contaminant from waste so as to render such waste reusable, or any process by which materials that would otherwise be disposed of or discarded are collected, separated or processed and returned to the economic mainstream in the form of raw materials or products.

"Operating Day" shall mean any day during which a Facility is accepting solid waste and recyclables for disposal for at least eight (8) hours.

"Transfer station" means a site or facility that accepts waste for temporary storage or consolidation and further transfer to a waste disposal, treatment or storage facility. "Transfer station" includes a site where waste is transferred from (1) a rail carrier to a motor vehicle or water carrier; (2) a water carrier to a rail carrier or motor vehicle; (3) a motor vehicle to a rail carrier, water carrier or motor vehicle; (4) a rail carrier to a rail carrier, if the waste is removed from a rail car; or (5) a water carrier to a water carrier if the waste is removed from a vessel."

"Successors" shall mean, as to Owner, any person or entity that acquires title to the Property or any portion thereof or beneficial interest therein if title is held by a land trustee, by any means, including but not limited to, sale, assignment, transfer, conveyance or foreclosure, and, as to Kilbourn, its successors and/or assigns.

c. Royalties shall be payable to Kilbourn by Owner and/or Operator no later than the 20th day following March 31, June 30, September 30 and December 31 of each year. In the event that any Royalties are not paid when due, Kilbourn shall give written notice thereof to Owner, and to Operator if known to Kilbourn. If, after five (5) days after receipt of written notice of such non-payment, the Royalties are not received by Kilbourn, Owner and/or Operator shall be in default of its obligations hereunder and the amount not paid when due shall bear a late payment charge at a rate of 1½% per month or portion thereof from the date due until the date of payment or, at the option of Kilbourn, Kilbourn may receive a credit from Owner and/or Operator to be utilized by Designated Haulers (as defined herein), as determined by Kilbourn, which credit shall be equal to the amount of the Royalties due but not paid, and shall be applied toward the tipping fees charged to such Designated Haulers at the Facility by Owner and/or Operator. Kilbourn shall give written

notice to Owner and/or Operator of the identity of the Designated Haulers which are to utilize the credit. Owner and/or Operator shall keep complete and accurate books and records relating to Average Daily Tonnage, Average Revenue Per Ton, Gross Revenues and Operating Days. Owner and/or Operator shall deliver to Kilbourn no later than the 20th day after the end of each calendar quarter, a certificate executed by the operations manager of each Facility setting forth the amount of Gross Revenues, number of Operating Days, Average Daily Tonnage and Average Revenue Per Ton for the applicable calendar quarter. A representative of Kilbourn shall be permitted to have access to the applicable books and records of Owner and/or Operator to verify the Average Daily Tonnage, Average Revenue Per Ton, Gross Revenues and operating Days. Such access shall be limited to once every calendar quarter, upon five (5) days, prior written notice, during normal business hours and in the presence of a representative of Owner and/or Operator. In the event such verification reveals that the Royalties payable were understated, Owner and/or Operator promptly pay Kilbourn the amount of the understatement, together with a late payment charge of 9% of the understatement per annum, unless due to fraud or misrepresentation and in such case the late payment charge shall be 1½% per month or portion thereof. In the event such verification reveals that the Royalties payable for the applicable quarter were understated by more than 10%, Owner and/or Operator shall reimburse Kilbourn for the reasonable costs of such verification and any reasonable costs incurred by Kilbourn to verify the certification for the succeeding calendar quarter.

2. RESERVATION OF CAPACITY.

a. If the Property or any portion thereof is operated as a Facility and is allowed by its permits to accept up to 2,500 tons per day of solid waste and recyclables, Owner and/or Operator shall cause to be reserved for the haulers of solid waste and/or recyclables designated in writing by Kilbourn (the "Designated Haulers") the right to dispose of up to 1,000 tons of solid waste and/or recyclables per full Operating Day based upon the average daily volume of solid waste and/or recyclables delivered to the Facility during a calendar week (the "Reserve Capacity"). At least sixty (60) days prior to anticipated commencement of commercial operations at the Facility, Owner and/or Operator shall give Kilbourn written notice thereof, which notice shall also indicate the maximum Preferential Rate (as defined below) that will be charged to the Designated Haulers for the initial Commitment Period (as defined below). At least thirty (30) days prior to commencement of commercial operations at the Facility, Kilbourn shall give Owner and/or Operator written notification as to (i) the portion of the Reserve Capacity (the "Disposal Reservation") that Kilbourn, acting on behalf of the Designated Haulers, commits, in the aggregate, to utilize and (ii) a certification to Owner and/or Operator as to the identity of the Designated Haulers that will be entitled to use the Disposal Reservation and the identity of Designated Haulers that will be entitled to receive the Preferential Rate. The "Commitment Period" shall initially mean the period of time from the commencement of commercial operations of the Facility until the end of the then current calendar quarter, then each of the next succeeding eight (8) calendar quarters, and thereafter each and every six (6) month period.

b. Subject to the provisions of this Subsection 2(b), at least thirty (30) days prior to the beginning of each Commitment Period or within thirty (30) days after Kilbourn has been

notified of any change in the Preferential Rate, Kilbourn may increase (to the extent available) or decrease the Disposal Reservation, and provide to Owner and/or Operator a certificate as to the identity of the Designated Haulers that will be entitled to use the adjusted Disposal Reservation and the identity of the Designated Haulers which will be entitled to receive the Preferential Rate. Except as set forth below in Subsections 2(c), (d), (e) and (f), during any Commitment Period after Kilbourn has made its Disposal Reservation, Owner and/or Operator shall be entitled to enter into one or more binding agreements ("Disposal Agreements") with haulers under which Owner and/or Operator is bound to accept an aggregate amount of solid waste and/or recyclables that does not exceed the full capacity of the Facility, less the then current Disposal Reservation and the then current Buffer (as defined below).

c. Owner agrees that it will maintain or cause Operator to maintain a Buffer (the "Buffer") of the lesser of (i) 25% above the then current Disposal Reservation or (ii) 200 tons per Operating Day, not to exceed the Reserve Capacity. Thirty (30) days prior to each Commitment Period as set forth in (b) above, Kilbourn shall be permitted (but not obligated) to increase its Disposal Reservation up to the amount of its Disposal Reservation for the prior Commitment Period and the Buffer, but not to exceed the Reserve Capacity. Provided, however, except as set forth in Subsections 2(d), (e) and (f) hereof, to the extent that Kilbourn elects to increase the Disposal Reservation for the next succeeding Commitment Period up to the then current Disposal Reservation plus the Buffer and Owner and/or Operator is bound by the Disposal Agreements for the remaining capacity of the Facility over and above the then effective Disposal Reservation and Buffer, Owner shall not be obligated to provide Kilbourn with a Buffer for the next succeeding Commitment Period or Periods, provided further, however, that when additional capacity becomes available due to the termination of one or more Disposal Agreements as set forth in Subsection (d) below, such additional capacity shall automatically be available for a Buffer with respect to the then current Disposal Reservation (without the need for Kilbourn to exercise its option set forth in Subsection 2(d)) and the Buffer (as determined in accordance with the first sentence of this Subsection 2(c)) shall be increased to the extent of such additional capacity without reducing Kilbourn's right to increase the Disposal Reservation pursuant to Subsections 2(d) and 2(e) below.

d. Owner shall notify Kilbourn or cause Operator to notify Kilbourn of the termination of each Disposal Agreement within five (5) business days thereof and provide Kilbourn with the option to increase the Disposal Reservation, not to exceed the Reserve Capacity, by all or any portion of the amount of solid waste and/or recyclables that were subject to such Disposal Agreement. Kilbourn shall exercise this option on or before the close of business seven (7) business days after Kilbourn's receipt of Owner's notice of the termination of the applicable Disposal Agreement. This option shall not prohibit or restrict Kilbourn's ability to otherwise increase the Disposal Reservation in accordance with the terms of this Section 2 provided, however, that Kilbourn's election to exercise the option granted in this Subsection (d) shall reduce Owner's and/or Operator's obligation to provide additional capacity of 250 tons per Operating Day per year pursuant to Subsection (e) below to the extent of such additional capacity being made available upon the termination of a Disposal Agreement.

e. Notwithstanding any provision hereof to the contrary, in the event that during any calendar year less than 250 tons per Operating Day are offered to Kilbourn pursuant to Subsection 2(d), Owner and/or Operator shall make available to Kilbourn for increase of the Disposal Reservation by the end of the then current calendar year, up to 250 tons per Operating Day less the number of tons per Operating Day offered to Kilbourn pursuant to Subsection 2(d) during such calendar year; provided, however, Kilbourn shall not be entitled to increase the combined Disposal Reservation and Buffer to an amount that exceeds the Reserve Capacity. Owner and/or Operator shall give Kilbourn notice of such available capacity at least five (5) business days prior to such additional capacity becoming available and Kilbourn shall be permitted to increase its Disposal Reservation by notifying Owner and/or Operator thereof on or before the close of business seven (7) business days after Kilbourn's receipt of such notice of such available capacity.

f. Owner and/or Operator shall also notify Kilbourn of any increase in the permitted capacity of the Facility to accept, process or transfer solid waste and/or recyclables within five (5) business days of the receipt of a non-appealable permit therefore from all governmental entities having jurisdiction over the Facility and provide Kilbourn with the option to increase the Disposal Reservation in accordance with Subsection (j) of this Section. This option shall be exercisable by Kilbourn on or before the date which is seven (7) business days after Kilbourn receives Owner's notice of such increase in the permitted capacity of the Facility. This option shall not prohibit or restrict Kilbourn's ability to otherwise increase the Disposal Reservation in accordance with the terms of this Section 2. Owner and/or Operator shall notify Kilbourn of the filing of any application for a permit to increase the capacity within seven (7) business days of the date of such filing.

g. The disposal rate to be charged by Owner and/or Operator to the Designated Haulers during any Commitment Period for an amount of solid waste and recyclables up to 1000 tons per Operating Day (regardless of the Disposal Reservation), shall be no greater than the lowest rate (the "Preferential Rate") charged by Owner and/or Operator during such Commitment Period to any other customer (except as set forth below) at the Facility, taking into consideration the type of waste delivered (i.e., waste requiring special handling, recyclables, general municipal waste, etc.), but without regard to other factors, including, but not limited to, the volumes delivered and the term and type of commitment for disposal at the Facility. The Preferential Rate shall not include the rate or rates charged to customers by Owner and/or Operator pursuant to "put or pay" agreements unless Kilbourn or particular Designated Hauler shall execute a put or pay agreement with substantially similar material terms and conditions, except those pertaining to volume. Owner shall notify Kilbourn of any change in the Preferential Rate at least thirty (30) days prior to any such change. Notwithstanding anything herein to the contrary, Owner and/or Operator shall be permitted during the first two (2) years of commercial operations of the Facility to sell the greater of ten (10%) percent or 500 tons per Operating Day and thereafter ten (10%) percent of the permitted capacity of the Facility at disposal rates which do not effect the Preferential Rate provided that such rates shall be made available by Owner and/or Operator to Kilbourn, Designated Haulers and third parties, as well as the Owner and/or Operator and Affiliates, and Owner and/or Operator shall provide written notice

of the availability of such rates at least five (5) days prior to the acceptance of solid waste and/or recyclables at the Facility at such rate or rates.

h. To the extent the Designated Haulers (in the aggregate) fail to utilize at least 80% of the Disposal Reservation during the applicable Commitment Period while the Disposal Reservation is less than 1000 tons per Operating Day, Kilbourn shall be obligated to pay Owner and/or Operator 50% of the Preferential Rate for all volumes not utilized by Kilbourn up to 80% of the applicable Disposal Reservation and while the Disposal Reservation is 1000 tons or more per Operating Day, Kilbourn shall be obligated to pay Owner and/or Operator 75% of the applicable tipping fee (a portion of which may include the Preferential Rate if such volumes not utilized are less than 1000 tons per Operating Day) for the Disposal Reservation for all volumes not utilized by Kilbourn up to 80% of the applicable Disposal Reservation.

i. All solid waste delivered to the Facility hereunder shall be acceptable in accordance with all applicable federal, state and local laws and ordinances, Owner's and/or Operator's rules and regulations governing the operation of the Facility and Owner's and/or Operator's permits. Designated Haulers may include only those haulers designated by Kilbourn which are (i) those haulers listed on Exhibit B attached hereto, (ii) haulers which are more than 25% owned by an individual listed on Exhibit B attached hereto, either directly or by a trust for the exclusive benefit of such individual and/or members of his immediate family or (iii) any party that acquires at least 80% of all of the outstanding shares or all or substantially all of the assets of any such hauler (other than a publicly traded company). Owner and/or Operator shall have the right to review any documents, instruments or agreements pursuant to which a hauler shall be deemed a Designated Hauler hereunder if such Designated Hauler is a hauler other than those set forth in Exhibit B. Owner and/or Operator shall keep the information contained in such documents, instruments or agreements confidential if required by such Designated Hauler. Except as otherwise set forth in this Restrictive Covenant, no sale or brokering of disposal capacity is permitted by Kilbourn or a Designated Hauler. Failure of Kilbourn to make the payments set forth in Subsection (h) of this Section 2 or to abide by any of the above shall permit Owner and/or Operator to deny access to Kilbourn or the Designated Hauler(s) to the Facility during the period of such failure. The limited partners of Kilbourn shall be permitted to negotiate and enter into separate agreements with the Owner and/or Operator for disposal of waste at any Facility in addition to the Reserve Capacity to the extent there is additional capacity available at such Facility.

j. The Reserve Capacity shall be increased by 15 tons per Operating Day for every 25 tons per Operating Day increase in the daily permitted capacity of the Facility in excess of 2500 tons per day; provided, however, the Reserve Capacity shall never under any circumstances exceed 2500 tons per Operating Day if the daily permitted capacity of the Facility is in excess of 5000 tons per day; and provided, further however, that the Preferential Rate shall only apply with respect to a maximum of 1,000 tons per operating Day.

k. No party shall be liable for any failure to perform under this Section 2 due to circumstances beyond its reasonable control including, but not limited to, strikes or other labor

disputes, change in laws or regulations, compliance with government requirements, riots, civil disturbance or sabotage, fires, floods, explosions, accidents, weather or acts of God affecting the parties hereto. In the event of any of the circumstances listed in the preceding sentence, or if any federal, state or local court or authority takes any action which would close or otherwise restrict operations at the Facility, the Owner and/or Operator shall have the right to reduce the Reserve Capacity in proportion to the mandated reduction in the full capacity of the Facility.

i. Owner shall deliver to Kilbourn or cause Operator to deliver to Kilbourn no later than forty (40) days prior to the commencement of the next succeeding Commitment Period, a certificate executed by the operations manager of the Facility setting forth the maximum Preferential Rate for each type of waste and recyclables to be charged for the next succeeding Commitment Period, an estimate of the amount of the Reserve Capacity available to Kilbourn for the next Commitment Period and the rate or rates charged by Owner and/or Operator during the period following delivery of the prior certificate for the volumes not subject to the Preferential Rate as set forth in Subsection (g) of this Section 2. Owner and/or Operator shall keep complete and accurate records of all disposal rates charged by Owner and/or Operator. A representative of Kilbourn shall be permitted access to the books and records of Owner and/or Operator to verify the accuracy of such certification. Such access shall be limited to once every calendar quarter, upon five (5) days written notice, during normal business hours and the presence of a representative of Owner and/or Operator. In the event such verification reveals that any Designated Hauler was overcharged for the disposal of any waste, Owner and/or Operator shall promptly refund to such Designated Hauler the amount of the overcharge, together with interest thereon at the rate of 1½% per month or portion thereof from the date the overcharge was paid by such Designated Hauler to the date such refund is paid to such Designated Hauler. In the event such verification reveals that any Designated Hauler was overcharged by more than 10% for disposal of such waste and/or recyclables, Owner and/or Operator shall reimburse Kilbourn for the reasonable costs of such verification and any reasonable costs incurred by Kilbourn to verify the certification for the succeeding quarter.

m. This Subsection 2(m) is an illustration of the application of the guaranteed access provisions of this Section 2. This illustration is based upon the assumption that the capacity of the Facility is 2,500 ton/day and therefore the Reserve Capacity is 1,000 tons/day. Assuming the Disposal Reservation is 500 tons/day, the Buffer would be 125 tons/day (i.e., the lesser of (i) 25% of the 500 tons/day Disposal Reservation or (ii) 200 tons/day). Because the Disposal Reservation and Buffer total 625 tons/day, the Disposal Reservation may be increased to 625 tons/day at the beginning of the next Commitment Period. If, prior to the next Commitment Period, Owner and/or Operator enters into Disposal Agreements for 1,875 tons/day (i.e., 2,500 tons/day Facility capacity, less 625 tons/day Disposal Reservation and Buffer), Kilbourn would not be entitled to increase the Disposal Reservation prior to the end of the then current calendar year, unless additional capacity becomes available due to the termination of one or more Disposal Agreements.

Assuming Disposal Agreements for 300 tons/day terminate while the Disposal Reservation is 625 tons/day, Kilbourn would be entitled to increase the Disposal Reservation in two manners. First, Kilbourn would be entitled to a Buffer of 156 tons/day (i.e., the lesser of (i) 25% of the 625

tons/day Disposal Reservation or (ii) 200 tons/day) and could increase the Disposal Reservation to 781 tons/day as of the beginning of the next Commitment Period. Second, Kilbourn could exercise its option under Subsection 2(d) to immediately increase the 625 tons/day Disposal Reservation by 144 tons/day (i.e. the excess of the 300 tons/day available upon termination of the Disposal Agreements, over the 156 tons/day Buffer) to a total of 769 tons/day, and, in such case, Kilbourn would be entitled to a Buffer of 192 tons/day (i.e., the lesser of (i) 25% of the 769 tons/day Disposal Reservation or (ii) 200 tons/day). However, since the total additional capacity is only 300 tons/day and 156 is used as a Buffer and 144 tons/day is utilized by Kilbourn for Disposal Reservation as set forth above (i.e., 2,500 tons/day Facility capacity, less 1,575⁺ tons/day subject to Disposal Agreements, less the Disposal Reservation of 769 tons/day and the Buffer of 144 tons/day), the Buffer would be limited to 156 tons/day. Therefore, the 769 tons/day Disposal Reservation could be increased at the beginning of the next Commitment Period to 925 tons/day.

Based on the assumptions of the first paragraph of this Subsection 2(m) and assuming none of the Disposal Agreements that cover a total of 1,875 tons/day terminate during the calendar year, the Disposal Reservation will be limited to 625 tons/day. Pursuant to Subsection 2(e), by the end of the then current calendar year, Kilbourn would be entitled to increase the Disposal Reservation by up to an additional 250 tons/day to a total of 875 tons/day. However, if Disposal Agreements for 300 tons/day terminate during the then current calendar year and Kilbourn is entitled to increase the Disposal Reservation by 144 tons/day pursuant to Subsection 2(d), the number of tons that must be made available to Kilbourn by the end of the then current calendar year pursuant to Subsection 2(e) would be reduced to 106 tons/day (i.e., 250 tons/day minimum offer under Subsection 2(e), less 144 tons/day offer under Subsection 2(d)).

3. COVENANT RUNNING WITH THE LAND. The obligations under this Restrictive Covenant shall be perpetual and shall run with the land. The obligations under this Restrictive Covenant shall survive any sale, assignment, transfer or conveyance of the Property or any portion thereof or interest therein. However, notwithstanding the foregoing, nothing herein shall prohibit or otherwise prevent Owner from selling the Property or any part of the Property or any Facility constructed on the Property for any purpose or for any use. Thereafter, a prior Owner that has sold, assigned, transferred or conveyed all its right, title or interest in the Property or any part thereof to a Successor of which such prior Owner has no ownership or control, directly or indirectly, shall be relieved of its obligations under this Restrictive Covenant accruing from and after such sale, assignment, transfer or conveyance with respect to the Property or portion thereof sold, assigned, transferred or conveyed.

The provisions of this Restrictive Covenant with respect to the payment of Royalties and providing disposal rights as set forth in paragraphs 1 and 2, shall be suspended for any period during which no Facility is being operated on the Property, and if a Facility is being operated on a portion of the Property, this Restrictive Covenant shall be applicable only to such portion and shall remain suspended as to all other portions until such time, if any, as a Facility shall be operated on such portions. This Restrictive Covenant is a covenant that runs with the land and shall not be interpreted or construed in any manner as a restrictive use covenant.

4. NOTICES. Any Royalties, notices or other communications which any party hereto may be required or may desire to give hereunder shall be delivered personally or if mailed, postage prepaid, by United States registered or certified mail, return receipt requested, or by overnight express courier, addressed:

In the case of Kilbourn to: Kilbourn Limited Partnership
% David Bulthuis
Hillside Disposal Service
4152 May Street
Hillside, IL 60162

With a copy to: Barbara J. Putta
Butler, Rubin, Saltarelli & Boyd
70 W. Madison Street
Suite 1800
Chicago, IL 60602

In the case of Owner to: Colliers Bennett & Kahnweiler
9700 W. Bryn Mawr Avenue
Rosemont, IL 60018
Attn: David Kahnweiler

With a copy to: Marcia Sullivan
Katten Muchin & Zavis
525 W. Monroe Street
Suite 1600
Chicago, IL 60661

or at such other addresses or to the attention of such other persons as may from time to time be designated by the party to be addressed by written notice to the other in the manner herein provided. Notices, demands and requests given in the manner aforesaid shall be deemed sufficiently served or given for all purposes hereunder when received or when delivery is refused or when the same are returned to sender for failure to be called for. In the event that Kilbourn changes its address and fails to inform Owner of a changed address, and Owner is unable, using reasonable efforts, to locate Kilbourn, or if Kilbourn is voluntarily or involuntarily dissolved or otherwise terminates its existence, then Owner shall send all Royalties, notices, and other communications hereunder c/o Jim DeWitt, 1201 Greenwood Avenue, Maywood, IL 60153 or c/o Kenneth Hoving, 363 Trinity Lane, Oak Brook, IL 60521 or c/o Butler, Rubin, Saltarelli & Boyd, Three First National Plaza, Suite 1800, Chicago, Illinois 60602.

5. CONTINUING COVENANTS. Each and all of the covenants, conditions and restrictions contained herein shall be deemed and construed to be continuing. No waiver of a breach of any of the covenants, conditions and restrictions contained herein shall be construed to be a waiver of

any other breach of the same or any other of such covenants, conditions or restrictions, nor shall failure to enforce any one of such covenants, conditions or restrictions be construed as waiver of any other such covenants, conditions or restrictions.

6. PRIORITY AND TITLE THROUGH FORECLOSURE. This Restrictive Covenant shall be executed and recorded before any mortgage or deed of trust that may be executed and recorded in connection with Owner's acquisition of the Property. Owner agrees that all liens, encumbrances or other security interests that exist or may exist against the Facility or the Property shall be subject and subordinate to the Restrictive Covenant. Owner further agrees that it will maintain sufficient assets and capital to make the payment of Royalties hereunder, to the extent due, during any period in which Gross Revenues are generated. Should any mortgage or deed of trust with respect to the Property be foreclosed, then the title acquired by such foreclosure, and the person or persons who thereupon and thereafter become the owner or owners of the conveyed premises, shall be subject to and bound by all the covenants, conditions and restrictions contained herein.

7. CHANGE IN CIRCUMSTANCES. No change in circumstances, including, but not limited to, changes in surrounding land uses or applicable zoning ordinances, shall have any effect whatsoever upon the applicability, validity or enforceability of the covenants, conditions and restrictions contained herein; provided, however, that any of the covenants, conditions and restrictions contained herein, at any time and in any manner, may and shall only be changed by and with the written mutual consent of Kilbourn or its Successors and the then Owner or Owners of the Property.

8. RULE AGAINST PERPETUITIES. If and to the extent that any of the covenants, conditions or restrictions would otherwise be unlawful or void for violation of (a) the rule against perpetuities, (b) the rule restricting restraints on alienation or (c) any other applicable statute or common law rule analogous thereto or otherwise imposing limitations upon the time during which such covenants, conditions or restrictions may be valid, then said covenant, condition or restriction shall continue and endure only until the expiration of twenty-one (21) years after the death of the last to survive of the class of persons consisting of all of the lawful descendants of George H. W. Bush, former President of the United States, living at the date of this Restrictive Covenant.

9. BINDING ON SUCCESSORS OF OWNER AND SUCCESSORS OF KILBOURN. Each Successor of Owner, by taking title to the Property or any portion thereof, and each purchaser under any contract for a deed of conveyance pursuant to which said grantee will take title, accepts such title subject to all covenants, conditions and restrictions, and the jurisdiction, rights and powers created or reserved by this Restrictive Covenant. All rights, benefits and privileges of every character hereby granted, created, reserved or declared, and all covenants, conditions and restrictions hereby imposed, shall be deemed and taken to be covenants running with the land, and shall bind any person having at any time any interest or estate in said land as if such person were the Owner, and shall inure to the benefit of Kilbourn and its Successors in like manner as though the provisions of this Restrictive Covenant were recited and stipulated at length in each and every deed of conveyance, or in any mortgage or trust deed or other evidence of obligation, and the obligations

described in this Restrictive Covenant shall be sufficient to bind the respective grantees, transferees, mortgagees, trustees, tenants, successors and assigns of the Property as fully and completely as though such rights were recited fully and set forth in their entirety in any such documents. This Restrictive Covenant shall inure to the benefit of, and be specifically enforceable by, Kilbourn and its Successors.

10. ENFORCEMENT. Kilbourn from time to time shall have the right to sue for and obtain a prohibitive or mandatory injunction, or other equitable relief, to prevent the breach of, or to enforce the observance of, the covenants, conditions and restrictions set forth in this Restrictive Covenant, in addition to the right to bring an action in law or in equity seeking any other appropriate remedy. In no event shall the failure of Kilbourn to enforce any of the covenants, conditions or restrictions herein provided due to a particular violation thereof be deemed to be a waiver of the right to do so respecting any such violation or any subsequent violation.

11. MODIFICATIONS. Any revocations, modifications, amendments or supplements of this Restrictive Covenant shall be effective only if expressed in a written instrument or instruments executed and acknowledged by the parties hereto and their respective successors and recorded in the Office of the Recorder of Deeds of Cook County, Illinois.

12. TRUSTS. In the event title to all or any portion of the Property is conveyed to a title holding trust, under the terms of which all powers of management, operation and control of all or any portion of the Property remain vested in the trust beneficiary or beneficiaries, then the beneficiaries thereunder from time to time shall be responsible for payment of all obligations, liens or indebtedness and for the performance of all covenants, conditions and restrictions chargeable or created under this Restrictive Covenant against the Property. No claim shall be made against any such title holding trustee personally for payment of any lien or obligation hereunder created, and the trustee shall not be obligated to sequester funds or trust property to apply, in whole or in part, against such lien or obligation. The amount of such lien or obligation shall continue to be a charge or lien upon the Property and the beneficiaries of such trust, notwithstanding any transfers of the beneficial interest of any such trust or any transfers of title to all or any portion of the Property.

13. SEVERABILITY. It is expressly agreed that, if any covenant, condition or restriction herein contained, or any portion thereof, is held or otherwise found to be invalid or void by any court of competent jurisdiction, such invalidity or voidness shall in no way affect this Restrictive Covenant or any other covenant, condition or restriction contained in this Restrictive Covenant, which shall remain in full force and effect.

14. CAPTIONS. The captions in this Restrictive Covenant are inserted for convenience of reference only and in no way define, describe or limit the scope or intent of this instrument or any of the provisions thereof.

98837295

15. GOOD FAITH AND FAIR DEALING. The parties hereto shall have a continuing obligation to exercise good faith and fair dealing in all matters relating to this Restrictive Covenant and the transactions contemplated hereby.

IN WITNESS WHEREOF Owner and Kilbourn have executed this Agreement of Restrictive Covenant as of the date above written.

OWNER: CHICAGO AVENUE
DEVELOPMENT L.L.C., an Illinois limited
liability company

KILBOURN LIMITED PARTNERSHIP,
an Illinois limited partnership
By: Kilbourn Corporation, its general
partner

By: _____
Its: _____

By: David G. Beal
Its: President

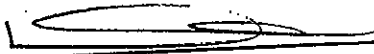
98837295

15. GOOD FAITH AND FAIR DEALING. The parties hereto shall have a continuing obligation to exercise good faith and fair dealing in all matters relating to this Restrictive Covenant and the transactions contemplated hereby.

IN WITNESS WHEREOF Owner and Kilbourn have executed this Agreement of Restrictive Covenant as of the date above written.

OWNER: CHICAGO AVENUE
DEVELOPMENT L.L.C., an Illinois limited
liability company

KILBOURN LIMITED PARTNERSHIP,
an Illinois limited partnership
By: Kilbourn Corporation, its general
partner

By: 
Its: manager

By: _____
Its: _____

15
-14-

98837295

STATE OF Illinois }
 } SS.
COUNTY OF Cook }

I, Andrea M. Gordon, a Notary Public in and for said county, in the state aforesaid, do hereby certify that David G. Bulthuis is the person whose name is subscribed to above, known to me to be the President of Kilbourn Corporation, general partner of KILBOURN LIMITED PARTNERSHIP, an Illinois limited partnership, appeared before me this day in person and acknowledged and swore that he/she signed, sealed and delivered the said instrument as his/her respective free and voluntary act and deed on behalf of such corporation for the uses and purposes therein set forth.

Given under my hand and notarial seal the 16th day of September, 1998.



Andrea M. Gordon
Notary Public
My Commission Expires: 12/8/2000

STATE OF _____ }
 } SS.
COUNTY OF _____ }

I, _____, a Notary Public in and for said county, in the state aforesaid, do hereby certify that _____ is the person whose name is subscribed to above, known to me to be the _____ of CHICAGO AVENUE DEVELOPMENT L.L.C., an Illinois limited liability company, appeared before me this day in person and acknowledged and swore that he/she signed, sealed and delivered the said instrument as his/her respective free and voluntary act and deed on behalf of such _____ for the uses and purposes therein set forth.

Given under my hand and notarial seal the ____ day of _____, 1998.

Notary Public
My Commission Expires: _____

STATE OF _____ }
COUNTY OF _____ } SS.

98837295

I, _____, a Notary Public in and for said county, in the state aforesaid, do hereby certify that _____ is the person whose name is subscribed to above, known to me to be the _____ of Kilbourn Corporation, general partner of KILBOURN LIMITED PARTNERSHIP, an Illinois limited partnership, appeared before me this day in person and acknowledged and swore that he/she signed, sealed and delivered the said instrument as his/her respective free and voluntary act and deed on behalf of such corporation for the uses and purposes therein set forth.

Given under my hand and notarial seal the _____ day of _____, 1998.

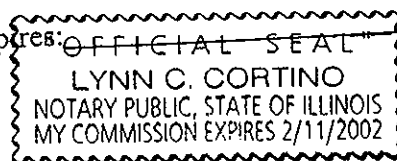
Notary Public
My Commission Expires: _____

STATE OF Illinois }
COUNTY OF DuPage } SS.

I, Lynn C. Cortino, a Notary Public in and for said county, in the state aforesaid, do hereby certify that David R. Kohnweiler is the person whose name is subscribed to above, known to me to be the manager of CHICAGO AVENUE DEVELOPMENT L.L.C., an Illinois limited liability company, appeared before me this day in person and acknowledged and swore that he/she signed, sealed and delivered the said instrument as his/her respective free and voluntary act and deed on behalf of such _____ for the uses and purposes therein set forth.

Given under my hand and notarial seal the 14 day of September, 1998.

Lynn C. Cortino
Notary Public
My Commission Expires: _____



98837295

EXHIBIT A

Legal Description

98837295

EXHIBIT A

LEGAL DESCRIPTION

Property Address:

4501 W. Chicago Avenue
Chicago, Illinois

Permanent Index No.: 16-10-200-045

98837295

LEGAL DESCRIPTION:

PARCEL 1:

THAT PART OF THE NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT A POINT ON THE WEST LINE OF NORTH PULASKI ROAD (BEING THE WEST LINE OF THE EAST 33.00 FEET OF THE NORTH EAST 1/4 OF SECTION 10 AFORESAID) SAID POINT BEING ON A LINE DRAWN 970.00 FEET SOUTH OF AND PARALLEL WITH THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH EAST 1/4 OF SECTION 10); THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG SAID PARALLEL LINE 313.92 FEET; THENCE SOUTH 0 DEGREES 14 MINUTES 49 SECONDS WEST, 104.05 FEET; THENCE SOUTH 6 DEGREES 33 MINUTES 01 SECONDS EAST, 257.53 FEET TO THE SOUTH LINE OF THE NORTH 1379.90 FEET OF THE SAID NORTH EAST 1/4 OF SECTION 10; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG SAID SOUTH LINE 335.22 FEET OF THE INTERSECTION OF A CIRCLE CONVEX NORTHEASTERLY, HAVING A RADIUS OF 566.44 FEET AND BEING 40.00 FEET NORTHEASTERLY OF AND CONCENTRIC WITH THE NORTHEASTERLY LINE OF LOT 2 IN FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED MAY 31, 1984 AS DOCUMENT 27109489; THENCE NORTHWESTERLY ALONG THE ARC OF SAID CIRCLE 188.32 FEET (THE CHORD OF WHICH BEARS NORTH 73 DEGREES 59 MINUTES 08 SECONDS WEST FOR 187.45 FEET) TO THE POINT OF TANGENCY THEREOF; THENCE NORTH 83 DEGREES 30 MINUTES 35 SECONDS WEST PARALLEL WITH THE NORTHERLY LINE OF SAID LOT 2 EXTENDED NORTHWESTERLY IN AFORESAID FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT 625.11 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE WESTERLY MOST NORTHERLY LINE OF LOT 1 IN AFORESAID FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE NORTH 74 DEGREES 25 MINUTES 26 SECONDS WEST ALONG SAID PARALLEL LINE 229.02 FEET TO THE INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE WESTERLY MOST NORTHERLY LINE OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT 21532046; THENCE NORTH 74 DEGREES 22 MINUTES 11 SECONDS WEST ALONG SAID PARALLEL LINE 71.41 FEET TO THE POINT OF BEGINNING OF THE TRACT HEREIN DESCRIBED; THENCE NORTH 0 DEGREES 13 MINUTES 54 SECONDS EAST, ALONG A LINE DRAWN 1743.23 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF THE AFORESAID NORTH EAST 1/4 OF SECTION 10, A DISTANCE OF 711.97 FEET TO A POINT WHICH IS 465.01 FEET SOUTH OF THE NORTH LINE OF THE AFORESAID NORTH EAST 1/4 OF SECTION 10 AS MEASURED ALONG SAID PARALLEL LINE; THENCE NORTHWESTERLY 130.22 FEET ALONG THE ARC OF A CIRCLE, TANGENT TO THE LAST DESCRIBED LINE, CONVEX NORTHEASTERLY, HAVING A RADIUS OF 100.00 FEET, AND WHOSE CHORD BEARS NORTH 37 DEGREES 04 MINUTES 27 SECONDS WEST, 121.21 FEET TO A POINT OF TANGENCY; THENCE NORTH 74 DEGREES 22 MINUTES 48 SECONDS WEST, 556.92 FEET; THENCE WESTERLY 136.22

20

FEET ALONG THE ARC OF A CIRCLE, TANGENT TO THE LAST DESCRIBED LINE, CONVEX NORTHERLY, HAVING A RADIUS OF 500.00 FEET, AND WHOSE CHORD BEARS NORTH 82 DEGREES 11 MINUTES 06 SECONDS WEST, 135.80 FEET TO A POINT OF TANGENCY; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST, ALONG A LINE DRAWN 200.00 FEET SOUTH OF AND PARALLEL WITH THE AFORESAID NORTH LINE OF THE NORTH EAST 1/4 AND THE NORTH WEST 1/4 OF SECTION 10, A DISTANCE OF 232.80 FEET; THENCE NORTH 0 DEGREES 13 MINUTES 54 SECONDS EAST, 150.00 FEET ALONG A LINE DRAWN PARALLEL WITH THE AFORESAID EAST LINE OF THE NORTH EAST 1/4 OF SECTION 10 AND PASSING THROUGH A POINT ON THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE WHICH IS 2721.08 FEET WESTERLY OF THE EAST LINE OF THE NORTH EAST 1/4 OF SECTION 10 AFORESAID, AS MEASURED ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG SAID SOUTH LINE, 1255.22 FEET TO THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED AS DOCUMENT 20302748; THENCE SOUTH 0 DEGREES 02 MINUTES 14 SECONDS EAST, ALONG SAID EAST LINE, 69.47 FEET TO AN ANGLE POINT IN SAID NORTH KILBOURN AVENUE; THENCE SOUTH 55 DEGREES 36 MINUTES 59 SECONDS EAST, ALONG THE NORTHERLY LINE OF THE AFORESAID NORTH KILBOURN AVENUE, 782.245 FEET TO A NORTHEASTERLY CORNER OF NORTH KILBOURN AVENUE (BEING THE NORTH WEST CORNER OF LOT 14 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT 21532046); THENCE SOUTH 55 DEGREES 38 MINUTES 13 SECONDS EAST, ALONG THE NORTHERLY LINE OF SAID LOT 14, A DISTANCE OF 137.55 FEET; THENCE NORTH 34 DEGREES 21 MINUTES 47 SECONDS EAST, 42.00 FEET; THENCE SOUTH 55 DEGREES 38 MINUTES 13 SECONDS EAST, ALONG A LINE DRAWN 42.00 FEET NORTH EAST OF AND PARALLEL WITH THE MOST NORTHERLY LINE OF SAID LOT 14, A DISTANCE OF 81.34 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42 FEET NORTH EAST OF AND PARALLEL WITH THE NORTHERLY LINE OF LOTS 14 AND 15 IN SAID NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE SOUTH 65 DEGREES 24 MINUTES 31 SECONDS EAST, ALONG SAID PARALLEL LINE, 875.26 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTH EAST OF AND PARALLEL WITH THE NORTHERLY LINE OF LOT 16 IN SAID NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE SOUTH 74 DEGREES 22 MINUTES 11 SECONDS EAST, ALONG SAID PARALLEL LINE, 605.00 FEET TO THE HEREINABOVE DESCRIBED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS.

EXCEPTING THEREFROM THE FOLLOWING:

THAT PART OF THE NORTH WEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH WEST 1/4 OF SECTION 10), WITH THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED OCTOBER 26, 1967 AS DOCUMENT 20302748; THENCE SOUTH 89 DEGREES 59 MINUTES 25 SECONDS EAST ALONG THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE 249.53 FEET TO THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING EASTERLY ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE 329.67 FEET; THENCE SOUTH 0 DEGREES 02 MINUTES 47 SECONDS EAST, 260.00 FEET; THENCE NORTH 64 DEGREES 40 MINUTES 37 SECONDS WEST, 364.855 FEET TO A POINT ON A LINE DRAWN THROUGH THE POINT OF BEGINNING AND PARALLEL TO THE EAST LINE OF THE PARCEL OF LAND HEREIN DESCRIBED AND ALSO BEING DISTANT 104.00 FEET SOUTH OF SAID POINT OF BEGINNING; THENCE NORTH 0 DEGREES 02 MINUTES 47 SECONDS WEST ALONG SAID PARALLEL LINE 104.00 FEET TO THE HEREINABOVE DESIGNATED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS.

PARCEL 2:

AN UNDIVIDED 1/2 INTEREST IN:

THAT PART OF THE NORTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH WEST 1/4 OF SECTION 10), WITH THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED OCTOBER 26, 1967 AS DOCUMENT 20302748; THENCE SOUTH 89 DEGREES 59 MINUTES 25 SECONDS EAST ALONG THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE 249.53 FEET TO THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING EASTERLY ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE 329.67 FEET; THENCE SOUTH 0 DEGREES 02 MINUTES 47 SECONDS EAST, 260.00 FEET; THENCE NORTH 64 DEGREES 40 MINUTES 37 SECONDS WEST, 364.855 FEET TO A POINT ON A LINE DRAWN THROUGH THE POINT OF BEGINNING AND PARALLEL TO THE EAST LINE OF THE PARCEL OF LAND HEREIN DESCRIBED AND ALSO BEING DISTANT 104.00 FEET SOUTH OF SAID POINT OF BEGINNING; THENCE NORTH 0 DEGREES 02 MINUTES 47 SECONDS WEST ALONG SAID PARALLEL LINE 104.00 FEET TO THE HEREINABOVE DESIGNATED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS.

PARCEL 3:

EASEMENT APPURTENANT TO AND FOR THE BENEFIT OF PARCEL 1 AS SET FORTH IN EASEMENT DATED FEBRUARY 12, 1991 AND RECORDED FEBRUARY 13, 1991 AS DOCUMENT 91068203 AND ASSIGNED TO RAIL-IT BY DOCUMENT DATED AUGUST 15, 1991 AND RECORDED AUGUST 19, 1991 AS DOCUMENT 91421654, OVER THE FOLLOWING PROPERTY, TO WIT:

THAT PART OF THE NORTHEAST 1/4 AND THE NORTH WEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS;

COMMENCING AT THE NORTH EAST CORNER OF SAID SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST ALONG THE NORTH LINE OF THE AFORESAID NORTH EAST 1/4 OF SAID SECTION 10, A DISTANCE OF 2655.08 FEET; THENCE SOUTH 0 DEGREES 13 MINUTES 54 SECONDS WEST PARALLEL TO THE EAST LINE OF THE NORTH EAST 1/4 OF SAID SECTION 10 THE SOUTH LINE OF THE NORTH 50 FEET OF THE NORTH EAST 1/4 OF SECTION 10 (BEING THE SOUTH LINE OF WEST CHICAGO AVENUE) AND THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING SOUTH 0 DEGREES 13 MINUTES 54 SECONDS WEST ALONG SAID PARALLEL LINE 150.00 FEET; THENCE NORTH 89 DEGREES 59 MINUTES 25 SECONDS WEST, ALONG A LINE DRAWN PARALLEL WITH THE NORTH LINE OF THE AFORESAID NORTH EAST 1/4 AND NORTHWEST 1/4 OF SECTION 10, A DISTANCE OF 66.00 FEET; THENCE NORTH 0 DEGREES 13 MINUTES 54 SECONDS EAST, 150.00 FEET TO THE POINT OF INTERSECTION WITH THE SOUTH LINE OF THE NORTH 50.00 FEET OF THE NORTH WEST 1/4 OF SECTION 10 AFORESAID (BEING THE SOUTH LINE OF WEST CHICAGO AVENUE); THENCE SOUTH 89 DEGREES 59 MINUTES 25 SECONDS EAST, ALONG SAID SOUTH LINE, 66.00 FEET TO THE HEREINABOVE DESCRIBED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS.

PARCEL 4:

EASEMENT AS GRANTED IN DOCUMENT DATED AUGUST 15, 1991 AND RECORDED AUGUST 19, 1991 AS DOCUMENT 91421653 FOR THE BENEFIT OF PARCEL 1 IN FAVOR OF RAIL-IT, OVER THE FOLLOWING DESCRIBED PROPERTY:

A STRIP OF LAND 35.13 FEET WIDE THE CENTER LINE OF WHICH IS DEFINED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE WEST LINE OF THE EAST 25.00 FEET (AS MEASURED AT RIGHT ANGLES TO THE EAST LINE THEREOF) OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT, BEING A SUBDIVISION OF PART OF THE NORTH 1/2 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THIRD THIRD PRINCIPAL MERIDIAN, WITH THE NORTHERLY LINE OF SAID LOT 16; THENCE NORTHWESTERLY ALONG A LINE FORMING AN ANGLE OF 42 DEGREES 41 MINUTES 39 SECONDS WITH SAID NORTHERLY LINE OF LOT 16 AS MEASURED FROM THE WEST TO THE NORTHWEST FOR A DISTANCE OF 61.94 FEET TO THE TERMINUS POINT OF SAID CENTER LINE SAID POINT BEING THE INTERSECTION OF A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE AFORESAID NORTHERLY LINE OF SAID LOT 16, AND A LINE DRAWN 1743.23 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF THE NORTH EAST 1/4 OF AFORESAID SECTION 10, IN COOK COUNTY, ILLINOIS.

PARCEL 5:

EASEMENT FOR THE BENEFIT OF PARCEL 1 CREATED BY DOCUMENT DATED SEPTEMBER 2, 1969 AND RECORDED SEPTEMBER 17, 1969 AS DOCUMENT 20961619 AND ASSIGNED TO RAIL-IT BY DOCUMENT DATED AUGUST 15, 1991 AND RECORDED AUGUST 19, 1991 AS DOCUMENT 91421655 OVER THE FOLLOWING PROPERTY TO WIT:

THE EAST 50.00 FEET (AS MEASURED AT RIGHT ANGLES TO THE EAST LINE THEREOF) OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT, BEING A SUBDIVISION OF PART OF THE NORTH 1/2 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13, EAST OF THE THIRD PRINCIPAL MERIDIAN, IN COOK COUNTY, ILLINOIS.

23

98837295

EXHIBIT B

Designated Haulers

ARC DISPOSAL COMPANY, INC.
HILLSIDE DISPOSAL SERVICE, INC.
ROY STROM REFUSE REMOVAL SERVICE, INC.

DOCUMENT #=20476220.01; AUTHOR=MSULLIVA
saved as
WAKKILBOURNCOVENANT.7

24

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)

SCHEDULE A

POLICY NO. : 1401 008985187 D2

DATE OF POLICY: PRO FORMA POLICY

AMOUNT OF INSURANCE: \$10,000.00

1. NAME OF INSURED:

BK CHICAGO AVENUE L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY AND CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY, EACH AS TO AN UNDIVIDED FIFTY PERCENT INTEREST, AS TENANTS IN COMMON

PRO FORMA INSURED: TO COME

2. THE ESTATE OR INTEREST IN THE LAND AND WHICH IS COVERED BY THIS POLICY IS A FEE SIMPLE, UNLESS OTHERWISE NOTED.

3. TITLE TO SAID ESTATE OR INTEREST AT THE DATE HEREOF IS VESTED IN:

THE INSURED.

4. THE LAND HEREIN DESCRIBED IS ENCUMBERED BY THE FOLLOWING MORTGAGE OR TRUST DEED AND ASSIGNMENTS:

NONE

AND THE MORTGAGES OR TRUST DEEDS, IF ANY, SHOWN IN SCHEDULE B HEREOF.

THIS POLICY VALID ONLY IF SCHEDULE B IS ATTACHED.

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)
SCHEDULE A (CONTINUED)

POLICY NO. : 1401 008985187 D2

5. THE LAND REFERRED TO IN THIS POLICY IS DESCRIBED AS FOLLOWS:

PARCEL 1:

THAT PART OF THE NORTHEAST 1/4 AND THE NORTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13 EAST OF THE THIRD PRINCIPAL MERIDIAN BOUNDED AND DAF

COMMENCING AT A POINT ON THE WEST LINE OF NORTH PULASKI ROAD (BEING THE WEST LINE OF THE EAST 33.00 FEET OF THE NORTHEAST 1/4 OF SECTION 10 AFORESAID) SAID POINT BEING ON A LINE DRAWN 970.00 FEET SOUTH OF AND PARALLEL WITH THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTHEAST 1/4 OF SECTION 10); THENCE NORTH 89 DEGREES, 59 MINUTES, 25 SECONDS WEST ALONG SAID PARALLEL LINE 313.92 FEET; THENCE SOUTH 0 DEGREES, 14 MINUTES 49 SECONDS WEST, 104.05 FEET; THENCE SOUTH 6 DEGREES, 33 MINUTES, 01 SECONDS EAST, 257.53 FEET TO THE SOUTH LINE OF THE NORTH 1379.90 FEET OF THE SAID NORTHEAST 1/4 OF SECTION 10; THENCE NORTH 89 DEGREES, 59 MINUTES, 25 SECONDS WEST ALONG SAID SOUTH LINE 335.22 FEET TO THE INTERSECTION OF A CIRCLE CONVEX NORTHEASTERLY, HAVING A RADIUS OF 566.44 FEET AND BEING 40.00 FEET NORTHEASTERLY OF AND CONCENTRIC WITH THE NORTHEASTERLY LINE OF LOT 2 IN FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED MAY 31, 1984 AS DOCUMENT 27109489; THENCE NORTHWESTERLY ALONG THE ARC OF SAID CIRCLE 188.32 FEET (THE CHORD OF WHICH BEARS NORTH 73 DEGREES, 59 MINUTES, 08 SECONDS WEST FOR 187.45 FEET) TO THE POINT OF TANGENCY THEREOF; THENCE NORTH 83 DEGREES, 30 MINUTES, 35 SECONDS WEST PARALLEL WITH THE NORTHERLY LINE OF SAID LOT 2 EXTENDED NORTHWESTERLY IN AFORESAID FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT 625.11 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE WESTERLY MOST NORTHERLY LINE OF LOT 1 IN AFORESAID FIRST ADDITION TO NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE NORTH 74 DEGREES, 25 MINUTES, 26 SECONDS WEST ALONG SAID PARALLEL LINE 229.02 FEET TO THE INTERSECTION WITH A LINE DRAWN 42.00 FEET NORTHEASTERLY OF AND PARALLEL WITH THE WESTERLY MOST NORTHERLY LINE OF LOT 16 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT 21532046; THENCE NORTH 74 DEGREES, 22 MINUTES, 11 SECONDS WEST ALONG SAID PARALLEL LINE 71.41 FEET TO THE POINT OF BEGINNING OF THE TRACT HEREIN DESCRIBED; THENCE NORTH 0 DEGREES, 13 MINUTES, 54 SECONDS EAST, ALONG A LINE DRAWN 1743.23 FEET WEST OF AND PARALLEL WITH THE EAST LINE OF THE AFORESAID NORTH EAST 1/4 OF SECTION 10, A DISTANCE OF 711.97 FEET TO A POINT WHICH IS 465.01 FEET SOUTH OF THE NORTH LINE OF THE AFORESAID NORTHEAST 1/4 OF SECTION 10 AS MEASURED ALONG SAID PARALLEL LINE; THENCE NORTHWESTERLY 130.22 FEET ALONG THE ARC OF A CIRCLE, TANGENT TO THE LAST DESCRIBED LINE, CONVEX NORTHEASTERLY, HAVING A RADIUS OF 100.00 FEET, AND WHOSE CHORD BEARS NORTH 37 DEGREES, 04 MINUTES, 27 SECONDS WEST, 121.21 FEET TO A POINT OF TANGENCY; THENCE NORTH 74 DEGREES, 22 MINUTES, 48 SECONDS WEST, 556.92 FEET; THENCE WESTERLY 136.22 FEET ALONG THE ARC OF A CIRCLE, TANGENT TO THE LAST DESCRIBED LINE, CONVEX NORTHERLY, HAVING A RADIUS OF 500.00 FEET, AND WHOSE CHORD BEARS NORTH 82 DEGREES, 11 MINUTES, 06 SECONDS WEST, 135.80 FEET T A POINT OF TANGENCY; THENCE NORTH 89 DEGREES, 59 MINUTES, 25 SECONDS WEST, ALONG A LINE DRAWN 200.00 FEET SOUTH OF AND PARALLEL WITH THE AFORESAID NORTH LINE OF THE NORTHEAST 1/4 AND THE

CONTINUED ON NEXT PAGE

THIS POLICY VALID ONLY IF SCHEDULE B IS ATTACHED.

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)
SCHEDULE A (CONTINUED)

POLICY NO. : 1401 008985187 D2

NORTHWEST 1/4 OF SECTION 10, A DISTANCE OF 232.80 FEET; THENCE NORTH 0 DEGREES, 13 MINUTES, 54 SECONDS EAST, 150.00 FEET ALONG A LINE DRAWN PARALLEL WITH THE AFORESAID EAST LINE OF THE NORTHEAST 1/4 OF SECTION 10 AND PASSING THROUGH A POINT ON THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE WHICH IS 2721.08 FEET WESTERLY OF THE EAST LINE OF THE NORTHEAST 1/4 OF SECTION 10 AFORESAID, AS MEASURED ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE; THENCE NORTH 89 DEGREES, 59 MINUTES, 25 SECONDS WEST ALONG SAID SOUTH LINE, 1255.22 FEET TO THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED AS DOCUMENT 20302748; THENCE SOUTH 0 DEGREES, 02 MINUTES, 14 SECONDS EAST, ALONG SAID EAST LINE, 69.47 FEET TO AN ANGLE POINT IN SAID NORTH KILBOURN AVENUE; THENCE SOUTH 55 DEGREES, 36 MINUTES, 59 SECONDS EAST, ALONG THE NORTHERLY LINE OF THE AFORESAID NORTH KILBOURN AVENUE, 782.245 FEET TO A NORTHEASTERLY CORNER OF NORTH KILBOURN AVENUE (BEING THE NORTH WEST CORNER OF LOT 14 IN NORTHWESTERN CENTER INDUSTRIAL DISTRICT RECORDED JULY 1, 1971 AS DOCUMENT 21532046); THENCE SOUTH 55 DEGREES, 38 MINUTES, 13 SECONDS EAST, ALONG THE NORTHERLY LINE OF SAID LOT 14, A DISTANCE OF 137.55 FEET; THENCE NORTH 34 DEGREES, 21 MINUTES, 47 SECONDS EAST, 42.00 FEET; THENCE SOUTH 55 DEGREES, 38 MINUTES, 13 SECONDS EAST, ALONG A LINE DRAWN 42.00 FEET NORTH EAST OF AND PARALLEL WITH THE MOST NORTHERLY LINE OF SAID LOT 14, A DISTANCE OF 81.34 FEET TO THE POINT OF INTERSECTION WITH A LINE DRAWN 42 FEET NORTH EAST OF AND PARALLEL WITH THE NORTHERLY LINE OF LOTS 14 AND 15 IN SAID NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE SOUTH 65 DEGREES, 24 MINUTES, 31 SECONDS EAST, ALONG SAID PARALLEL LINE, 875.26 FEET TO THE POINT OF INTERSECTION WITH A LINE DAWN 42.00 FEET NORTH EAST OF AND PARALLEL WITH THE NORTHERLY LINE OF LOT 16 IN SAID NORTHWESTERN CENTER INDUSTRIAL DISTRICT; THENCE SOUTH 74 DEGREES, 22 MINUTES, 11 SECONDS EAST, ALONG SAID PARALLEL LINE, 605.00 FEET TO THE HEREINABOVE DESCRIBED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS

EXCEPTING THEREFROM THE FOLLOWING:

THAT PART OF THE NORTH WEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13 EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTH WEST 1/4 OF SECTION 10), WITH THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED OCTOBER 26, 1967 AS DOCUMENT 20302748; THENCE SOUTH 89 DEGREES, 59 MINUTES, 25 SECONDS EAST ALONG THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE 249.53 FEET TO THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING EASTERLY ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE 329.67 FEET; THENCE SOUTH 0 DEGREES, 02 MINUTES, 47 SECONDS EAST, 260.00 FEET; THENCE NORTH 64 DEGREES, 40 MINUTES, 37 SECONDS WEST, 364.855 FEET TO A POINT ON A LINE DRAWN THROUGH THE POINT OF BEGINNING AND PARALLEL TO THE EAST LINE OF THE PARCEL OF LAND HEREIN DESCRIBED AND ALSO BEING DISTANT 104.00 FEET SOUTH OF SAID POINT OF BEGINNING; THENCE NORTH 0 DEGREES, 02 MINUTES, 47 SECONDS WEST ALONG SAID PARALLEL LINE 104.00 FEET TO THE HEREINABOVE DESIGNATED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS

PARCEL 2:

THAT PART OF THE NORTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13 EAST OF THE THIRD PRINCIPAL MERIDIAN, BOUNDED AND DESCRIBED AS FOLLOWS:

THIS POLICY VALID ONLY IF SCHEDULE B IS ATTACHED.

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)

SCHEDULE A (CONTINUED)

POLICY NO. : 1401 008985187 D2

COMMENCING AT THE INTERSECTION OF THE SOUTH LINE OF WEST CHICAGO AVENUE (SAID SOUTH LINE BEING A LINE DRAWN 50.00 FEET SOUTH OF AND PARALLEL WITH THE NORTH LINE OF SAID NORTHWEST 1/4 OF SECTION 10), WITH THE EAST LINE OF NORTH KILBOURN AVENUE RECORDED OCTOBER 26, 1967 AS DOCUMENT 20302748; THENCE SOUTH 89 DEGREES, 59 MINUTES, 25 SECONDS EAST ALONG THE AFORESAID SOUTH LINE OF WEST CHICAGO AVENUE 249.53 FEET TO THE POINT OF BEGINNING OF THE PARCEL OF LAND HEREIN DESCRIBED; THENCE CONTINUING EASTERLY ALONG THE SOUTH LINE OF WEST CHICAGO AVENUE 329.67 FEET; THENCE SOUTH 0 DEGREES, 02 MINUTES, 47 SECONDS EAST, 260.00 FEET; THENCE NORTH 64 DEGREES, 40 MINUTES, 37 SECONDS WEST, 364.855 FEET TO A POINT ON A LINE DRAWN THROUGH THE POINT OF BEGINNING AND PARALLEL TO THE EAST LINE OF THE PARCEL OF LAND HEREIN DESCRIBED AND ALSO BEING DISTANT 104.00 FEET SOUTH OF SAID POINT OF BEGINNING; THENCE NORTH 0 DEGREES, 02 MINUTES, 47 SECONDS WEST ALONG SAID PARALLEL LINE 104.00 FEET TO THE HEREINABOVE DESIGNATED POINT OF BEGINNING, IN COOK COUNTY, ILLINOIS

THIS POLICY VALID ONLY IF SCHEDULE B IS ATTACHED.

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)

SCHEDULE B

1401 008985187 D2

NOTWITHSTANDING THE PROVISIONS OF THE CONDITIONS AND STIPULATIONS OF THIS POLICY, ALL ENDORSEMENTS, IF ANY, ATTACHED HERETO ARE VALID DESPITE THE LACK OF SIGNATURE BY EITHER THE PRESIDENT, A VICE PRESIDENT, THE SECRETARY, AN ASSISTANT SECRETARY, OR VALIDATING OFFICER OR AUTHORIZED SIGNATORY OF THE COMPANY.

EXCEPTIONS FROM COVERAGE

THIS POLICY DOES NOT INSURE AGAINST LOSS OR DAMAGE SUSTAINED BY THE INSURED (AND THE COMPANY WILL NOT PAY COSTS, ATTORNEY'S FEES OR EXPENSES) BY REASON OF THE FOLLOWING EXCEPTIONS:

GENERAL EXCEPTIONS:

- (1) RIGHTS OR CLAIMS OF PARTIES IN POSSESSION NOT SHOWN BY PUBLIC RECORDS.
(2) ENCROACHMENTS, OVERLAPS, BOUNDARY LINE DISPUTES, OR OTHER MATTERS WHICH WOULD BE DISCLOSED BY AN ACCURATE SURVEY AND INSPECTION OF THE PREMISES.
(3) EASEMENTS, OR CLAIMS OF EASEMENTS, NOT SHOWN BY THE PUBLIC RECORDS.
(4) ANY LIEN, OR RIGHT TO A LIEN, FOR SERVICES, LABOR OR MATERIAL HERETOFORE OR HEREAFTER FURNISHED, IMPOSED BY LAW AND NOT SHOWN BY THE PUBLIC RECORDS.
(5) TAXES OR SPECIAL ASSESSMENTS WHICH ARE NOT SHOWN AS EXISTING LIENS BY THE PUBLIC RECORDS.

SPECIAL EXCEPTIONS: THE MORTGAGE, IF ANY, REFERRED TO IN ITEM 4 OF SCHEDULE A.

AG 6. NOTE: THIS IS A PRO FORMA POLICY FURNISHED TO OR ON BEHALF OF THE PARTY TO BE INSURED. IT DOES NOT REPRESENT THE PRESENT STATE OF TITLE AND IS NOT A COMMITMENT TO INSURE THE ESTATE OR INTEREST AS SHOWN HEREIN, NOR DOES IT EVIDENCE THE WILLINGNESS OF THE COMPANY TO PROVIDE ANY AFFIRMATIVE COVERAGE SHOWN HEREIN. ANY SUCH COMMITMENT MUST BE AN EXPRESS WRITTEN UNDERTAKING ON APPROPRIATE FORMS OF THE COMPANY.

AF 7.

1. TAXES FOR THE YEAR(S) 2016 AND 2017
2017 TAXES ARE NOT YET DUE OR PAYABLE.

1A. NOTE: 2016 FIRST INSTALLMENT WAS DUE MARCH 1, 2017
NOTE: 2016 FINAL INSTALLMENT NOT YET DUE OR PAYABLE

Table with 5 columns: PERM TAX#, PCL, YEAR, 1ST INST, STAT. Row 1: 16-10-200-061-0000, 1 OF 1, 2016, \$26,103.40, PAID

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)

SCHEDULE B

1401 008985187 D2

EXCEPTIONS FROM COVERAGE
(CONTINUED)

- C 8. PERMANENT EASEMENT IN FAVOR OF THE CITY OF CHICAGO TO INSTALL, MAINTAIN AND USE A SANITARY SEWER, IN, UPON, UNDER AND ACROSS THE FOLLOWING DESCRIBED PROPERTY:

A STRIP OF LAND 20 FEET WIDE, EXTENDING ACROSS THE EAST 1/2 OF THE NORTHWEST 1/4 AND A PART OF THE EAST 1/2 OF THE SOUTHWEST 1/4 OF SECTION 10, TOWNSHIP 39 NORTH, RANGE 13 EAST OF THE THIRD PRINCIPAL MERIDIAN, SAID STRIP OF LAND BEING 10 FEET WIDE ON EITHER SIDE OF A CENTER LINE DRAWN PARALLEL WITH THE EAST LINE OF THE NORTHWEST 1/4 OF SAID SECTION 10 AND EXTENDING FROM THE NORTH LINE OF WEST KINZIE STREET (BEING ALSO THE SOUTH LINE OF THE PROPERTY OF THE CHICAGO AND NORTHWESTERN RAILWAY COMPANY) THROUGH A POINT IN THE SOUTH LINE OF THE NORTHWEST 1/4 OF SAID SECTION 10 WHICH POINT IS DISTANT 669.88 FEET WEST OF THE SOUTH EAST CORNER THEREOF AND RUNNING THENCE NORTH TO THE NORTH LINE OF SECTION 10 AFORESAID, SUBJECT TO CHICAGO AVENUE TO INSTALL, MAINTAIN AND USE A SANITARY SEWER.

ALL AS CONTAINED IN GRANT MADE BY CHICAGO AND NORTH WESTERN RAILWAY COMPANY, A CORPORATION OF WISCONSIN, TO THE CITY OF CHICAGO, ILLINOIS, DATED FEBRUARY 28, 1952 AND RECORDED MARCH 28, 1952 AS DOCUMENT 15305732 AND SUBJECT TO THE CONDITIONS AND RESTRICTIONS CONTAINED THEREIN

AFFECTS PARCEL 1 AND 2

- D 9. NOTE: THE FOLLOWING ITEM, WHILE APPEARING ON THIS COMMITMENT/POLICY, IS PROVIDED SOLELY FOR YOUR INFORMATION.

THE FOLLOWING ENVIRONMENTAL DISCLOSURE DOCUMENT(S) FOR TRANSFER OF REAL PROPERTY APPEAR OF RECORD WHICH INCLUDE A DESCRIPTION OF THE LAND INSURED OR A PART THEREOF:

DOCUMENT NUMBER: 91421657 DATE OF RECORDING: AUGUST 19, 1991
(AFFECTS THE LAND AND OTHER PROPERTY)

NOTE: THIS DOCUMENT DOES NOT CONSTITUTE A LIEN.

- E 10. RIGHTS OF THE PUBLIC OR QUASI-PUBLIC UTILITIES, IF ANY, AS DISCLOSED BY SURVEY MADE BY SPACECO INC., DATED ~, NUMBER 2581.02 DEPICTING THE FOLLOWING ON THE LAND: OVERHEAD WIRES, POWER POLES AND WELLS
- H 11. RIGHTS OF WAY FOR DRAINAGE TILES, DITCHES, FEEDERS AND LATERALS, IF ANY.

- I 12. AGREEMENT OF RESTRICTIVE COVENANTS AND THE EASEMENTS, PROVISIONS, COVENANTS, CONDITIONS AND RESTRICTIONS CONTAINED THEREIN DATED SEPTEMBER 15, 1998 AND RECORDED SEPTEMBER 18, 1998 AS DOCUMENT 98837295 MADE BY AND BETWEEN CHICAGO

CHICAGO TITLE INSURANCE COMPANY

OWNER'S POLICY (1992)

SCHEDULE B

1401 008985187 D2

**EXCEPTIONS FROM COVERAGE
(CONTINUED)**

AVENUE DEVELOPMENT L.L.C. IN FAVOR OF KILBOURN LIMITED PARTNERSHIP RELATING TO ROYALTY PAYMENTS, RESTRICTIONS ON CAPACITY, QUARTERLY PAYMENTS IN FAVOR OF KILBOURN LIMITED PARTNERSHIP, RIGHT OF FIRST REFUSAL TO UTILIZE LAND SPACE WHICH OWNER HAS RESERVED FOR WASTE HAULERS, ENFORCEMENT RIGHTS, ACCESS TO RECORDS AND LAND, OBLIGATIONS, NOTICE REQUIREMENTS, OPTION TO UTILIZE ADDITIONAL SPACE IF CAPACITY IS INCREASED FOR WASTE. SAID PROVISIONS ARE CONTINGENT UPON THE USE OF THE LAND AS A "RECYCLING FACILITY" OR A "TRANSFER STATION" AND SHALL SURVIVE ANY SALE, ASSIGNMENT, TRANSFER OR CONVEYANCE OF LAND OR INTEREST THEREIN AND SAID COVENANTS SHALL BE SUSPENDED FOR ANY PERIOD DURING WHICH NO FACILITY IS BEING OPERATED ON THE LAND OR A ON ANY PORTION OF THE LAND WHERE NO SUCH FACILITY IS OPERATED. IN THE EVENT THE LAND IS USED AS A REBYCLING FACILITY OR TRANSFER STATION, AS DEFINED THEREIN.

- M 13. TERMS, PROVISIONS, CONDITIONS AND RESTRICTIONS CONTAINED IN THE HOME DEPOT, ARMITAGE PROJECT, TAX INCREMENT ALLOCATION REDEVELOPMENT ACT AND HOME DEPOT U.S.A., INC. REDEVELOPMENT AGREEMENT RECORDED DECEMBER 3, 2007 AS DOCUMENT 0733709069
- P 14. WE HAVE EXAMINED THE PLAT OF SURVEY BY SPACECO INC., DATED ~, NUMBER 2581.02 AND NOTE THE FOLLOWING:
1. ENCROACHMENT OF THE PUBLIC WALK LOCATED MAINLY ON PUBLIC PROPERTY NORTH AND ADJOINING, ONTO LAND BY .1 FEET TO .5 FEET.
 2. POSSIBLE ENCROACHMENT OF THE RETAINING WALL LOCATED AT THE NORTHWEST CORNER OF THE LAND ONTO PUBLIC PROPERTY WEST AND ADJOINING.
 3. THERE IS A WALKING PATH RUNNING THROUGH THE PROPERTY FROM A POINT ON THE NORTH LINE, FROM WEST CHICAGO AVENUE, TO NORTH KILBOURN AVENUE.

CHICAGO TITLE INSURANCE COMPANY
OWNERS/ LOAN POLICY
PROFORMA DELETE EXCEPTIONS

POLICY NO. : 1401 008985187 D2

FOR THE PURPOSES OF THIS PRO FORMA POLICY, THE FOLLOWING EXCEPTIONS ARE HEREBY DELETED:

- B 6. MORTGAGE, SECURITY AGREEMENT, FIXTURE FILING AND ASSIGNMENT OF LEASES AND RENTS DATED JULY 13, 2012 AND RECORDED JULY 20, 2012 AS DOCUMENT 1220241013 MADE BY BK CHICAGO AVENUE L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY AND CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY, EACH AS TO AN UNDIVIDED FIFTY PERCENT INTEREST, AS TENANTS IN COMMON TO THE PRIVATEBANK AND TRUST COMPANY TO SECURE A NOTE FOR \$3,332,000.00.

FIRST AMENDMENT TO MORTGAGE, SECURITY AGREEMENT, FIXTURE FILING AND ASSIGNMENT OF LEASES AND RENTS DATED SEPTEMBER 19, 2016 WITH AN EFFECTIVE DATE OF JULY 13, 2016 AND RECORDED SEPTEMBER 21, 2016 AS DOCUMENT NUMBER 1626522112 BY BK CHICAGO AVENUE L.L.C. AN ILLINOIS LIMITED LIABILITY COMPANY AND CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY TO AND FOR THE BENEFIT OF THE PRIVATEBANK AND TRUST COMPANY AN ILLINOIS STATE CHARTERED BANK

- R 7. ASSIGNMENT OF LEASES AND RENTS RECORDED JULY 20, 2012 AS DOCUMENT NO. 1220241014 MADE BY BK CHICAGO AVENUE L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY AND CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY TO AND FOR THE BENEFIT OF THE PRIVATEBANK AND TRUST COMPANY.

FIRST AMENDMENT TO ASSITNMENT OF LEASES AND RENTS DATED SEPTEMBER 19, 2016 WITH AN EFFECTIVE DATE OF JULY 13, 2016 RECORDED SEPTEMBER 21, 2016 AS DOCUMENT NUMBER 1626522113 , BY BK CHICAGO AVENUE L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY, AND CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY TO AND FOR THE BENEFIT OF THE PRIVATEBANK AND TRUST COMPANY AN ILLINOIS STATE CHARTERED BANK.

- S 8. SECURITY INTEREST OF THE PRIVATEBANK AND TRUST COMPANY, SECURED PARTY, IN CERTAIN DESCRIBED CHATTELS ON THE LAND, AS DISCLOSED BY FINANCING STATEMENT NAMING BK CHICAGO AVENUE L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY AND CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY, EACH AS DEBTOR AND RECORDED JULY 20, 2012 AS DOCUMENT NO. 1220241015.

UCC FINANCING STATEMENT AMENDMENT RECORDED SEPTEMBER 21, 2016 AS DOCUMENT NUMBER 1626522114.

- L 9. MUNICIPAL REAL ESTATE TRANSFER TAX STAMPS (OR PROOF OF EXEMPTION) MUST ACCOMPANY ANY CONVEYANCE AND CERTAIN OTHER TRANSFERS OF PROPERTY LOCATED IN CHICAGO. PLEASE CONTACT SAID MUNICIPALITY PRIOR TO CLOSING FOR ITS SPECIFIC REQUIREMENTS, WHICH MAY INCLUDE THE PAYMENT OF FEES, AN INSPECTION OR OTHER APPROVALS.

- X 10. WE SHOULD BE FURNISHED A STATEMENT THAT THERE IS NO PROPERTY MANAGER EMPLOYED TO MANAGE THE LAND, OR, IN THE ALTERNATIVE, A FINAL LIEN WAIVER FROM ANY SUCH PROPERTY MANAGER. ~

- Y 11. EXISTING UNRECORDED LEASES AND ALL RIGHTS THEREUNDER OF THE LESSEES AND OF ANY PERSON OR PARTY CLAIMING BY, THROUGH OR UNDER THE LESSEES. ~

- AC 12. INFORMATION SHOULD BE FURNISHED ESTABLISHING THE PRESENT VALUE OF THE LAND

CHICAGO TITLE INSURANCE COMPANY
OWNERS/ LOAN POLICY
PROFORMA DELETE EXCEPTIONS (CONTINUED)

POLICY NO. : 1401 008985187 D2

AND IMPROVEMENTS THEREON. IF SUCH VALUE IS GREATER THAN THE AMOUNT OF INSURANCE REQUESTED, THE APPLICATION SHOULD BE AMENDED TO REQUEST AN AMOUNT EQUIVALENT TO THE FULL VALUE OF THE PROPERTY, AND, IN DEFAULT THEREOF, THE RIGHT IS RESERVED TO INSERT IN THE OWNER'S POLICY THE COMPANY'S USUAL COINSURANCE EXCEPTION.

- AD 13. WE SHOULD BE FURNISHED (A) CERTIFICATION FROM THE ILLINOIS SECRETARY OF STATE THAT BK CHICAGO AVENUE L.L.C., AN ILLINOIS LIMITED LIABILITY COMPANY HAS PROPERLY FILED ITS ARTICLES OF ORGANIZATION, (B) A COPY OF THE ARTICLES OF ORGANIZATION, TOGETHER WITH ANY AMENDMENTS THERETO, (C) A COPY OF THE OPERATING AGREEMENT, IF ANY, TOGETHER WITH ANY AMENDMENTS THERETO, (D) A LIST OF INCUMBENT MANAGERS OR OF INCUMBENT MEMBERS IF MANAGERS HAVE NOT BEEN APPOINTED, AND (E) CERTIFICATION THAT NO EVENT OF DISSOLUTION HAS OCCURRED.

NOTE: IN THE EVENT OF A SALE OF ALL OR SUBSTANTIALLY ALL OF THE ASSETS OF THE L.L.C. OR OF A SALE OF L.L.C. ASSETS TO A MEMBER OR MANAGER, WE SHOULD BE FURNISHED A COPY OF A RESOLUTION AUTHORIZING THE TRANSACTION ADOPTED BY THE MEMBERS OF SAID L.L.C. ~

- AE 14. WE SHOULD BE FURNISHED (A) CERTIFICATION FROM THE ILLINOIS SECRETARY OF STATE THAT CHIA LLC, AN ILLINOIS LIMITED LIABILITY COMPANY, HAS PROPERLY FILED ITS ARTICLES OF ORGANIZATION, (B) A COPY OF THE ARTICLES OF ORGANIZATION, TOGETHER WITH ANY AMENDMENTS THERETO, (C) A COPY OF THE OPERATING AGREEMENT, IF ANY, TOGETHER WITH ANY AMENDMENTS THERETO, (D) A LIST OF INCUMBENT MANAGERS OR OF INCUMBENT MEMBERS IF MANAGERS HAVE NOT BEEN APPOINTED, AND (E) CERTIFICATION THAT NO EVENT OF DISSOLUTION HAS OCCURRED.

NOTE: IN THE EVENT OF A SALE OF ALL OR SUBSTANTIALLY ALL OF THE ASSETS OF THE L.L.C. OR OF A SALE OF L.L.C. ASSETS TO A MEMBER OR MANAGER, WE SHOULD BE FURNISHED A COPY OF A RESOLUTION AUTHORIZING THE TRANSACTION ADOPTED BY THE MEMBERS OF SAID L.L.C.

CHICAGO TITLE INSURANCE COMPANY

POLICY SIGNATURE PAGE

POLICY NO. : 1401 008985187 D2

THIS POLICY SHALL NOT BE VALID OR BINDING UNTIL SIGNED BY AN AUTHORIZED SIGNATORY.

CHICAGO TITLE INSURANCE COMPANY

BY _____

AUTHORIZED SIGNATORY



APPENDIX F

Regulatory Database Information

Vacant Parcel

4301 W. Chicago Ave
CHICAGO, IL 60651

Inquiry Number: 5109170.2s
November 15, 2017

The EDR Radius Map™ Report with GeoCheck®



6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

<u>SECTION</u>	<u>PAGE</u>
Executive Summary	ES1
Overview Map	2
Detail Map	3
Map Findings Summary	4
Map Findings	8
Orphan Summary	135
Zip Scan Report	ZIP-1
Government Records Searched/Data Currency Tracking	GR-1
 <u>GEOCHECK ADDENDUM</u>	
Physical Setting Source Addendum	A-1
Physical Setting Source Summary	A-2
Physical Setting Source Map	A-8
Physical Setting Source Map Findings	A-9
Physical Setting Source Records Searched	PSGR-1

Thank you for your business.
 Please contact EDR at 1-800-352-0050
 with any questions or comments.

Disclaimer - Copyright and Trademark Notice

This Report contains certain information obtained from a variety of public and other sources reasonably available to Environmental Data Resources, Inc. It cannot be concluded from this Report that coverage information for the target and surrounding properties does not exist from other sources. **NO WARRANTY EXPRESSED OR IMPLIED, IS MADE WHATSOEVER IN CONNECTION WITH THIS REPORT. ENVIRONMENTAL DATA RESOURCES, INC. SPECIFICALLY DISCLAIMS THE MAKING OF ANY SUCH WARRANTIES, INCLUDING WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR USE OR PURPOSE. ALL RISK IS ASSUMED BY THE USER. IN NO EVENT SHALL ENVIRONMENTAL DATA RESOURCES, INC. BE LIABLE TO ANYONE, WHETHER ARISING OUT OF ERRORS OR OMISSIONS, NEGLIGENCE, ACCIDENT OR ANY OTHER CAUSE, FOR ANY LOSS OF DAMAGE, INCLUDING, WITHOUT LIMITATION, SPECIAL, INCIDENTAL, CONSEQUENTIAL, OR EXEMPLARY DAMAGES. ANY LIABILITY ON THE PART OF ENVIRONMENTAL DATA RESOURCES, INC. IS STRICTLY LIMITED TO A REFUND OF THE AMOUNT PAID FOR THIS REPORT.** Purchaser accepts this Report "AS IS". Any analyses, estimates, ratings, environmental risk levels or risk codes provided in this Report are provided for illustrative purposes only, and are not intended to provide, nor should they be interpreted as providing any facts regarding, or prediction or forecast of, any environmental risk for any property. Only a Phase I Environmental Site Assessment performed by an environmental professional can provide information regarding the environmental risk for any property. Additionally, the information provided in this Report is not to be construed as legal advice.

Copyright 2017 by Environmental Data Resources, Inc. All rights reserved. Reproduction in any media or format, in whole or in part, of any report or map of Environmental Data Resources, Inc., or its affiliates, is prohibited without prior written permission. EDR and its logos (including Sanborn and Sanborn Map) are trademarks of Environmental Data Resources, Inc. or its affiliates. All other trademarks used herein are the property of their respective owners.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

4301 W. CHICAGO AVE
CHICAGO, IL 60651

COORDINATES

Latitude (North): 41.8938030 - 41° 53' 37.69"
Longitude (West): 87.7357430 - 87° 44' 8.67"
Universal Transverse Mercator: Zone 16
UTM X (Meters): 438964.4
UTM Y (Meters): 4638033.5
Elevation: 610 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map: 5681444 CHICAGO LOOP, IL
Version Date: 2012

Northwest Map: 5680695 RIVER FOREST, IL
Version Date: 2012

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from: 20150822
Source: USDA

MAPPED SITES SUMMARY

Target Property Address:
4301 W. CHICAGO AVE
CHICAGO, IL 60624

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1		4301 W CHICAGO AVE	IL CHICAGO ENV		TP
2	CHICAGO TRANSIT AUTH	4401 W CHICAGO AVE	IL LUST, RCRA NonGen / NLR, FINDS, ECHO	Lower	501, 0.095, North
A3	FLORENCE MACARONI CO	4346 WEST CHICAGO	IL LUST	Lower	586, 0.111, NNE
A4	FLORENCE MACARONI IN	4334 W CHICAGO AVE	IL UST	Lower	657, 0.124, NNE
5	MACHINE SHOP	4416 W. CHICAGO AVEN	IL UST	Lower	663, 0.126, NNW
B6	MOORE SUPPLY CO	4318 W CHICAGO AVE	IL UST, IL BOL	Lower	721, 0.137, NE
B7	MOORE SUPPLY CO	4318 W CHICAGO AVE	RCRA-SQG, FINDS, ECHO	Lower	721, 0.137, NE
8	SIMPLOMATIC MFG	816 N KOSTNER	RCRA-SQG, FINDS, ECHO	Lower	734, 0.139, North
C9	AMERICAN ENVELOPE	4440 WEST OHIO STREE	IL ENG CONTROLS, IL INST CONTROL, IL SRP	Lower	800, 0.152, South
D10	CHICAGO, CITY OF	700 NORTH KILBOURN A	IL LUST	Higher	806, 0.153, West
C11	U. S. ART	4400 W OHIO ST	RCRA NonGen / NLR	Lower	822, 0.156, South
E12	KERRIGAN LEWIS WIRE	4421 W RICE ST	RCRA-SQG, IL LUST, ICIS, FINDS	Lower	838, 0.159, NNW
E13	KERRIGAN LEWIS WIRE	4421 W RICE ST	IL UST	Lower	838, 0.159, NNW
F14	STRONA WAREHOUSE	4350 W OHIO	RCRA NonGen / NLR, FINDS, ECHO	Lower	851, 0.161, SSE
F15	PPG INDUSTRIES INC S	4350 W OHIO ST	RCRA NonGen / NLR	Lower	851, 0.161, SSE
D16	CHICAGO, CITY OF	715 NORTH KILBOURN	IL LUST	Higher	865, 0.164, West
G17	JOYCE BEVERAGES	4433 W OHIO ST	IL UST	Lower	948, 0.180, SSW
G18	KEMMERER BOTTLING	4433 WEST OHIO ST.	IL LUST	Lower	948, 0.180, SSW
19	F&B MFG CO	4248 W CHICAGO AVE	RCRA NonGen / NLR, FINDS, ECHO	Lower	966, 0.183, NE
G20	COLOVOS CO	4444 W OHIO ST	IL UST, IL BOL	Lower	974, 0.184, SSW
G21	COLOVOS	4444 W OHIO ST	SEMS-ARCHIVE, CORRACTS, RCRA-SQG, IL LUST, IL ENG...	Lower	974, 0.184, SSW
22	RAIL IT PROPERTY	733 N KILBOURN	IL UST	Higher	977, 0.185, West
23	INDUSTRIAL STORAGE W	4343 W OHIO ST	RCRA NonGen / NLR	Lower	1005, 0.190, SSE
H24	LC SQUARED	4455 W RICE ST	IL UST	Lower	1023, 0.194, NW
H25	BRACHS CANDY FACTORY	4545 RACE ST	IL UST	Lower	1040, 0.197, NW
H26	BRACHS CANDY FACTORY	4545 RACE ST	RCRA NonGen / NLR, FINDS, ECHO	Lower	1040, 0.197, NW
H27	BRACH & BROCK CONFEC	4545 WEST RACE ST.	IL LUST	Lower	1040, 0.197, NW
I28	DUNBAR ARMORED	4500 W. CHICAGO AVE.	IL UST	Higher	1071, 0.203, WNW
I29	FEDERAL ARMORED EXPR	4500 W CHICAGO AVE	RCRA-CESQG, FINDS, ECHO	Higher	1071, 0.203, WNW
J30	NORTHWEST SORTING CT	750 N KILBOURN AVE	RCRA-SQG, ICIS, FINDS, ECHO, NY MANIFEST	Higher	1112, 0.211, West
J31	DEPT STREETS & SANIT	750 N KILBOURN AVE	IL UST	Higher	1112, 0.211, West
K32	COUNTRY DELIGHT	4201 W CHICAGO AVE	IL UST	Lower	1171, 0.222, ENE
K33	FORMER SWISS VALLEY	4155 W. CHICAGO AVEN	IL UST	Lower	1259, 0.238, ENE
K34	CERTIFIED GROCERS	4206 WEST CHICAGO AV	IL LUST	Lower	1274, 0.241, ENE
35	HOSPITAL LAUNDRY SER	4141 WEST CHICAGO AV	IL LUST	Lower	1480, 0.280, ENE
36	LAIDLAW TRANSIT, INC	902 KILBOURN ST.	IL LUST	Lower	1482, 0.281, NNW
37	PROSPERITY TRUCKING	4600 WEST ERIE	IL LUST	Lower	1586, 0.300, WSW
38	L. PRITIKIN & BECKER	4224 WEST CHICAGO	IL LUST	Lower	1631, 0.309, ENE
39	ST. FRANCIS OF ASSIS	932 KOSTNER RD.	IL LUST	Lower	1654, 0.313, North

MAPPED SITES SUMMARY

Target Property Address:
4301 W. CHICAGO AVE
CHICAGO, IL 60624

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
40	CITY OF CHICAGO	4233 W FERDINAND	RCRA-SQG, IL SRP, US AIRS, FINDS, ECHO	Lower	1730, 0.328, SSE
L41	PLAYSKOOL, INC.-NORT	4501 WEST AUGUSTA BO	IL LUST, IL ENG CONTROLS, IL INST CONTROL, IL SRP	Lower	1960, 0.371, NNW
L42	PLAYSKOOL INC	4501 W AUGUSTA BLVD	SEMS-ARCHIVE, CORRACTS, RCRA NonGen / NLR	Lower	1960, 0.371, NNW
L43	HUDSON SCREW MACHINE	4500 WEST AUGUSTA BL	IL LUST	Lower	2070, 0.392, NNW
44	SCENTEX INC.	4545 WEST AUGUSTA BL	IL LUST	Lower	2167, 0.410, NW
M45	UNION PACIFIC RAILRO	400 NORTH PULASKI RO	IL LUST, IL CHICAGO ENV	Lower	2181, 0.413, South
M46	UNION PACIFIC RAILRO	400 NORTH PULASKI	IL LUST	Lower	2181, 0.413, South
47	FERDINAND REALTY	4100 WEST FERDINAND	IL INST CONTROL, IL SRP	Lower	2205, 0.418, SE
48	BETHEL NEW LIFE	4235 WEST FERDINAND	IL INST CONTROL, IL SRP	Lower	2279, 0.432, SE
N49	WHOLESALE OIL CO.	4540 WEST AUGUSTA BL	IL LUST	Lower	2365, 0.448, NW
N50	WHOLESALE OIL CO.	4560 WEST AUGUSTA BL	IL LUST	Lower	2376, 0.450, NW
O51	INDUSTRIAL METAL ENT	901 N KILPATRICK AVE	IL LUST, RCRA NonGen / NLR	Lower	2440, 0.462, WNW
52	BEARINGS MFG	1033 N KOLMAR	RCRA-SQG, IL LUST, FINDS, ECHO	Lower	2443, 0.463, NNW
53	AE STALEY	4616 WEST AUGUSTA BL	IL LUST	Lower	2470, 0.468, NW
O54	VAUGHN MFG CO	900 N KILPATRICK	IL LUST, RCRA NonGen / NLR, FINDS, ECHO	Lower	2476, 0.469, WNW
55	CHICAGO REAL ESTATE	4014 WEST CHICAGO AV	IL LUST	Lower	2528, 0.479, ENE
56	KEMMERER BOTTLING	356 N KILBOURN	IL LUST, RCRA NonGen / NLR, FINDS, ECHO	Lower	2561, 0.485, SSW
57	ATLAS FINISHING CO	4118 W LAKE ST	RCRA-SQG, IL SSU, IL BROWNFIELDS, IL SPILLS,...	Lower	3369, 0.638, SSE
58	ALLIED METAL COMPANY	4528 WEST DIVISION S	SEMS-ARCHIVE, CORRACTS, RCRA NonGen / NLR, TRIS,...	Lower	3457, 0.655, NNW
59	DIVISION PAINT	4150 W DIVISION ST	IL SSU, IL BOL	Lower	3520, 0.667, NNE
60	BULK PETROLEUM	4049 W WASHINGTON BL	IL SSU, IL LUST, IL BOL	Lower	4914, 0.931, SSE

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was identified in the following records. For more information on this property see page 8 of the attached EDR Radius Map report:

<u>Site</u>	<u>Database(s)</u>	<u>EPA ID</u>
4301 W CHICAGO AVE 4301 W CHICAGO AVE CHICAGO, IL	IL CHICAGO ENV	N/A

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL..... National Priority List
Proposed NPL..... Proposed National Priority List Sites
NPL LIENS..... Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL..... National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY..... Federal Facility Site Information listing
SEMS..... Superfund Enterprise Management System

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF..... RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG..... RCRA - Large Quantity Generators

Federal institutional controls / engineering controls registries

LUCIS..... Land Use Control Information System
US ENG CONTROLS..... Engineering Controls Sites List
US INST CONTROL..... Sites with Institutional Controls

Federal ERNS list

ERNS..... Emergency Response Notification System

EXECUTIVE SUMMARY

State and tribal landfill and/or solid waste disposal site lists

IL SWF/LF..... Available Disposal for Solid Waste in Illinois - Solid Waste Landfills Subject to State Surcharge
IL CCDD..... Clean Construction or Demolition Debris
IL LF SPECIAL WASTE..... Special Waste Site List
IL NIPC..... Solid Waste Landfill Inventory

State and tribal leaking storage tank lists

INDIAN LUST..... Leaking Underground Storage Tanks on Indian Land
IL LUST TRUST..... Underground Storage Tank Fund Payment Priority List

State and tribal registered storage tank lists

FEMA UST..... Underground Storage Tank Listing
IL AST..... Above Ground Storage Tanks
INDIAN UST..... Underground Storage Tanks on Indian Land

State and tribal voluntary cleanup sites

INDIAN VCP..... Voluntary Cleanup Priority Listing

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS..... A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI..... Report on the Status of Open Dumps on Indian Lands
ODI..... Open Dump Inventory
DEBRIS REGION 9..... Torres Martinez Reservation Illegal Dump Site Locations
IHS OPEN DUMPS..... Open Dumps on Indian Land

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL..... Delisted National Clandestine Laboratory Register
IL CDL..... Meth Drug Lab Site Listing
US CDL..... National Clandestine Laboratory Register

Local Land Records

LIENS 2..... CERCLA Lien Information

Records of Emergency Release Reports

HMIRS..... Hazardous Materials Information Reporting System
IL SPILLS 90..... SPILLS 90 data from FirstSearch

Other Ascertainable Records

FUDS..... Formerly Used Defense Sites

EXECUTIVE SUMMARY

DOD.....	Department of Defense Sites
SCRD DRYCLEANERS.....	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR.....	Financial Assurance Information
EPA WATCH LIST.....	EPA WATCH LIST
2020 COR ACTION.....	2020 Corrective Action Program List
TSCA.....	Toxic Substances Control Act
SSTS.....	Section 7 Tracking Systems
ROD.....	Records Of Decision
RMP.....	Risk Management Plans
RAATS.....	RCRA Administrative Action Tracking System
PRP.....	Potentially Responsible Parties
PADS.....	PCB Activity Database System
FTTS.....	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS.....	Material Licensing Tracking System
COAL ASH DOE.....	Steam-Electric Plant Operation Data
COAL ASH EPA.....	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER.....	PCB Transformer Registration Database
RADINFO.....	Radiation Information Database
HIST FTTS.....	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS.....	Incident and Accident Data
CONSENT.....	Superfund (CERCLA) Consent Decrees
INDIAN RESERV.....	Indian Reservations
FUSRAP.....	Formerly Utilized Sites Remedial Action Program
UMTRA.....	Uranium Mill Tailings Sites
US MINES.....	Mines Master Index File
ABANDONED MINES.....	Abandoned Mines
UXO.....	Unexploded Ordnance Sites
DOCKET HWC.....	Hazardous Waste Compliance Docket Listing
FUELS PROGRAM.....	EPA Fuels Program Registered Listing
IL AIRS.....	Air Inventory Listing
IL COAL ASH.....	Coal Ash Site Listing
IL DRYCLEANERS.....	Illinois Licensed Drycleaners
IL Financial Assurance.....	Financial Assurance Information Listing
IL HWAR.....	Hazard Waste Annual Report
IL IMPDMNT.....	Surface Impoundment Inventory
IL NPDES.....	A Listing of Active Permits
IL PIMW.....	Potentially Infectious Medical Waste
IL TIER 2.....	Tier 2 Information Listing
IL UIC.....	Underground Injection Wells

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP.....	EDR Proprietary Manufactured Gas Plants
EDR Hist Auto.....	EDR Exclusive Historic Auto Stations
EDR Hist Cleaner.....	EDR Exclusive Historic Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

IL RGA HWS.....	Recovered Government Archive State Hazardous Waste Facilities List
-----------------	--

EXECUTIVE SUMMARY

IL RGA LF..... Recovered Government Archive Solid Waste Facilities List
IL RGA LUST..... Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.

Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be potential NPL site.

A review of the SEMS-ARCHIVE list, as provided by EDR, and dated 07/11/2017 has revealed that there are 2 SEMS-ARCHIVE sites within approximately 0.5 miles of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>COLOVOS</i>	<i>4444 W OHIO ST</i>	<i>SSW 1/8 - 1/4 (0.184 mi.)</i>	<i>G21</i>	<i>35</i>
<i>PLAYSKOOL INC</i>	<i>4501 W AUGUSTA BLVD</i>	<i>NNW 1/4 - 1/2 (0.371 mi.)</i>	<i>L42</i>	<i>88</i>

Federal RCRA CORRACTS facilities list

CORRACTS: CORRACTS is a list of handlers with RCRA Corrective Action Activity. This report shows which nationally-defined corrective action core events have occurred for every handler that has had corrective action activity.

A review of the CORRACTS list, as provided by EDR, and dated 09/13/2017 has revealed that there are 3 CORRACTS sites within approximately 1 mile of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
<i>COLOVOS</i>	<i>4444 W OHIO ST</i>	<i>SSW 1/8 - 1/4 (0.184 mi.)</i>	<i>G21</i>	<i>35</i>
<i>PLAYSKOOL INC</i>	<i>4501 W AUGUSTA BLVD</i>	<i>NNW 1/4 - 1/2 (0.371 mi.)</i>	<i>L42</i>	<i>88</i>

EXECUTIVE SUMMARY

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
ALLIED METAL COMPANY	4528 WEST DIVISION S	NNW 1/2 - 1 (0.655 mi.)	58	113

Federal RCRA generators list

RCRA-SQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

A review of the RCRA-SQG list, as provided by EDR, and dated 09/13/2017 has revealed that there are 5 RCRA-SQG sites within approximately 0.25 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
NORTHWEST SORTING CT	750 N KILBOURN AVE	W 1/8 - 1/4 (0.211 mi.)	J30	69

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
MOORE SUPPLY CO	4318 W CHICAGO AVE	NE 1/8 - 1/4 (0.137 mi.)	B7	12
SIMPLOMATIC MFG	816 N KOSTNER	N 1/8 - 1/4 (0.139 mi.)	8	14
KERRIGAN LEWIS WIRE	4421 W RICE ST	NNW 1/8 - 1/4 (0.159 mi.)	E12	22
COLOVOS	4444 W OHIO ST	SSW 1/8 - 1/4 (0.184 mi.)	G21	35

RCRA-CESQG: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

A review of the RCRA-CESQG list, as provided by EDR, and dated 09/13/2017 has revealed that there is 1 RCRA-CESQG site within approximately 0.25 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
FEDERAL ARMORED EXPR	4500 W CHICAGO AVE	WNW 1/8 - 1/4 (0.203 mi.)	I29	67

State- and tribal - equivalent CERCLIS

IL SSU: The State Response Action Program database identifies the status of all sites under the responsibility of the Illinois EPA's State Sites Unit.

A review of the IL SSU list, as provided by EDR, and dated 06/09/2015 has revealed that there are 3 IL SSU sites within approximately 1 mile of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
ATLAS FINISHING CO	4118 W LAKE ST	SSE 1/2 - 1 (0.638 mi.)	57	110

EXECUTIVE SUMMARY

SSU Status: Transferred
 Facility Id: 0316005987
 Facility Id: 0316005987

DIVISION PAINT ***4150 W DIVISION ST*** ***NNE 1/2 - 1 (0.667 mi.)*** ***59*** ***133***

SSU Status: Archived
 Facility Id: 0316230005
 Facility Id: 0316230005

BULK PETROLEUM ***4049 W WASHINGTON BL*** ***SSE 1/2 - 1 (0.931 mi.)*** ***60*** ***134***

SSU Status: Completed
 Facility Id: 0316235123
 Facility Id: 0316235123

State and tribal leaking storage tank lists

IL LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Illinois Environmental Protection Agency's LUST Incident Report.

A review of the IL LUST list, as provided by EDR, and dated 07/24/2017 has revealed that there are 27 IL LUST sites within approximately 0.5 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
CHICAGO, CITY OF NFA/NFR Letter: 5/15/1995 Incident Num: 932601 IL EPA Id: 316265016	700 NORTH KILBOURN A	W 1/8 - 1/4 (0.153 mi.)	D10	18
CHICAGO, CITY OF Incident Num: 940242 IL EPA Id: 316235058	715 NORTH KILBOURN	W 1/8 - 1/4 (0.164 mi.)	D16	29
 <u>Lower Elevation</u>	 <u>Address</u>	 <u>Direction / Distance</u>	 <u>Map ID</u>	 <u>Page</u>
<i>CHICAGO TRANSIT AUTH</i> NFA/NFR Letter: 4/27/2000 Incident Num: 923534 IL EPA Id: 316685038	<i>4401 W CHICAGO AVE</i>	<i>N 0 - 1/8 (0.095 mi.)</i>	<i>2</i>	<i>8</i>
FLORENCE MACARONI CO Incident Num: 982757 IL EPA Id: 316255156	4346 WEST CHICAGO	NNE 0 - 1/8 (0.111 mi.)	A3	10
<i>KERRIGAN LEWIS WIRE</i> NFA/NFR Letter: 5/13/2008 Incident Num: 982309 IL EPA Id: 316255153	<i>4421 W RICE ST</i>	<i>NNW 1/8 - 1/4 (0.159 mi.)</i>	<i>E12</i>	<i>22</i>
KEMMERER BOTTLING NFA/NFR Letter: 11/17/1993 Incident Num: 890951 IL EPA Id: 316265024	4433 WEST OHIO ST.	SSW 1/8 - 1/4 (0.180 mi.)	G18	31
<i>COLOVOS</i> NFA/NFR Letter: 6/17/1993	<i>4444 W OHIO ST</i>	<i>SSW 1/8 - 1/4 (0.184 mi.)</i>	<i>G21</i>	<i>35</i>

EXECUTIVE SUMMARY

Incident Num: 923204 IL EPA Id: 316260001					
BRACH & BROCK CONFEC NFA/NFR Letter: 12/30/1996 Incident Num: 960026 Incident Num: 952139 IL EPA Id: 316286330	4545 WEST RACE ST.	NW 1/8 - 1/4 (0.197 mi.)	H27	66	
CERTIFIED GROCERS NFA/NFR Letter: 1/14/2002 Incident Num: 912797 IL EPA Id: 316235033	4206 WEST CHICAGO AV	ENE 1/8 - 1/4 (0.241 mi.)	K34	79	
HOSPITAL LAUNDRY SER NFA/NFR Letter: 8/18/1993 Incident Num: 931621 IL EPA Id: 316235051	4141 WEST CHICAGO AV	ENE 1/4 - 1/2 (0.280 mi.)	35	79	
LIDLAW TRANSIT, INC NFA/NFR Letter: 10/8/1992 Incident Num: 921906 IL EPA Id: 316325145	902 KILBOURN ST.	NNW 1/4 - 1/2 (0.281 mi.)	36	80	
PROSPERITY TRUCKING NFA/NFR Letter: 7/14/1994 Incident Num: 940684 IL EPA Id: 316255093	4600 WEST ERIE	WSW 1/4 - 1/2 (0.300 mi.)	37	80	
L. PRITIKIN & BECKER Incident Num: 991926 IL EPA Id: 316255165	4224 WEST CHICAGO	ENE 1/4 - 1/2 (0.309 mi.)	38	81	
ST. FRANCIS OF ASSIS Incident Num: 20001171 IL EPA Id: 316255185	932 KOSTNER RD.	N 1/4 - 1/2 (0.313 mi.)	39	81	
PLAYSKOOL, INC.-NORT NFA/NFR Letter: 5/5/1994 0 Incident Num: 932448 IL EPA Id: 316005348	4501 WEST AUGUSTA BO	NNW 1/4 - 1/2 (0.371 mi.)	L41	85	
HUDSON SCREW MACHINE NFA/NFR Letter: 7/15/1994 Incident Num: 923161 IL EPA Id: 316235021	4500 WEST AUGUSTA BL	NNW 1/4 - 1/2 (0.392 mi.)	L43	93	
SCENTEX INC. NFA/NFR Letter: 12/29/2009 Incident Num: 921543 IL EPA Id: 316235070	4545 WEST AUGUSTA BL	NW 1/4 - 1/2 (0.410 mi.)	44	93	
UNION PACIFIC RAILRO Incident Num: 20150815 IL EPA Id: 316005912	400 NORTH PULASKI RO	S 1/4 - 1/2 (0.413 mi.)	M45	94	
UNION PACIFIC RAILRO NFA/NFR Letter: 10/23/2008 Incident Num: 20070188 IL EPA Id: 316005912	400 NORTH PULASKI	S 1/4 - 1/2 (0.413 mi.)	M46	95	
WHOLESALE OIL CO. Incident Num: 992412	4540 WEST AUGUSTA BL	NW 1/4 - 1/2 (0.448 mi.)	N49	98	

EXECUTIVE SUMMARY

IL EPA Id: 316255173 WHOLESALE OIL CO. Incident Num: 992411 IL EPA Id: 316255172	4560 WEST AUGUSTA BL	NW 1/4 - 1/2 (0.450 mi.)	N50	98
INDUSTRIAL METAL ENT NFA/NFR Letter: 7/14/1997 NFA/NFR Letter: 3/6/1996 0 Incident Num: 903302 Incident Num: 942667 IL EPA Id: 316255044	901 N KILPATRICK AVE	WNW 1/4 - 1/2 (0.462 mi.)	O51	99
BEARINGS MFG Incident Num: 980158 IL EPA Id: 316000090	1033 N KOLMAR	NNW 1/4 - 1/2 (0.463 mi.)	52	102
AE STALEY NFA/NFR Letter: 5/7/1996 0 Incident Num: 890973 IL EPA Id: 316235020	4616 WEST AUGUSTA BL	NW 1/4 - 1/2 (0.468 mi.)	53	104
VAUGHN MFG CO NFA/NFR Letter: 8/30/1994 Incident Num: 930007 IL EPA Id: 316003125	900 N KILPATRICK	WNW 1/4 - 1/2 (0.469 mi.)	O54	105
CHICAGO REAL ESTATE NFA/NFR Letter: 5/21/2013 Incident Num: 20130109 IL EPA Id: 316235188	4014 WEST CHICAGO AV	ENE 1/4 - 1/2 (0.479 mi.)	55	107
KEMMERER BOTTLING NFA/NFR Letter: 11/7/1994 Incident Num: 900638 IL EPA Id: 316265028	356 N KILBOURN	SSW 1/4 - 1/2 (0.485 mi.)	56	108

State and tribal registered storage tank lists

IL UST: The Underground Storage Tank database contains registered USTs. USTs are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA). The data come from the Illinois State Fire Marshal's STC Facility List.

A review of the IL UST list, as provided by EDR, and dated 07/24/2017 has revealed that there are 13 IL UST sites within approximately 0.25 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
RAIL IT PROPERTY Tank Status: Removed Status: CLOSED Facility Id: 2033951	733 N KILBOURN	W 1/8 - 1/4 (0.185 mi.)	22	40
DUNBAR ARMORED Tank Status: Currently in use Status: ACTIVE Facility Id: 2032579	4500 W. CHICAGO AVE.	WNW 1/8 - 1/4 (0.203 mi.)	I28	66
DEPT STREETS & SANIT	750 N KILBOURN AVE	W 1/8 - 1/4 (0.211 mi.)	J31	74

EXECUTIVE SUMMARY

Tank Status: Removed
 Status: CLOSED
 Facility Id: 2018804

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
FLORENCE MACARONI IN Tank Status: Exempt from registration Status: EXEMPT Facility Id: 2038571	4334 W CHICAGO AVE	NNE 0 - 1/8 (0.124 mi.)	A4	10
MACHINE SHOP Tank Status: Exempt from registration Status: EXEMPT Facility Id: 2045147	4416 W. CHICAGO AVEN	NNW 1/8 - 1/4 (0.126 mi.)	5	11
MOORE SUPPLY CO Tank Status: Removed Status: CLOSED Facility Id: 2031171	4318 W CHICAGO AVE	NE 1/8 - 1/4 (0.137 mi.)	B6	12
KERRIGAN LEWIS WIRE Tank Status: Exempt from registration Status: EXEMPT Facility Id: 2037489	4421 W RICE ST	NNW 1/8 - 1/4 (0.159 mi.)	E13	25
JOYCE BEVERAGES Tank Status: Removed Status: CLOSED Facility Id: 2007495	4433 W OHIO ST	SSW 1/8 - 1/4 (0.180 mi.)	G17	30
COLOVOS CO Tank Status: Removed Status: CLOSED Facility Id: 2030245	4444 W OHIO ST	SSW 1/8 - 1/4 (0.184 mi.)	G20	33
LC SQUARED Tank Status: Out of service Status: INACTIVE/HEATING OIL Facility Id: 2035418	4455 W RICE ST	NW 1/8 - 1/4 (0.194 mi.)	H24	63
BRACHS CANDY FACTORY Tank Status: Exempt from registration Status: EXEMPT Facility Id: 2034481	4545 RACE ST	NW 1/8 - 1/4 (0.197 mi.)	H25	64
COUNTRY DELIGHT Tank Status: Removed Status: CLOSED Facility Id: 2010448	4201 W CHICAGO AVE	ENE 1/8 - 1/4 (0.222 mi.)	K32	77
FORMER SWISS VALLEY Tank Status: Exempt from registration Status: EXEMPT Facility Id: 2042615	4155 W. CHICAGO AVEN	ENE 1/8 - 1/4 (0.238 mi.)	K33	78

EXECUTIVE SUMMARY

State and tribal institutional control / engineering control registries

IL ENG CONTROLS: Sites with Engineering Controls.

A review of the IL ENG CONTROLS list, as provided by EDR, and dated 06/29/2017 has revealed that there are 3 IL ENG CONTROLS sites within approximately 0.5 miles of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
AMERICAN ENVELOPE Illinois Epa Id: 0316006089	4440 WEST OHIO STREE	S 1/8 - 1/4 (0.152 mi.)	C9	16
COLOVOS Illinois Epa Id: 0316260001	4444 W OHIO ST	SSW 1/8 - 1/4 (0.184 mi.)	G21	35
PLAYSKOOL, INC.-NORT Illinois Epa Id: 0316005348	4501 WEST AUGUSTA BO	NNW 1/4 - 1/2 (0.371 mi.)	L41	85

IL INST CONTROL: Legal or administrative restrictions on land use and/or other activities (e.g., groundwater use restrictions) which effectively limit exposure to contamination may be employed as alternatives to removal or treatment of contamination.

A review of the IL INST CONTROL list, as provided by EDR, and dated 06/29/2017 has revealed that there are 5 IL INST CONTROL sites within approximately 0.5 miles of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
AMERICAN ENVELOPE Illinois EPA Id: 0316006089	4440 WEST OHIO STREE	S 1/8 - 1/4 (0.152 mi.)	C9	16
COLOVOS Illinois EPA Id: 0316260001	4444 W OHIO ST	SSW 1/8 - 1/4 (0.184 mi.)	G21	35
PLAYSKOOL, INC.-NORT Illinois EPA Id: 0316005348	4501 WEST AUGUSTA BO	NNW 1/4 - 1/2 (0.371 mi.)	L41	85
FERDINAND REALTY Illinois EPA Id: 0316265090	4100 WEST FERDINAND	SE 1/4 - 1/2 (0.418 mi.)	47	95
BETHEL NEW LIFE Illinois EPA Id: 0316265114	4235 WEST FERDINAND	SE 1/4 - 1/2 (0.432 mi.)	48	96

State and tribal voluntary cleanup sites

IL SRP: Illinois Environmental Protection Agency, Site Remediation Program Database

A review of the IL SRP list, as provided by EDR, and dated 06/29/2017 has revealed that there are 6 IL SRP sites within approximately 0.5 miles of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
AMERICAN ENVELOPE IL EPA Id: 0316006089	4440 WEST OHIO STREE	S 1/8 - 1/4 (0.152 mi.)	C9	16
COLOVOS IL EPA Id: 0316260001	4444 W OHIO ST	SSW 1/8 - 1/4 (0.184 mi.)	G21	35
CITY OF CHICAGO	4233 W FERDINAND	SSE 1/4 - 1/2 (0.328 mi.)	40	82

EXECUTIVE SUMMARY

IL EPA Id: 0316325300				
PLAYSKOOL, INC.-NORT	4501 WEST AUGUSTA BO	NNW 1/4 - 1/2 (0.371 mi.)	L41	85
IL EPA Id: 0316005348				
FERDINAND REALTY	4100 WEST FERDINAND	SE 1/4 - 1/2 (0.418 mi.)	47	95
IL EPA Id: 0316265090				
BETHEL NEW LIFE	4235 WEST FERDINAND	SE 1/4 - 1/2 (0.432 mi.)	48	96
IL EPA Id: 0316265114				

ADDITIONAL ENVIRONMENTAL RECORDS

Other Ascertainable Records

RCRA NonGen / NLR: RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

A review of the RCRA NonGen / NLR list, as provided by EDR, and dated 09/13/2017 has revealed that there are 7 RCRA NonGen / NLR sites within approximately 0.25 miles of the target property.

<u>Lower Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
CHICAGO TRANSIT AUTH	4401 W CHICAGO AVE	N 0 - 1/8 (0.095 mi.)	2	8
U. S. ART	4400 W OHIO ST	S 1/8 - 1/4 (0.156 mi.)	C11	18
STRONA WAREHOUSE	4350 W OHIO	SSE 1/8 - 1/4 (0.161 mi.)	F14	26
PPG INDUSTRIES INC S	4350 W OHIO ST	SSE 1/8 - 1/4 (0.161 mi.)	F15	28
F&B MFG CO	4248 W CHICAGO AVE	NE 1/8 - 1/4 (0.183 mi.)	19	31
INDUSTRIAL STORAGE W	4343 W OHIO ST	SSE 1/8 - 1/4 (0.190 mi.)	23	41
BRACHS CANDY FACTORY	4545 RACE ST	NW 1/8 - 1/4 (0.197 mi.)	H26	64

NY MANIFEST: Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

A review of the NY MANIFEST list, as provided by EDR, and dated 10/01/2017 has revealed that there is 1 NY MANIFEST site within approximately 0.25 miles of the target property.

<u>Equal/Higher Elevation</u>	<u>Address</u>	<u>Direction / Distance</u>	<u>Map ID</u>	<u>Page</u>
NORTHWEST SORTING CT	750 N KILBOURN AVE	W 1/8 - 1/4 (0.211 mi.)	J30	69
EPA ID: ILD980260855				

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 5109170.2S



- ★ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ▲ Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites

- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Upgradient Area



This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

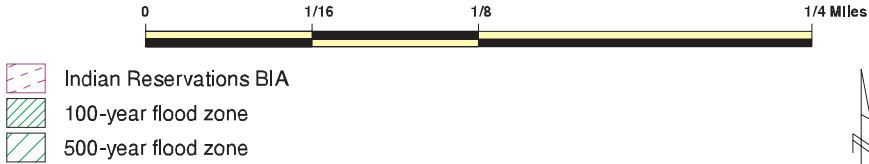
SITE NAME: Vacant Parcel
 ADDRESS: 4301 W. Chicago Ave
 CHICAGO IL 60651
 LAT/LONG: 41.893803 / 87.735743

CLIENT: AMEC Environment & Infrastructure, Inc.
 CONTACT: Mary Jank
 INQUIRY #: 5109170.2s
 DATE: November 15, 2017 6:04 pm

DETAIL MAP - 5109170.2S



- ★ Target Property
- ▲ Sites at elevations higher than or equal to the target property
- ◆ Sites at elevations lower than the target property
- ▲ Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites



- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Vacant Parcel
 ADDRESS: 4301 W. Chicago Ave
 CHICAGO IL 60651
 LAT/LONG: 41.893803 / 87.735743

CLIENT: AMEC Environment & Infrastructure, Inc.
 CONTACT: Mary Jank
 INQUIRY #: 5109170.2s
 DATE: November 15, 2017 6:06 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
<i>Federal NPL site list</i>								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
<i>Federal Delisted NPL site list</i>								
Delisted NPL	1.000		0	0	0	0	NR	0
<i>Federal CERCLIS list</i>								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
SEMS	0.500		0	0	0	NR	NR	0
<i>Federal CERCLIS NFRAP site list</i>								
SEMS-ARCHIVE	0.500		0	1	1	NR	NR	2
<i>Federal RCRA CORRACTS facilities list</i>								
CORRACTS	1.000		0	1	1	1	NR	3
<i>Federal RCRA non-CORRACTS TSD facilities list</i>								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
<i>Federal RCRA generators list</i>								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	5	NR	NR	NR	5
RCRA-CESQG	0.250		0	1	NR	NR	NR	1
<i>Federal institutional controls / engineering controls registries</i>								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
<i>Federal ERNS list</i>								
ERNS	TP		NR	NR	NR	NR	NR	0
<i>State- and tribal - equivalent CERCLIS</i>								
IL SSU	1.000		0	0	0	3	NR	3
<i>State and tribal landfill and/or solid waste disposal site lists</i>								
IL SWF/LF	0.500		0	0	0	NR	NR	0
IL CCDD	0.500		0	0	0	NR	NR	0
IL LF SPECIAL WASTE	0.500		0	0	0	NR	NR	0
IL NIPC	0.500		0	0	0	NR	NR	0
<i>State and tribal leaking storage tank lists</i>								
IL LUST	0.500		2	7	18	NR	NR	27

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
INDIAN LUST	0.500		0	0	0	NR	NR	0
IL LUST TRUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0
IL UST	0.250		1	12	NR	NR	NR	13
IL AST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
IL ENG CONTROLS	0.500		0	2	1	NR	NR	3
IL INST CONTROL	0.500		0	2	3	NR	NR	5
State and tribal voluntary cleanup sites								
IL SRP	0.500		0	2	4	NR	NR	6
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
IL BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
IHS OPEN DUMPS	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
IL CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
IL SPILLS	TP		NR	NR	NR	NR	NR	0
IL SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		1	6	NR	NR	NR	7
FUDS	1.000		0	0	0	0	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
FUSRAP	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
ABANDONED MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
UXO	1.000		0	0	0	0	NR	0
DOCKET HWC	TP		NR	NR	NR	NR	NR	0
ECHO	TP		NR	NR	NR	NR	NR	0
FUELS PROGRAM	0.250		0	0	NR	NR	NR	0
IL AIRS	TP		NR	NR	NR	NR	NR	0
IL BOL	TP		NR	NR	NR	NR	NR	0
IL CHICAGO ENV	TP	1	NR	NR	NR	NR	NR	1
IL COAL ASH	0.500		0	0	0	NR	NR	0
IL DRYCLEANERS	0.250		0	0	NR	NR	NR	0
IL Financial Assurance	TP		NR	NR	NR	NR	NR	0
IL HWAR	TP		NR	NR	NR	NR	NR	0
IL IMPDMENT	0.500		0	0	0	NR	NR	0
NY MANIFEST	0.250		0	1	NR	NR	NR	1
IL NPDES	TP		NR	NR	NR	NR	NR	0
IL PIMW	0.250		0	0	NR	NR	NR	0
IL TIER 2	TP		NR	NR	NR	NR	NR	0
IL UIC	TP		NR	NR	NR	NR	NR	0

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	1.000		0	0	0	0	NR	0
---------	-------	--	---	---	---	---	----	---

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
<u>EDR RECOVERED GOVERNMENT ARCHIVES</u>								
<i>Exclusive Recovered Govt. Archives</i>								
IL RGA HWS	TP		NR	NR	NR	NR	NR	0
IL RGA LF	TP		NR	NR	NR	NR	NR	0
IL RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		1	4	40	28	4	0	77

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

MAP FINDINGS

Map ID			EDR ID Number
Direction			EPA ID Number
Distance			
Elevation	Site	Database(s)	

1		IL CHICAGO ENV	S117499817
Target Property	4301 W CHICAGO AVE CHICAGO, IL		N/A

Actual: 610 ft.

CHICAGO ENV:

Map Location:	4301 W CHICAGO AVE; CHICAGO, IL; (41.895262, -87.733476)
Complaints:	Not reported
Neshaps and Demolition Notices:	Not reported
Enforcement:	Not reported
Inspections:	Not reported
Permits:	Y
Tanks:	Y
Holds and Lust Nfr:	Not reported
Latitude:	41.895262
Longitude:	-87.733476

2	CHICAGO TRANSIT AUTHORITY	IL LUST	1000824678
North	4401 W CHICAGO AVE	RCRA NonGen / NLR	ILD984910562
< 1/8	CHICAGO, IL 60651	FINDS	
0.095 mi.		ECHO	
501 ft.			

Relative: Lower

LUST:

Incident Num:	923534
IL EPA Id:	316685038
Product:	Gasoline
IEMA Date:	1992-12-11
Project Manager:	Weller
Project Manager Phone:	(217) 524-4647
Email:	Melinda.Weller@illinois.gov
PRP Name:	Chicago Transit Authority
PRP Contact:	Mary Cavanah
PRP Address:	Merchandise Mart, Room 405
PRP City,St,Zip:	Chicago, IL 60654
PRP Phone:	Not reported
Site Classification:	Not reported
Section 57.5(g) Letter:	731
Date Section 57.5(g) Letter:	Not reported
Non LUST Determination Letter:	Not reported
20 Report Received:	9/24/1993
45 Report Received:	9/24/1993
NFA/NFR Letter:	4/27/2000
NFR Date Recorded:	6/9/2000 0

RCRA NonGen / NLR:

Date form received by agency: 01/19/1993

Facility name: CHICAGO TRANSIT AUTHORITY

Facility address: 4401 W CHICAGO AVE
CHICAGO, IL 60651

EPA ID: ILD984910562

Mailing address: MERCHANDISE MART PLAZA RM 405
CHICAGO, IL 60654

Contact: MARY CAVAH

Contact address: MERCHANDISE MART PLAZA RM 405
CHICAGO, IL 60654

Contact country: US

Contact telephone: 312-664-7200

Contact email: Not reported

EPA Region: 05

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

CHICAGO TRANSIT AUTHORITY (Continued)

1000824678

Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: CHICAGO TRANSIT AUTHORITY
Owner/operator address: MERCHANDISE MART PLAZA
CHICAGO, IL 60654
Owner/operator country: Not reported
Owner/operator telephone: 312-664-7200
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Municipal
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

FINDS:

Registry ID: 110005920600

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

CHICAGO TRANSIT AUTHORITY (Continued)

1000824678

Envid: 1000824678
 Registry ID: 110005920600
 DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005920600>

A3
NNE
< 1/8
0.111 mi.
586 ft.

FLORENCE MACARONI CO.
4346 WEST CHICAGO
CHICAGO, IL 60651

IL LUST **S104529194**
N/A

Site 1 of 2 in cluster A

Relative:
Lower

LUST:

Incident Num: 982757
 IL EPA Id: 316255156
 Product: Other Petroleum
 IEMA Date: 1998-11-05
 Project Manager: Benedict
 Project Manager Phone: Not reported
 Email: Not reported
 PRP Name: Florence Macaroni Co.
 PRP Contact: Tom Behnke
 PRP Address: 4334 West Chicago Ave.
 PRP City,St,Zip: Chicago, IL 60651
 PRP Phone: 3122526113
 Site Classification: Not reported
 Section 57.5(g) Letter: 732
 Date Section 57.5(g) Letter: Not reported
 Non LUST Determination Letter: Not reported
 20 Report Received: Not reported
 45 Report Received: Not reported
NFA/NFR Letter: Not reported
 NFR Date Recorded: Not reported

Actual:
609 ft.

A4
NNE
< 1/8
0.124 mi.
657 ft.

FLORENCE MACARONI INC
4334 W CHICAGO AVE
CHICAGO, IL 60651

IL UST **U003668496**
N/A

Site 2 of 2 in cluster A

Relative:
Lower

UST:

Facility ID: 2038571
 Facility Status: EXEMPT
Facility Type: INDUSTRIAL / MANUFACTURING
 Owner Id: U0028391
 Owner Name: Roy Pier Dominici
 Owner Address: 4334 W Chicago Ave
 Owner City,St,Zip: Chicago, IL 60651

Actual:
608 ft.

Tank Number: 1
Tank Status: Exempt from registration
 Tank Capacity: 1000
 Tank Substance: Heating Oil
 Last Used Date: 12/1/1973
 OSFM First Notify Date: 11/30/1998
 Red Tag Issue Date: Not reported
 Install Date: Not reported
Green Tag Decal: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

FLORENCE MACARONI INC (Continued)

U003668496

Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

5
NNW
1/8-1/4
0.126 mi.
663 ft.

MACHINE SHOP
4416 W. CHICAGO AVENUE
CHICAGO, IL 60651

IL UST U004191082
N/A

Relative:
Lower

UST:

Facility ID: 2045147
Facility Status: EXEMPT
Facility Type: INDUSTRIAL / MANUFACTURING
Owner Id: U0036565
Owner Name: Simplomatic Manufacturing
Owner Address: 816 N. Kostner Ave.
Owner City,St,Zip: Chicago, IL 60651

Actual:
609 ft.

Tank Number: 1
Tank Status: Exempt from registration
Tank Capacity: 1000
Tank Substance: Heating Oil
Last Used Date: 12/31/1973
OSFM First Notify Date: 5/14/2012
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

B6
NE
1/8-1/4
0.137 mi.
721 ft.

MOORE SUPPLY CO
4318 W CHICAGO AVE
CHICAGO, IL 60651

Site 1 of 2 in cluster B

IL UST **U001142848**
IL BOL **N/A**

Relative:
Lower

UST:

Actual:
608 ft.

Facility ID: 2031171
Facility Status: CLOSED
Facility Type: COMMERCIAL / RETAIL
Owner Id: U0020456
Owner Name: Moore Supply Co
Owner Address: 4318 W Chicago Ave
Owner City,St,Zip: Chicago, IL 60651

Tank Number: 1
Tank Status: Removed
Tank Capacity: 1000
Tank Substance: Diesel Fuel
Last Used Date: 1/1/1902
OSFM First Notify Date: 8/4/1992
Red Tag Issue Date: Not reported
Install Date: 1/1/1947
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

BOL:

Site Id: 170000297523
Inv Num: 0316235042
Interest Name: Moore Supply Co
Interest Type: BOL
Media Code: LAND

B7
NE
1/8-1/4
0.137 mi.
721 ft.

MOORE SUPPLY CO
4318 W CHICAGO AVE
CHICAGO, IL 60651

Site 2 of 2 in cluster B

RCRA-SQG **1000823882**
FINDS **ILD984902163**
ECHO

Relative:
Lower

RCRA-SQG:

Actual:
608 ft.

Date form received by agency: 08/12/1992
Facility name: MOORE SUPPLY CO
Facility address: 4318 W CHICAGO AVE
CHICAGO, IL 60651
EPA ID: ILD984902163
Contact: DICK MOORE SR
Contact address: 4318 W CHICAGO AVE
CHICAGO, IL 60651

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

MOORE SUPPLY CO (Continued)

1000823882

Contact country: US
Contact telephone: 312-235-4400
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name: MOORE SUPPLY CO
Owner/operator address: 4318 W CHICAGO AVE
CHICAGO, IL 60651
Owner/operator country: Not reported
Owner/operator telephone: 312-235-4400
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

FINDS:

Registry ID: 110005915180

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

MOORE SUPPLY CO (Continued)

1000823882

events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000823882
Registry ID: 110005915180
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005915180>

8
North
1/8-1/4
0.139 mi.
734 ft.

SIMPLOMATIC MFG
816 N KOSTNER
CHICAGO, IL 60651

RCRA-SQG 1000348306
FINDS ILD005127121
ECHO

Relative:
Lower

RCRA-SQG:

Date form received by agency: 03/17/1989
Facility name: SIMPLOMATIC MFG
Facility address: 816 N KOSTNER
CHICAGO, IL 60651
EPA ID: ILD005127121
Contact: PAT HAIRPOLD
Contact address: 816 N KOSTNER
CHICAGO, IL 60651
Contact country: US
Contact telephone: 312-342-7757
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Actual:
608 ft.

Owner/Operator Summary:

Owner/operator name: SIMPLOMATIC MFG CO
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported
Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

SIMPLOMATIC MFG (Continued)

1000348306

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D000
. Waste name: Not Defined

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: F002
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Violation Status: No violations found

FINDS:

Registry ID: 110005814413

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport,

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

SIMPLOMATIC MFG (Continued)

1000348306

and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000348306
 Registry ID: 110005814413
 DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005814413>

C9
South
1/8-1/4
0.152 mi.
800 ft.

AMERICAN ENVELOPE
4440 WEST OHIO STREET
CHICAGO, IL 60624

IL ENG CONTROLS
IL INST CONTROL
IL SRP

S110685041
N/A

Site 1 of 2 in cluster C

Relative:
Lower

ENGINEERING CONTROLS:

Illinois Epa Id: 0316006089
 NFR Letter: 12/21/2010
 Date NFR Recorded: 12/27/2010
 Comprehensive / Focused: Comprehensive
 Remediation Applicant Name: Mason Awtry
 RA Company: Rolam Equities, LLC
 RA Address: 5000 West Roosevelt Road
 RA City,St,Zip: Chicago, IL 60644
 Worker Caution: Yes
 Acres: 4.5
 Land Use: Industrial/Commercial
 Ground Water Use Restriction: No
 Highway Authority Agreement: No
 Ordinance: No
 Industrial - Commercial: Yes
 Slab on Grade: No
 BCT: No
 Building Slab: Yes
 Asphalt Used: Yes
 Concrete Used: No
 Clean Soil 3ft: No
 Clean Soil 10ft: No
 Alternate Barrier: No

Actual:
609 ft.

IL INSTUTIONAL CONTROL:

Illinois EPA Id: 0316006089
 NFR Letter: 12/21/2010
 Date NFR Recorded: 12/27/2010
 Comprehensive / Focused: Comprehensive
 Remediation Applicant Name: Mason Awtry
 RA Company: Rolam Equities, LLC
 RA Address: 5000 West Roosevelt Road
 RA City,St,Zip: Chicago, IL 60644
 Worker Caution: Yes
 Acres: 4.5
 Land Use: Industrial/Commercial
 Ground Water Use Restriction: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

AMERICAN ENVELOPE (Continued)

S110685041

Highway Authority Agreement: No
Ordinance: No
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

SRP:

IL EPA Id: 0316006089
US EPA Id: ILD026330969
Longitude: -87.735729
Latitude: 41.892008
Contact Name: Mason Awtry
Contact Address: 5000 West Roosevelt Road
Contact City,St,Zip: Chicago, IL 60644
Date Enrolled: 05/28/2010
Point Of Contact: Megan Wells-Paske
Consultant Company: Pioneer Engineering & Environmental Services, Inc.
Consultant Address: 700 North Sacramento Boulevard
Consultant City,St,Zip: Chicago, IL 60612
Proj Mgr Assigned: Jim Mergen
Sec. 4 Letter Date: Not reported
Active: No
Remediation Applicant Co: Rolam Equities, LLC
Remediation Applicant Name: Mason Awtry
Remediation Applicant Company: Rolam Equities, LLC
Remediation Applicant Address: 5000 West Roosevelt Road
Remediation Applicant City,St,Zip: Chicago, IL 60644
Illinois EPA: 0316006089
Site Name: American Envelope
NFR Letter: 2010-12-21
NFR Letter Date Recorded: 2010-12-27
Comprehensive/Focused: Comprehensive
Worker Caution: Yes
Acres: 4.5
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: No
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

AMERICAN ENVELOPE (Continued)

S110685041

[Click here for IL SRP:](#)

D10
West
1/8-1/4
0.153 mi.
806 ft.

CHICAGO, CITY OF
700 NORTH KILBOURN AVE.
CHICAGO, IL 60624

IL LUST S105225790
N/A

Site 1 of 2 in cluster D

Relative:
Higher

LUST:

Incident Num: 932601
IL EPA Id: 316265016
Product: Not reported
IEMA Date: 1993-09-28
Project Manager: Reuter
Project Manager Phone: Not reported
Email: Not reported
PRP Name: City of Chicago
PRP Contact: William Abolt
PRP Address: 320 North Clark St., Room 600A
PRP City,St,Zip: Chicago, IL 60610
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 6/29/1994
45 Report Received: Not reported
NFA/NFR Letter: 5/15/1995
NFR Date Recorded: Not reported

Actual:
610 ft.

C11
South
1/8-1/4
0.156 mi.
822 ft.

U. S. ART
4400 W OHIO ST
CHICAGO, IL 60624

RCRA NonGen / NLR 1000291621
ILD026330969

Site 2 of 2 in cluster C

Relative:
Lower

RCRA NonGen / NLR:

Date form received by agency: 05/12/2016
Facility name: U. S. ART
Facility address: 4400 W OHIO ST
CHICAGO, IL 60624
EPA ID: ILD026330969
Contact: CHRIS MARAVICH
Contact address: 4400 W OHIO ST
CHICAGO, IL 60624
Contact country: US
Contact telephone: 773-801-1811
Contact email: Not reported
EPA Region: 05
Land type: Private
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Actual:
609 ft.

Owner/Operator Summary:

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

U. S. ART (Continued)

1000291621

CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: MAIL WELL CORP
Owner/operator address: 23 INVERNESS WAY E
ENGLEWOOD, CO 80112

Owner/operator country: Not reported
Owner/operator telephone: 303-790-8023
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:

Date form received by agency: 03/19/1997
Site name: AMERICAN MAIL WELL ENVELOPE
Classification: Small Quantity Generator

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D018
. Waste name: BENZENE

. Waste code: D035
. Waste name: METHYL ETHYL KETONE

. Waste code: D040

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

U. S. ART (Continued)

1000291621

- . Waste name: TRICHTHLORETHYLENE
- . Waste code: F002
- . Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHTHLORETHYLENE, 1,1,1-TRICHTHLORETHANE, CHLOROBENZENE, 1,1,2-TRICHTHLORE-1,2,2-TRIFLUOROETHANE, ORTHO-DICHTHLOREBENZENE, TRICHTHLOREFLUOROMETHANE, AND 1,1,2, TRICHTHLORETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.
- . Waste code: F003
- . Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.
- . Waste code: F005
- . Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Date form received by agency: 03/01/1996
Site name: AMERICAN MAIL WELL ENVELOPE
Classification: Large Quantity Generator

Date form received by agency: 03/01/1994
Site name: MILLS-AMERICAN ENVELOPE CO
Classification: Large Quantity Generator

Date form received by agency: 03/01/1992
Site name: MILLS-AMERICAN ENVELOPE CO
Classification: Large Quantity Generator

Date form received by agency: 02/28/1990
Site name: MILLS-AMERICAN ENVELOPE CO
Classification: Large Quantity Generator

Facility Has Received Notices of Violations:
Regulation violated: SR - 722.111
Area of violation: Generators - General
Date violation determined: 12/14/1989
Date achieved compliance: 03/08/1990
Violation lead agency: State
Enforcement action: VIOLATION NOTICE (VN)

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

U. S. ART (Continued)

1000291621

Enforcement action date: 01/26/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: SR - 722.134(a)
Area of violation: Generators - Pre-transport
Date violation determined: 12/14/1989
Date achieved compliance: 05/04/1990
Violation lead agency: State
Enforcement action: VIOLATION NOTICE (VN)
Enforcement action date: 01/26/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: State
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Regulation violated: Not reported
Area of violation: LDR - General
Date violation determined: 12/14/1989
Date achieved compliance: 07/27/1990
Violation lead agency: State
Enforcement action: WRITTEN INFORMAL
Enforcement action date: 02/02/1990
Enf. disposition status: Not reported
Enf. disp. status date: Not reported
Enforcement lead agency: EPA
Proposed penalty amount: Not reported
Final penalty amount: Not reported
Paid penalty amount: Not reported

Evaluation Action Summary:
Evaluation date: 04/05/2016
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Not reported
Date achieved compliance: Not reported
Evaluation lead agency: State

Evaluation date: 12/14/1989
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: Generators - Pre-transport
Date achieved compliance: 05/04/1990
Evaluation lead agency: State

Evaluation date: 12/14/1989
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE
Area of violation: LDR - General
Date achieved compliance: 07/27/1990
Evaluation lead agency: State

Evaluation date: 12/14/1989
Evaluation: COMPLIANCE EVALUATION INSPECTION ON-SITE

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

U. S. ART (Continued)

1000291621

Area of violation: Generators - General
Date achieved compliance: 03/08/1990
Evaluation lead agency: State

**E12
NNW
1/8-1/4
0.159 mi.
838 ft.**

**KERRIGAN LEWIS WIRE CDT
4421 W RICE ST
CHICAGO, IL 60651**

**RCRA-SQG 1001404616
IL LUST ILR000060475
ICIS
FINDS**

Site 1 of 2 in cluster E

**Relative:
Lower**

RCRA-SQG:

**Actual:
608 ft.**

Date form received by agency: 01/12/1999
Facility name: KERRIGAN LEWIS WIRE CDT
Facility address: 4421 W RICE ST
CHICAGO, IL 60651
EPA ID: ILR000060475
Contact: JAMES KOMOROWSKI
Contact address: 4421 W RICE ST
CHICAGO, IL 60651
Contact country: US
Contact telephone: 773-772-7208
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name: DEARBORN CDT INC
Owner/operator address: 250 W CARPENTER AVE
WHEELING, IL 60090
Owner/operator country: Not reported
Owner/operator telephone: 847-459-1000
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

KERRIGAN LEWIS WIRE CDT (Continued)

1001404616

Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

LUST:

Incident Num: 982309
IL EPA Id: 316255153
Product: Other Petroleum
IEMA Date: 1998-09-17
Project Manager: McGill
Project Manager Phone: (217) 524-5137
Email: Scott.McGill@illinois.gov
PRP Name: Kerrigan-Lewis Lawyer-CDT
PRP Contact: John Ciesla
PRP Address: 4421 West Rice St.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: 7737727208
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 12/16/1998
45 Report Received: 12/16/1998
NFA/NFR Letter: 5/13/2008
NFR Date Recorded: 7/1/2008 0

ICIS:

Enforcement Action ID: 05-2010-0087
FRS ID: 110001228779
Action Name: Kerrigan Lewis Notice of Determination
Facility Name: KERRIGAN LEWIS CO
Facility Address: 4421 WEST RICE STREET
CHICAGO, IL 60651
Enforcement Action Type: EPCRA 325 Action For Penalty
Facility County: COOK
Program System Acronym: ICIS
Enforcement Action Forum Desc: Administrative - Formal
EA Type Code: 325
Facility SIC Code: Not reported
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.896117
Longitude in Decimal Degrees: -87.736469
Permit Type Desc: Not reported
Program System Acronym: 1800019023
Facility NAICS Code: Not reported
Tribal Land Code: Not reported

Facility Name: KERRIGAN LEWIS CO
Address: 4421 W RICE ST
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

KERRIGAN LEWIS WIRE CDT (Continued)

1001404616

SIC Code: Not reported

Facility Name: KERRIGAN LEWIS CO
Address: 4421 W RICE ST
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: Not reported

Facility Name: KERRIGAN LEWIS CO
Address: 4421 W RICE ST
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: Not reported

Facility Name: KERRIGAN LEWIS CO
Address: 4421 W RICE ST
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: Not reported

FINDS:

Registry ID: 110001228779

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

AIR MINOR

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

KERRIGAN LEWIS WIRE CDT (Continued)

1001404616

ICIS (Integrated Compliance Information System) is the Integrated Compliance Information System and provides a database that, when complete, will contain integrated Enforcement and Compliance information across most of EPA's programs. The vision for ICIS is to replace EPA's independent databases that contain Enforcement data with a single repository for that information. Currently, ICIS contains all Federal Administrative and Judicial enforcement actions. This information is maintained in ICIS by EPA in the Regional offices and it Headquarters. A future release of ICIS will replace the Permit Compliance System (PCS) which supports the NPDES and will integrate that information with Federal actions already in the system. ICIS also has the capability to track other activities occurring in the Region that support Compliance and Enforcement programs. These include; Incident Tracking, Compliance Assistance, and Compliance Monitoring.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

**E13
 NNW
 1/8-1/4
 0.159 mi.
 838 ft.**

**KERRIGAN LEWIS WIRE CDT
 4421 W RICE ST
 CHICAGO, IL 60651**

**IL UST U003668320
 N/A**

Site 2 of 2 in cluster E

**Relative:
 Lower**

UST:

**Actual:
 608 ft.**

Facility ID: 2037489
 Facility Status: EXEMPT
Facility Type: INDUSTRIAL / MANUFACTURING
 Owner Id: U0027826
 Owner Name: Kerrigan Lewis Wire Cdt
 Owner Address: 4421 W Rice St
 Owner City,St,Zip: Chicago, IL 60651

Tank Number: 1
Tank Status: Exempt from registration
 Tank Capacity: 1000
 Tank Substance: Heating Oil
 Last Used Date: 1/1/1967
 OSFM First Notify Date: 8/25/1998
 Red Tag Issue Date: Not reported
 Install Date: 1/1/1953
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: Not reported
 Motor Fuel Permit Inspection Date: Not reported
 Motor Fuel Permit Expiration Date: Not reported
 MOTOR FUEL TYPE: Not reported
 Pending Nov: N
 IEMA: 98-2309
 Equipment Type: Not reported
 Equipment: Not reported
 Last Passing Date: Not reported
 Test Expire Date: Not reported

Tank Number: 2

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

KERRIGAN LEWIS WIRE CDT (Continued)

U003668320

Tank Status:	Exempt from registration
Tank Capacity:	3000
Tank Substance:	Heating Oil
Last Used Date:	1/1/1967
OSFM First Notify Date:	8/25/1998
Red Tag Issue Date:	Not reported
Install Date:	1/1/1953
Green Tag Decal:	Not reported
Green Tag Issue Date:	Not reported
Green Tag Expire Date:	Not reported
Fee Due:	Not reported
Motor Fuel Permit Inspection Date:	Not reported
Motor Fuel Permit Expiration Date:	Not reported
MOTOR FUEL TYPE:	Not reported
Pending Nov:	N
IEMA:	Not reported
Equipment Type:	Not reported
Equipment:	Not reported
Last Passing Date:	Not reported
Test Expire Date:	Not reported

Tank Number:	3
Tank Status:	Exempt from registration
Tank Capacity:	1000
Tank Substance:	Heating Oil
Last Used Date:	1/1/1967
OSFM First Notify Date:	8/25/1998
Red Tag Issue Date:	Not reported
Install Date:	1/1/1953
Green Tag Decal:	Not reported
Green Tag Issue Date:	Not reported
Green Tag Expire Date:	Not reported
Fee Due:	Not reported
Motor Fuel Permit Inspection Date:	Not reported
Motor Fuel Permit Expiration Date:	Not reported
MOTOR FUEL TYPE:	Not reported
Pending Nov:	N
IEMA:	Not reported
Equipment Type:	Not reported
Equipment:	Not reported
Last Passing Date:	Not reported
Test Expire Date:	Not reported

F14
SSE
 1/8-1/4
 0.161 mi.
 851 ft.

STRONA WAREHOUSE
4350 W OHIO
CHICAGO, IL 60624
 Site 1 of 2 in cluster F

RCRA NonGen / NLR 1000338276
FINDS ILD984767491
ECHO

Relative:
Lower

RCRA NonGen / NLR:
 Date form received by agency: 11/01/2007
 Facility name: STRONA WAREHOUSE
 Facility address: 4350 W OHIO
 CHICAGO, IL 60624
 EPA ID: ILD984767491
 Contact: ENV COORDINATOR
 Contact address: Not reported

Actual:
609 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

STRONA WAREHOUSE (Continued)

1000338276

Contact country: Not reported
Contact telephone: US
Contact telephone: 713-754-4258
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: SCHULMAN GEROME
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:

Date form received by agency: 11/09/1988
Site name: STRONA WAREHOUSE
Classification: Large Quantity Generator

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

STRONA WAREHOUSE (Continued)

1000338276

- . Waste code: D001
- . Waste name: IGNITABLE WASTE

- . Waste code: U056
- . Waste name: BENZENE, HEXAHYDRO- (I) (OR) CYCLOHEXANE (I)

Violation Status: No violations found

FINDS:

Registry ID: 110005830244

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000338276
Registry ID: 110005830244
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005830244>

F15
SSE
1/8-1/4
0.161 mi.
851 ft.

PPG INDUSTRIES INC STRONA WAREHOUSE CO
4350 W OHIO ST
CHICAGO, IL 60624
Site 2 of 2 in cluster F

RCRA NonGen / NLR

1000119742
ILD049816796

Relative:
Lower

RCRA NonGen / NLR:

Date form received by agency: 05/04/1981
Facility name: PPG INDUSTRIES INC STRONA WAREHOUSE CO
Facility address: 4350 W OHIO ST
CHICAGO, IL 60624
EPA ID: ILD049816796
Mailing address: ONE GATEWAY CENTER
PITTSBURGH, PA 15222
Contact: S WEIDA
Contact address: ONE GATEWAY CENTER
PITTSBURGH, PA 15222
Contact country: US
Contact telephone: 412-434-4407
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

PPG INDUSTRIES INC STRONA WAREHOUSE CO (Continued)

1000119742

Owner/operator country: Not reported
 Owner/operator telephone: 312-555-1212
 Owner/operator email: Not reported
 Owner/operator fax: Not reported
 Owner/operator extension: Not reported
 Legal status: Private
 Owner/Operator Type: Owner
 Owner/Op start date: Not reported
 Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
 Owner/operator address: ADDRESS NOT REPORTED
 CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
 Owner/operator telephone: 312-555-1212
 Owner/operator email: Not reported
 Owner/operator fax: Not reported
 Owner/operator extension: Not reported
 Legal status: Private
 Owner/Operator Type: Operator
 Owner/Op start date: Not reported
 Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
 Mixed waste (haz. and radioactive): No
 Recycler of hazardous waste: No
 Transporter of hazardous waste: No
 Treater, storer or disposer of HW: No
 Underground injection activity: No
 On-site burner exemption: No
 Furnace exemption: No
 Used oil fuel burner: No
 Used oil processor: No
 User oil refiner: No
 Used oil fuel marketer to burner: No
 Used oil Specification marketer: No
 Used oil transfer facility: No
 Used oil transporter: No

Violation Status: No violations found

D16
West
1/8-1/4
0.164 mi.
865 ft.

CHICAGO, CITY OF
715 NORTH KILBOURN
CHICAGO, IL 60624
Site 2 of 2 in cluster D

IL LUST S105225786
N/A

Relative:
Higher

LUST:
 Incident Num: 940242
 IL EPA Id: 316235058
 Product: Gasoline
 IEMA Date: 1994-02-01
 Project Manager: D. Hollis
 Project Manager Phone: Not reported
 Email: Not reported
 PRP Name: City of Chicago
 PRP Contact: Richard Bolger

Actual:
610 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

CHICAGO, CITY OF (Continued)

S105225786

PRP Address: 1685 North Throop St.
PRP City,St,Zip: Chicago, IL 60622
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: 5/9/1996 0
20 Report Received: 3/23/1994
45 Report Received: Not reported
NFA/NFR Letter: Not reported
NFR Date Recorded: Not reported

G17
SSW
1/8-1/4
0.180 mi.
948 ft.

JOYCE BEVERAGES
4433 W OHIO ST
CHICAGO, IL 60624

IL UST **U000791671**
N/A

Site 1 of 4 in cluster G

Relative:
Lower

UST:

Facility ID: 2007495
Facility Status: CLOSED
Facility Type: NONE
Owner Id: U0008127
Owner Name: American Bottling Co
Owner Address: 7955 S Cass Ave Suite 201
Owner City,St,Zip: Darien, IL 60561

Actual:
608 ft.

Tank Number: 1
Tank Status: Removed
Tank Capacity: 10000
Tank Substance: Gasoline
Last Used Date: Not reported
OSFM First Notify Date: 4/22/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

MAP FINDINGS

Map ID
Direction
Distance
Elevation

Site

Database(s)

EDR ID Number
EPA ID Number

G18
SSW
1/8-1/4
0.180 mi.
948 ft.

KEMMERER BOTTLING
4433 WEST OHIO ST.
CHICAGO, IL 60624

Site 2 of 4 in cluster G

IL LUST **S104527796**
N/A

Relative:
Lower

LUST:
Incident Num: 890951
IL EPA Id: 316265024
Product: Gasoline
IEMA Date: 1989-06-08
Project Manager: Harlow
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Kemmerer Bottling
PRP Contact: Ron McFarland
PRP Address: 777 Joyce Rd.
PRP City,St,Zip: Joliet, IL 60434
PRP Phone: Not reported
Site Classification: NFA
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 2/29/1992
45 Report Received: 2/29/1992
NFA/NFR Letter: 11/17/1993
NFR Date Recorded: Not reported

19
NE
1/8-1/4
0.183 mi.
966 ft.

F&B MFG CO
4248 W CHICAGO AVE
CHICAGO, IL 60651

RCRA NonGen / NLR **1000103708**
FINDS **ILD096462320**
ECHO

Relative:
Lower

RCRA NonGen / NLR:
Date form received by agency: 11/19/1984
Facility name: F & B MFG CO
Facility address: 4248 W CHICAGO AVE
CHICAGO, IL 60651

EPA ID: ILD096462320
Contact: RONALD SLABAS
Contact address: 4248 W CHICAGO AVE
CHICAGO, IL 60651

Contact country: US
Contact telephone: 312-227-4840
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:
Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

F&B MFG CO (Continued)

1000103708

Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D000
. Waste name: Not Defined

. Waste code: F001
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHTHLORETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHTHLORETHANE, CARBON TETRACHLORIDE AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: U228
. Waste name: ETHENE, TRICHTHLORO- (OR) TRICHTHLORETHYLENE

Violation Status: No violations found

FINDS:

Registry ID: 110005843427

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

F&B MFG CO (Continued)

1000103708

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000103708
 Registry ID: 110005843427
 DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005843427>

G20
SSW
1/8-1/4
0.184 mi.
974 ft.

COLOVOS CO
4444 W OHIO ST
CHICAGO, IL 60626
Site 3 of 4 in cluster G

IL UST U001142336
IL BOL N/A

Relative:
Lower

UST:

Facility ID: 2030245
 Facility Status: CLOSED
Facility Type: INDUSTRIAL / MANUFACTURING
 Owner Id: U0019799
 Owner Name: Colovos Co
 Owner Address: 4444 W Ohio St
 Owner City,St,Zip: Chicago, IL 60626

Actual:
608 ft.

Tank Number: 1
Tank Status: Removed
 Tank Capacity: 15000
 Tank Substance: Heating Oil
 Last Used Date: 11/1/1992
 OSFM First Notify Date: 6/10/1992
 Red Tag Issue Date: Not reported
 Install Date: 1/1/1971
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: Not reported
 Motor Fuel Permit Inspection Date: Not reported
 Motor Fuel Permit Expiration Date: Not reported
 MOTOR FUEL TYPE: Not reported
 Pending Nov: N
 IEMA: Not reported
 Equipment Type: Not reported
 Equipment: Not reported
 Last Passing Date: Not reported
 Test Expire Date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

COLOVOS CO (Continued)

U001142336

Tank Number: 2
Tank Status: **Removed**
Tank Capacity: 10000
Tank Substance: Heating Oil
Last Used Date: 11/1/1992
OSFM First Notify Date: 6/10/1992
Red Tag Issue Date: Not reported
Install Date: 1/1/1971
Green Tag Decal: **Not reported**
Green Tag Issue Date: **Not reported**
Green Tag Expire Date: **Not reported**
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 3
Tank Status: **Removed**
Tank Capacity: 10000
Tank Substance: Heating Oil
Last Used Date: 1/1/1986
OSFM First Notify Date: 2/15/1994
Red Tag Issue Date: Not reported
Install Date: 1/1/1974
Green Tag Decal: **Not reported**
Green Tag Issue Date: **Not reported**
Green Tag Expire Date: **Not reported**
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 4
Tank Status: **Removed**
Tank Capacity: 3000
Tank Substance: Not reported
Last Used Date: 1/1/1986
OSFM First Notify Date: 2/15/1994
Red Tag Issue Date: Not reported
Install Date: 1/1/1971
Green Tag Decal: **Not reported**
Green Tag Issue Date: **Not reported**
Green Tag Expire Date: **Not reported**

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

COLOVOS CO (Continued)

U001142336

Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

BOL:

Site Id: 170000174335
Inv Num: 0316260001
Interest Name: Colovos Co
Interest Type: BOL
Media Code: LAND

G21
SSW
1/8-1/4
0.184 mi.
974 ft.

COLOVOS
4444 W OHIO ST
CHICAGO, IL 60639
Site 4 of 4 in cluster G

SEMS-ARCHIVE 1000437011
CORRACTS ILD047584198
RCRA-SQG
IL LUST
IL ENG CONTROLS
IL INST CONTROL
IL SRP

Relative:
Lower

Actual:
608 ft.

SEMS-ARCHIVE:
Site ID: 507143
EPA ID: ILD047584198
Federal Facility: N
NPL: Not on the NPL
Non NPL Status: Deferred to RCRA

Following information was gathered from the prior CERCLIS update completed in 10/2013:

Site ID: 0507143
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: Deferred to RCRA

CERCLIS-NFRAP Site Alias Name(s):

Alias Name: COLOVOS
Alias Address: Not reported
Not reported

Program Priority:

Description: RCRA Deferral Audit

Description: RCRA Deferral - Lead Confirmed

CERCLIS-NFRAP Assessment History:

Action: ARCHIVE SITE
Date Started: / /
Date Completed: 12/11/95
Priority Level: Not reported

Action: PRELIMINARY ASSESSMENT

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

COLOVOS (Continued)

1000437011

Date Started: / /
Date Completed: 03/16/93
Priority Level: Deferred to RCRA (Subtitle C)

Action: DISCOVERY
Date Started: / /
Date Completed: 08/26/92
Priority Level: Not reported

CORRACTS:

EPA ID: ILD047584198
EPA Region: 05
Area Name: ENTIRE FACILITY
Actual Date: 19921228
Action: CA075LO - CA Prioritization, Facility or area was assigned a low corrective action priority
NAICS Code(s): Not reported
Original schedule date: Not reported
Schedule end date: Not reported

RCRA-SQG:

Date form received by agency: 11/17/1997
Facility name: COLOVOS
Facility address: 4444 W OHIO ST
CHICAGO, IL 60639
EPA ID: ILD047584198
Contact: MARVIN PEOPLES
Contact address: 4444 W OHIO ST
CHICAGO, IL 60639
Contact country: US
Contact telephone: 773-533-4444
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name: SCHWINN BICYCLE COMPANY
Owner/operator address: 1856 N. KOSTNER AVE.
CITY NOT REPORTED, IL 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-292-2900
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

COLOVOS (Continued)

1000437011

Owner/operator name: COLOVOS CO
Owner/operator address: 4444 W OHIO
CHICAGO, IL 60624
Owner/operator country: Not reported
Owner/operator telephone: 312-533-4444
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: F003
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F005
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Historical Generators:

Date form received by agency: 03/01/1996

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

COLOVOS (Continued)

1000437011

Site name: COLOVOS CO
Classification: Large Quantity Generator

Date form received by agency: 11/12/1980

Site name: COLOVOS
Classification: Not a generator, verified

. Waste code: F001

. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING:
TETRACHLOROETHYLENE, TRICHLORETHYLENE, METHYLENE CHLORIDE,
1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE AND CHLORINATED
FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING
CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF
ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED
IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE
SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: P030

. Waste name: CYANIDES (SOLUBLE CYANIDE SALTS), NOT OTHERWISE SPECIFIED

Corrective Action Summary:

Event date: 12/28/1992
Event: CA PRIORITIZATION-LOW CA PRIORITY

Violation Status: No violations found

LUST:

Incident Num: 923204
IL EPA Id: 316260001
Product: Fuel Oil
IEMA Date: 1992-11-12
Project Manager: Kessinger
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Colovos Co.
PRP Contact: Soto Colovos
PRP Address: 4444 West Ohio St.
PRP City,St,Zip: Chicago, IL 60624
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 11/30/1992
45 Report Received: 4/6/1993 0
NFA/NFR Letter: 6/17/1993
NFR Date Recorded: Not reported

ENGINEERING CONTROLS:

Illinois Epa Id: 0316260001
NFR Letter: 07/03/1996
Date NFR Recorded: 07/10/1997
Comprehensive / Focused: Focused
Remediation Applicant Name: Mark Levit
RA Company: Colovos Company
RA Address: 4444 West Ohio Street
RA City,St,Zip: Chicago, IL 60624

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

COLOVOS (Continued)

1000437011

Worker Caution: Yes
Acres: 2.97
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: No
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: No
Asphalt Used: No
Concrete Used: Yes
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

IL INSTUTIONAL CONTROL:

Illinois EPA Id: 0316260001
NFR Letter: 07/03/1996
Date NFR Recorded: 07/10/1997
Comprehensive / Focused: Focused
Remediation Applicant Name: Mark Levit
RA Company: Colovos Company
RA Address: 4444 West Ohio Street
RA City,St,Zip: Chicago, IL 60624
Worker Caution: Yes
Acres: 2.97
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: No
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: No
Asphalt Used: No
Concrete Used: Yes
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

SRP:

IL EPA Id: 0316260001
US EPA Id: ILD047584198
Longitude: -87.737476
Latitude: 41.892383
Contact Name: Mark Levit
Contact Address: 4444 West Ohio Street
Contact City,St,Zip: Chicago, IL 60624
Date Enrolled: 03/14/1994
Point Of Contact: Ronald W. Schrack, P.E.
Consultant Company: Schrack Environmental Consulting, Inc.
Consultant Address: 2 Mid America Plaza
Consultant City,St,Zip: Oakbrook Terrace, IL 60181
Proj Mgr Assigned: Greg Dunn
Sec. 4 Letter Date: Not reported

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

COLOVOS (Continued)

1000437011

Active: No
 Remediation Applicant Co: Colovos Company
 Remediation Applicant Name: Mark Levit
 Remediation Applicant Company: Colovos Company
 Remediation Applicant Address: 4444 West Ohio Street
 Remediation Applicant City,St,Zip: Chicago, IL 60624
 Illinois EPA: 0316260001
 Site Name: Colovos Company
 NFR Letter: 1996-07-03
 NFR Letter Date Recorded: 1997-07-10
 Comprehensive/Focused: Focused
 Worker Caution: Yes
 Acres: 2.97
 Land Use: Industrial/Commercial
 Ground Water Use Restriction: No
 Highway Authority Agreement: No
 Ordinance: No
 Industrial - Commercial: Yes
 Slab on Grade: No
 BCT: No
 Building Slab: No
 Asphalt Used: No
 Concrete Used: Yes
 Clean Soil 3ft: No
 Clean Soil 10ft: No
 Alternate Barrier: No

[Click here for IL SRP:](#)

22
West
1/8-1/4
0.185 mi.
977 ft.

RAIL IT PROPERTY
733 N KILBOURN
CHICAGO, IL 60624

IL UST **U002222602**
N/A

Relative:
Higher

UST:
 Facility ID: 2033951
 Facility Status: CLOSED
Facility Type: OTHER
 Owner Id: U0023880
 Owner Name: Rail It Limited Partnership
 Owner Address: 10700 Frankstown Rd
 Owner City,St,Zip: Pittsburgh, PA 15235

Actual:
611 ft.

Tank Number: 1
Tank Status: Removed
 Tank Capacity: 2000
 Tank Substance: Heating Oil
 Last Used Date: 1/1/1982
 OSFM First Notify Date: 3/17/1995
 Red Tag Issue Date: Not reported
 Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: Not reported
 Motor Fuel Permit Inspection Date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

RAIL IT PROPERTY (Continued)

U002222602

Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

23
SSE
1/8-1/4
0.190 mi.
1005 ft.

INDUSTRIAL STORAGE WHSE CORP
4343 W OHIO ST
CHICAGO, IL 60624

RCRA NonGen / NLR **1007370583**
ILR000128660

Relative:
Lower

RCRA NonGen / NLR:

Actual:
609 ft.

Date form received by agency: 04/01/2006
Facility name: INDUSTRIAL STORAGE WHSE CORP
Facility address: 4343 W OHIO ST
CHICAGO, IL 60624
EPA ID: ILR000128660
Contact: ENV COORDINATOR
Contact address: Not reported
Not reported
Contact country: US
Contact telephone: 630-406-6500
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: INDUSTRIAL STORAGE WHSE CORP
Owner/operator address: Not reported
Not reported
Owner/operator country: US
Owner/operator telephone: Not reported
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/1900
Owner/Op end date: Not reported

Owner/operator name: INDUSTRIAL STORAGE WHSE CORP
Owner/operator address: Not reported
Not reported
Owner/operator country: US
Owner/operator telephone: Not reported
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/1900
Owner/Op end date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

Owner/operator name: INDUSTRIAL STORAGE WHSE
Owner/operator address: 4343 W OHIO ST
CHICAGO, IL 60624
Owner/operator country: US
Owner/operator telephone: Not reported
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 12/20/1979
Owner/Op end date: Not reported

Owner/operator name: MIKE SWADE
Owner/operator address: 4343 W OHIO ST
CHICAGO, IL 60624
Owner/operator country: US
Owner/operator telephone: Not reported
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 12/20/1979
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Universal Waste Summary:

Waste type: Batteries
Accumulated waste on-site: Yes
Generated waste on-site: Yes

Waste type: Lamps
Accumulated waste on-site: Yes
Generated waste on-site: Yes

Waste type: Pesticides
Accumulated waste on-site: Yes
Generated waste on-site: Yes

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

Waste type: Thermostats
Accumulated waste on-site: Yes
Generated waste on-site: Yes

Historical Generators:

Date form received by agency: 06/09/2004

Site name: INDUSTRIAL STORAGE WHSE CORP

Classification: Large Quantity Generator

- . Waste code: D001
- . Waste name: IGNITABLE WASTE

- . Waste code: D002
- . Waste name: CORROSIVE WASTE

- . Waste code: D003
- . Waste name: REACTIVE WASTE

- . Waste code: D004
- . Waste name: ARSENIC

- . Waste code: D005
- . Waste name: BARIUM

- . Waste code: D006
- . Waste name: CADMIUM

- . Waste code: D007
- . Waste name: CHROMIUM

- . Waste code: D008
- . Waste name: LEAD

- . Waste code: D009
- . Waste name: MERCURY

- . Waste code: D010
- . Waste name: SELENIUM

- . Waste code: D011
- . Waste name: SILVER

- . Waste code: D012
- . Waste name: ENDRIN
(1,2,3,4,10,10-HEXACHLORO-1,7-EPOXY-1,4,4A,5,6,7,8,8A-OCTAHYDRO-1,4-EN
DO, ENDO-5,8-DIMETH-ANO-NAPHTHALENE)

- . Waste code: D013
- . Waste name: LINDANE (1,2,3,4,5,6-HEXA-CHLOROCYCLOHEXANE, GAMMA ISOMER)

- . Waste code: D014
- . Waste name: METHOXYCHLOR (1,1,1-TRICHLORO-2,2-BIS [P-METHOXYPHENYL] ETHANE)

- . Waste code: D015
- . Waste name: TOXAPHENE (C10 H10 CL8, TECHNICAL CHLORINATED CAMPHERE, 67-69 PERCENT
CHLORINE)

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: D016
- . Waste name: 2,4-D (2,4-DICHLOROPHENOXYACETIC ACID)

- . Waste code: D017
- . Waste name: 2,4,5-TP SILVEX (2,4,5-TRICHLOROPHENOXYPROPIONIC ACID)

- . Waste code: D018
- . Waste name: BENZENE

- . Waste code: D019
- . Waste name: CARBON TETRACHLORIDE

- . Waste code: D020
- . Waste name: CHLORDANE

- . Waste code: D021
- . Waste name: CHLORO BENZENE

- . Waste code: D022
- . Waste name: CHLOROFORM

- . Waste code: D023
- . Waste name: O-CRESOL

- . Waste code: D024
- . Waste name: M-CRESOL

- . Waste code: D025
- . Waste name: P-CRESOL

- . Waste code: D026
- . Waste name: CRESOL

- . Waste code: D027
- . Waste name: 1,4-DICHLORO BENZENE

- . Waste code: D028
- . Waste name: 1,2-DICHLOROETHANE

- . Waste code: D029
- . Waste name: 1,1-DICHLOROETHYLENE

- . Waste code: D030
- . Waste name: 2,4-DINITROTOLUENE

- . Waste code: D031
- . Waste name: HEPTACHLOR (AND ITS EPOXIDE)

- . Waste code: D032
- . Waste name: HEXACHLORO BENZENE

- . Waste code: D033
- . Waste name: HEXACHLORO BUTADIENE

- . Waste code: D034
- . Waste name: HEXACHLOROETHANE

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: D035
- . Waste name: METHYL ETHYL KETONE

- . Waste code: D036
- . Waste name: NITROBENZENE

- . Waste code: D037
- . Waste name: PENTACHLOROPHENOL

- . Waste code: D038
- . Waste name: PYRIDINE

- . Waste code: D039
- . Waste name: TETRACHLOROETHYLENE

- . Waste code: D040
- . Waste name: TRICHLORETHYLENE

- . Waste code: D041
- . Waste name: 2,4,5-TRICHLOROPHENOL

- . Waste code: D042
- . Waste name: 2,4,6-TRICHLOROPHENOL

- . Waste code: D043
- . Waste name: VINYL CHLORIDE

- . Waste code: F001
- . Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLORETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

- . Waste code: F002
- . Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

- . Waste code: F003
- . Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

- . Waste code: F004
- . Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: CRESOLS, CRESYLIC ACID, AND NITROBENZENE; AND THE STILL BOTTOMS FROM THE RECOVERY OF THESE SOLVENTS; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

- . Waste code: F005
- . Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

- . Waste code: F006
- . Waste name: WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS, EXCEPT FROM THE FOLLOWING PROCESSES: (1) SULFURIC ACID ANODIZING OF ALUMINUM; (2) TIN PLATING ON CARBON STEEL; (3) ZINC PLATING (SEGREGATED BASIS) ON CARBON STEEL; (4) ALUMINUM OR ZINC-ALUMINUM PLATING ON CARBON STEEL; (5) CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC, AND ALUMINUM PLATING ON CARBON STEEL; AND (6) CHEMICAL ETCHING AND MILLING OF ALUMINUM.

- . Waste code: F007
- . Waste name: SPENT CYANIDE PLATING BATH SOLUTIONS FROM ELECTROPLATING OPERATIONS.

- . Waste code: F008
- . Waste name: PLATING BATH RESIDUES FROM THE BOTTOM OF PLATING BATHS FROM ELECTROPLATING OPERATIONS IN WHICH CYANIDES ARE USED IN THE PROCESS.

- . Waste code: F009
- . Waste name: SPENT STRIPPING AND CLEANING BATH SOLUTIONS FROM ELECTROPLATING OPERATIONS IN WHICH CYANIDES ARE USED IN THE PROCESS.

- . Waste code: F010
- . Waste name: QUENCHING BATH RESIDUES FROM OIL BATHS FROM METAL HEAT TREATING OPERATIONS IN WHICH CYANIDES ARE USED IN THE PROCESS.

- . Waste code: F011
- . Waste name: SPENT CYANIDE SOLUTIONS FROM SLAT BATH POT CLEANING FROM METAL HEAT TREATING OPERATIONS.

- . Waste code: F012
- . Waste name: QUENCHING WASTEWATER TREATMENT SLUDGES FROM METAL HEAT TREATING OPERATIONS IN WHICH CYANIDES ARE USED IN THE PROCESS.

- . Waste code: F019
- . Waste name: WASTEWATER TREATMENT SLUDGES FROM THE CHEMICAL CONVERSION COATING OF ALUMINUM, EXCEPT FROM ZIRCONIUM PHOSPHATING IN ALUMINUM CAN WASHING WHEN SUCH PHOSPHATING IS AN EXCLUSIVE CONVERSION COATING PROCESS.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: F024
- . Waste name: PROCESS WASTES INCLUDING, BUT NOT LIMITED TO, DISTILLATION RESIDUES, HEAVY ENDS, TARS, AND REACTOR CLEAN-OUT WASTES FROM THE PRODUCTION OF CERTAIN CHLORINATED ALIPHATIC HYDROCARBONS BY FREE RADICAL CATALYZED PROCESSES. THESE CHLORINATED ALIPHATIC HYDROCARBONS ARE THOSE HAVING CARBON CHAIN LENGTHS RANGING FROM ONE TO, AND INCLUDING FIVE, WITH VARYING AMOUNTS AND POSITIONS OF CHLORINE SUBSTITUTION. (THIS LISTING DOES NOT INCLUDE WASTEWATERS, WASTEWATER TREATMENT SLUDGE, SPENT CATALYSTS, AND WASTES LISTED IN SECTIONS 261.31. OR 261.32)

- . Waste code: F025
- . Waste name: CONDENSED LIGHT ENDS, SPENT FILTERS AND FILTER AIDS, AND SPENT DESICCANT WASTES FROM THE PRODUCTION OF CERTAIN CHLORINATED ALIPHATIC HYDROCARBONS BY FREE RADICAL CATALYZED PROCESSES. THESE CHLORINATED ALIPHATIC HYDROCARBONS ARE THOSE HAVING CARBON CHAIN LENGTHS RANGING FROM ONE TO, AND INCLUDING FIVE, WITH VARYING AMOUNTS AND POSITIONS OF CHLORINE SUBSTITUTION.

- . Waste code: F032
- . Waste name: WASTEWATERS, PROCESS RESIDUALS, PRESERVATIVE DRIPPAGE, AND SPENT FORMULATIONS FROM WOOD PRESERVING PROCESSES GENERATED AT PLANTS THAT CURRENTLY USE, OR HAVE PREVIOUSLY USED, CHLOROPHENOLIC FORMULATIONS [EXCEPT POTENTIALLY CROSS-CONTAMINATED WASTES THAT HAVE HAD THE F032 WASTE CODE DELETED IN ACCORDANCE WITH SECTION 261.35 (I.E., THE NEWLY PROMULGATED EQUIPMENT CLEANING OR REPLACEMENT STANDARDS), AND WHERE THE GENERATOR DOES NOT RESUME OR INITIATE USE OF CHLOROPHENOLIC FORMULATIONS]. (THIS LISTING DOES NOT INCLUDE K001 BOTTOM SEDIMENT SLUDGE FROM THE TREATMENT OF WASTEWATER FROM WOOD PRESERVING PROCESSES THAT USE CREOSOTE AND/OR PENTACHLOROPHENOL.)

- . Waste code: F034
- . Waste name: WASTEWATERS, PROCESS RESIDUALS, PRESERVATIVE DRIPPAGE, AND SPENT FORMULATIONS FROM WOOD PRESERVING PROCESSES GENERATED AT PLANTS THAT USE CREOSOTE FORMULATIONS. THIS LISTING DOES NOT INCLUDE K001 BOTTOM SEDIMENT SLUDGE FROM THE TREATMENT OF WASTEWATER FROM WOOD PRESERVING PROCESSES THAT USE CREOSOTE AND/OR PENTACHLOROPHENOL.

- . Waste code: F035
- . Waste name: WASTEWATERS, PROCESS RESIDUALS, PRESERVATIVE DRIPPAGE, AND SPENT FORMULATIONS FROM WOOD PRESERVING PROCESSES GENERATED AT PLANTS THAT USE INORGANIC PRESERVATIVES CONTAINING ARSENIC OR CHROMIUM. THIS LISTING DOES NOT INCLUDE K001 BOTTOM SEDIMENT SLUDGE FROM THE TREATMENT OF WASTEWATER FROM WOOD PRESERVING PROCESSES THAT USE CREOSOTE AND/OR PENTACHLOROPHENOL.

- . Waste code: F037
- . Waste name: PETROLEUM REFINERY PRIMARY OIL/WATER/SOLIDS SEPARATION SLUDGE - ANY SLUDGE GENERATED FROM THE GRAVITATIONAL SEPARATION OF OIL/WATER/SOLIDS DURING THE STORAGE OR TREATMENT OF PROCESS WASTEWATERS AND OILY COOLING WASTEWATERS FROM PETROLEUM REFINERIES. SUCH SLUDGES INCLUDE, BUT ARE NOT LIMITED TO, THOSE GENERATED IN OIL/WATER/SOLIDS SEPARATORS; TANKS AND IMPOUNDMENTS; DITCHES AND OTHER CONVEYANCES; SUMPS; AND STORM WATER UNITS RECEIVING DRY WEATHER FLOW. SLUDGES GENERATED IN STORM WATER UNITS THAT DO NOT RECEIVE DRY WEATHER FLOW, SLUDGES GENERATED IN AGGRESSIVE BIOLOGICAL TREATMENT UNITS AS DEFINED IN SECTION 261.31(B)(2) (INCLUDING SLUDGES GENERATED IN ONE OR MORE ADDITIONAL UNITS AFTER WASTEWATERS HAVE BEEN TREATED IN AGGRESSIVE

MAP FINDINGS

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

BIOLOGICAL TREATMENT UNITS), AND K051 WASTES ARE EXEMPTED FROM THIS LISTING.

- . Waste code: F039
- . Waste name: LEACHATE RESULTING FROM THE TREATMENT, STORAGE, OR DISPOSAL OF WASTES CLASSIFIED BY MORE THAN ONE WASTE CODE UNDER SUBPART D, OR FROM A MIXTURE OF WASTES CLASSIFIED UNDER SUBPARTS C AND D OF THIS PART. (LEACHATE RESULTING FROM THE MANAGEMENT OF ONE OR MORE OF THE FOLLOWING EPA HAZARDOUS WASTES AND NO OTHER HAZARDOUS WASTES RETAINS ITS HAZARDOUS WASTE CODE(S): F020, F021, F022, F023, F026, F027, AND/OR F028.)

- . Waste code: K015
- . Waste name: STILL BOTTOMS FROM THE DISTILLATION OF BENZYL CHLORIDE.

- . Waste code: K016
- . Waste name: HEAVY ENDS OR DISTILLATION RESIDUES FROM THE PRODUCTION OF CARBON TETRACHLORIDE.

- . Waste code: K017
- . Waste name: HEAVY ENDS (STILL BOTTOMS) FROM THE PURIFICATION COLUMN IN THE PRODUCTION OF EPICHLOROHYDRIN.

- . Waste code: K018
- . Waste name: HEAVY ENDS FROM THE FRACTIONATION COLUMN IN ETHYL CHLORIDE PRODUCTION.

- . Waste code: K019
- . Waste name: HEAVY ENDS FROM THE DISTILLATION OF ETHYLENE DICHLORIDE IN ETHYLENE DICHLORIDE PRODUCTION.

- . Waste code: K020
- . Waste name: HEAVY ENDS FROM THE DISTILLATION OF VINYL CHLORIDE IN VINYL CHLORIDE MONOMER PRODUCTION.

- . Waste code: K021
- . Waste name: AQUEOUS SPENT ANTIMONY CATALYST WASTE FROM FLUOROMETHANE PRODUCTION.

- . Waste code: K022
- . Waste name: DISTILLATION BOTTOM TARS FROM THE PRODUCTION OF PHENOL/ACETONE FROM CUMENE.

- . Waste code: K023
- . Waste name: DISTILLATION LIGHT ENDS FROM THE PRODUCTION OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE.

- . Waste code: K024
- . Waste name: DISTILLATION BOTTOMS FROM THE PRODUCTION OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE.

- . Waste code: K025
- . Waste name: DISTILLATION BOTTOMS FROM THE PRODUCTION OF NITROBENZENE BY THE NITRATION OF BENZENE.

- . Waste code: K026
- . Waste name: STRIPPING STILL TAILS FROM THE PRODUCTION OF METHYL ETHYL PYRIDINES.

- . Waste code: K027

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste name: CENTRIFUGE AND DISTILLATION RESIDUES FROM TOLUENE DIISOCYANATE PRODUCTION.
- . Waste code: K028
- . Waste name: SPENT CATALYST FROM THE HYDROCHLORINATOR REACTOR IN THE PRODUCTION OF 1,1,1-TRICHLOROETHANE.
- . Waste code: K029
- . Waste name: WASTE FROM THE PRODUCT STEAM STRIPPER IN THE PRODUCTION OF 1,1,1-TRICHLOROETHANE.
- . Waste code: K030
- . Waste name: COLUMN BOTTOMS OR HEAVY ENDS FROM THE COMBINED PRODUCTION OF TRICHLOROETHYLENE AND PERCHLOROETHYLENE.
- . Waste code: K031
- . Waste name: BY-PRODUCT SALTS GENERATED IN THE PRODUCTION OF MSMA AND CACODYLIC ACID.
- . Waste code: K032
- . Waste name: WASTEWATER TREATMENT SLUDGE FROM THE PRODUCTION OF CHLORDANE.
- . Waste code: K033
- . Waste name: WASTEWATER AND SCRUB WATER FROM THE CHLORINATION OF CYCLOPENTADIENE IN THE PRODUCTION OF CHLORDANE.
- . Waste code: K034
- . Waste name: FILTER SOLIDS FROM THE FILTRATION OF HEXACHLOROCYCLOPENTADIENE IN THE PRODUCTION OF CHLORDANE.
- . Waste code: K035
- . Waste name: WASTEWATER TREATMENT SLUDGES GENERATED IN THE PRODUCTION OF CREOSOTE.
- . Waste code: K036
- . Waste name: STILL BOTTOMS FROM TOLUENE RECLAMATION DISTILLATION IN THE PRODUCTION OF DISULFOTON.
- . Waste code: K037
- . Waste name: WASTEWATER TREATMENT SLUDGES FROM THE PRODUCTION OF DISULFOTON.
- . Waste code: K038
- . Waste name: WASTEWATER FROM THE WASHING AND STRIPPING OF PHORATE PRODUCTION.
- . Waste code: K039
- . Waste name: FILTER CAKE FROM THE FILTRATION OF DIETHYLPHOSPHORODITHIOIC ACID IN THE PRODUCTION OF PHORATE.
- . Waste code: K040
- . Waste name: WASTEWATER TREATMENT SLUDGE FROM THE PRODUCTION OF PHORATE.
- . Waste code: K041
- . Waste name: WASTEWATER TREATMENT SLUDGE FROM THE PRODUCTION OF TOXAPHENE.
- . Waste code: K042
- . Waste name: HEAVY ENDS OR DISTILLATION RESIDUES FROM THE DISTILLATION OF TETRACHLOROBENZENE IN THE PRODUCTION OF 2,4,5-T.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: K043
- . Waste name: 2,6-DICHLOROPHENOL WASTE FROM THE PRODUCTION OF 2,4-D.

- . Waste code: K044
- . Waste name: WASTEWATER TREATMENT SLUDGES FROM THE MANUFACTURING AND PROCESSING OF EXPLOSIVES.

- . Waste code: K045
- . Waste name: SPENT CARBON FROM THE TREATMENT OF WASTEWATER CONTAINING EXPLOSIVES.

- . Waste code: K046
- . Waste name: WASTEWATER TREATMENT SLUDGES FROM THE MANUFACTURING, FORMULATION, AND LOADING OF LEAD-BASED INITIATING COMPOUNDS.

- . Waste code: K047
- . Waste name: PINK/RED WATER FROM TNT OPERATIONS.

- . Waste code: K048
- . Waste name: DISSOLVED AIR FLOTATION (DAF) FLOAT FROM THE PETROLEUM REFINING INDUSTRY.

- . Waste code: K049
- . Waste name: SLOP OIL EMULSION SOLIDS FROM THE PETROLEUM REFINING INDUSTRY.

- . Waste code: K050
- . Waste name: HEAT EXCHANGER BUNDLE CLEANING SLUDGE FROM THE PETROLEUM REFINING INDUSTRY.

- . Waste code: K051
- . Waste name: API SEPARATOR SLUDGE FROM THE PETROLEUM REFINING INDUSTRY.

- . Waste code: K052
- . Waste name: TANK BOTTOMS (LEADED) FROM THE PETROLEUM REFINING INDUSTRY.

- . Waste code: K060
- . Waste name: AMMONIA STILL LIME SLUDGE FROM COKING OPERATIONS.

- . Waste code: K061
- . Waste name: EMISSION CONTROL DUST/SLUDGE FROM THE PRIMARY PRODUCTION OF STEEL IN ELECTRIC FURNACES.

- . Waste code: K062
- . Waste name: SPENT PICKLE LIQUOR FROM STEEL FINISHING OPERATIONS OF PLANTS THAT PRODUCE IRON OR STEEL.

- . Waste code: K064
- . Waste name: ACID PLANT BLOWDOWN SLURRY/SLUDGE RESULTING FROM THE THICKENING OF BLOWDOWN SLURRY FROM PRIMARY COPPER PRODUCTION.

- . Waste code: K065
- . Waste name: SURFACE IMPOUNDMENT SOLIDS CONTAINED IN AND DREDGED FROM SURFACE IMPOUNDMENTS AT PRIMARY LEAD SMELTING FACILITIES.

- . Waste code: K066
- . Waste name: SLUDGE FROM TREATMENT OF PROCESS WASTEWATER AND/OR ACID PLANT BLOWDOWN FROM PRIMARY ZINC PRODUCTION.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: K069
- . Waste name: EMISSION CONTROL DUST/SLUDGE FROM SECONDARY LEAD SMELTING.

- . Waste code: K071
- . Waste name: BRINE PURIFICATION MUDS FROM THE MERCURY CELL PROCESS IN CHLORINE PRODUCTION, IN WHICH SEPARATELY PREPURIFIED BRINE IS NOT USED.

- . Waste code: K073
- . Waste name: CHLORINATED HYDROCARBON WASTE FROM THE PURIFICATION STEP OF THE DIAPHRAGM CELL PROCESS USING GRAPHITE ANODES IN CHLORINE PRODUCTION.

- . Waste code: K083
- . Waste name: DISTILLATION BOTTOMS FROM ANILINE PRODUCTION.

- . Waste code: K084
- . Waste name: WASTEWATER TREATMENT SLUDGES GENERATED DURING THE PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS.

- . Waste code: K085
- . Waste name: DISTILLATION OR FRACTIONATION COLUMN BOTTOMS FROM THE PRODUCTION OF CHLOROBENZENES.

- . Waste code: K086
- . Waste name: SOLVENT WASHES AND SLUDGES, CAUSTIC WASHES AND SLUDGES, OR WATER WASHES AND SLUDGES FROM CLEANING TUBS AND EQUIPMENT USED IN THE FORMULATION OF INK FROM PIGMENTS, DRIERS, SOAPS, AND STABILIZERS CONTAINING CHROMIUM AND LEAD.

- . Waste code: K087
- . Waste name: DECANter TANK TAR SLUDGE FROM COKING OPERATIONS.

- . Waste code: K088
- . Waste name: SPENT POTLINERS FROM PRIMARY ALUMINUM REDUCTION.

- . Waste code: K090
- . Waste name: EMISSION CONTROL DUST OR SLUDGE FROM FERROCHROMIUMSILICON PRODUCTION.

- . Waste code: K091
- . Waste name: EMISSION CONTROL DUST OR SLUDGE FROM FERROCHROMIUM PRODUCTION.

- . Waste code: K093
- . Waste name: DISTILLATION LIGHT ENDS FROM THE PRODUCTION OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE.

- . Waste code: K094
- . Waste name: DISTILLATION BOTTOMS FROM THE PRODUCTION OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE.

- . Waste code: K095
- . Waste name: DISTILLATION BOTTOMS FROM THE PRODUCTION OF 1,1,1-TRICHLOROETHANE.

- . Waste code: K096
- . Waste name: HEAVY ENDS FROM THE HEAVY ENDS COLUMN FROM THE PRODUCTION OF 1,1,1-TRICHLOROETHANE.

- . Waste code: K097
- . Waste name: VACUUM STRIPPER DISCHARGE FROM THE CHLORDANE CHLORINATOR IN THE

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

PRODUCTION OF CHLORDANE.

- . Waste code: K098
- . Waste name: UNTREATED PROCESS WASTEWATER FROM THE PRODUCTION OF TOXAPHENE.

- . Waste code: K099
- . Waste name: UNTREATED WASTEWATER FROM THE PRODUCTION OF 2,4-D.

- . Waste code: K100
- . Waste name: WASTE LEACHING SOLUTION FROM ACID LEACHING OF EMISSION CONTROL DUST/SLUDGE FROM SECONDARY LEAD SMELTING.

- . Waste code: K101
- . Waste name: DISTILLATION TAR RESIDUES FROM THE DISTILLATION OF ANILINE-BASED COMPOUNDS IN THE PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS.

- . Waste code: K102
- . Waste name: RESIDUE FROM THE USE OF ACTIVATED CARBON FOR DECOLORIZATION IN THE PRODUCTION OF VETERINARY PHARMACEUTICALS FROM ARSENIC OR ORGANO-ARSENIC COMPOUNDS.

- . Waste code: K103
- . Waste name: PROCESS RESIDUES FROM ANILINE EXTRACTION FROM THE PRODUCTION OF ANILINE.

- . Waste code: K104
- . Waste name: COMBINED WASTEWATERS GENERATED FROM NITROBENZENE/ANILINE PRODUCTION.

- . Waste code: K105
- . Waste name: SEPARATED AQUEOUS STREAM FROM THE REACTOR PRODUCT WASHING STEP IN THE PRODUCTION OF CHLOROBENZENES.

- . Waste code: K106
- . Waste name: WASTEWATER TREATMENT SLUDGE FROM THE MERCURY CELL PROCESS IN CHLORINE PRODUCTION.

- . Waste code: K107
- . Waste name: COLUMN BOTTOMS FROM PRODUCT SEPARATION FROM THE PRODUCTION OF 1,1-DIMETHYLHYDRAZINE (UDMH) FROM CARBOXYLIC ACID HYDRAZIDES.

- . Waste code: K108
- . Waste name: CONDENSED COLUMN OVERHEADS FROM PRODUCT SEPARATION AND CONDENSED REACTOR VENT GASES FROM THE PRODUCTION OF 1,1-DIMETHYLHYDRAZINE FROM CARBOXYLIC ACID HYDRAZIDES.

- . Waste code: K109
- . Waste name: SPENT FILTER CARTRIDGES FROM PRODUCT PURIFICATION FROM THE PRODUCT OF 1,1-DIMETHYLHYDRAZINE FROM CARBOXYLIC ACID HYDRAZIDES.

- . Waste code: K110
- . Waste name: CONDENSED COLUMN OVERHEADS FROM INTERMEDIATE SEPARATION FROM THE PRODUCTION OF 1,1-DIMETHYLHYDRAZINE FROM CARBOXYLIC ACID HYDRAZIDES.

- . Waste code: K111
- . Waste name: PRODUCT WASHWATERS FROM THE PRODUCTION OF DINITROTOLUENE VIA NITRATION OF TOLUENE.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: K112
- . Waste name: REACTION BY-PRODUCT WATER FROM THE DRYING COLUMN IN THE PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE.

- . Waste code: K113
- . Waste name: CONDENSED LIQUID LIGHT ENDS FROM PURIFICATION OF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE.

- . Waste code: K114
- . Waste name: VICINALS FROM THE PURIFICATION OF TOLUENEDIAMINE IN PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE.

- . Waste code: K115
- . Waste name: HEAVY ENDS FROM PURIFICATION OF TOLUENEDIAMINE IN THE PRODUCTION OF TOLUENEDIAMINE VIA HYDROGENATION OF DINITROTOLUENE.

- . Waste code: K116
- . Waste name: ORGANIC CONDENSATE FROM THE SOLVENT RECOVERY COLUMN IN THE PRODUCTION OF TOLUENE DIISOCYANATE VIA PHOSGENATION OF TOLUENEDIAMINE.

- . Waste code: K117
- . Waste name: WASTEWATER FROM THE REACTOR VENT GAS SCRUBBER IN THE PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE.

- . Waste code: K118
- . Waste name: SPENT ADSORBENT SOLIDS FROM PURIFICATION OF ETHYLENE DIBROMIDE IN THE PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE.

- . Waste code: K123
- . Waste name: PROCESS WASTEWATER (INCLUDING SUPERNATES, FILTRATES, AND WASHWATERS) FROM THE PRODUCTION OF ETHYLENEBISDITHIOCARBAMIC ACID AND ITS SALTS.

- . Waste code: K124
- . Waste name: REACTOR VENT SCRUBBER WATER FROM THE PRODUCTION OF ETHYLENEBISDITHIOCARBAMIC ACID AND ITS SALTS.

- . Waste code: K125
- . Waste name: FILTRATION, EVAPORATION, AND CENTRIFUGATION SOLIDS FROM THE PRODUCTION OF ETHYLENEBISDITHIOCARBAMIC ACID AND ITS SALTS.

- . Waste code: K126
- . Waste name: BAGHOUSE DUST AND FLOOR SWEEPINGS IN MILLING AND PACKAGING OPERATIONS FROM PRODUCTION OR FORMULATION OF ETHYLENEBISDITHIOCARBAMIC ACID AND ITS SALTS.

- . Waste code: K131
- . Waste name: WASTEWATER FROM THE REACTOR AND SPENT SULFURIC ACID FROM THE ACID DRYER FROM THE PRODUCTION OF METHYL BROMIDE.

- . Waste code: K132
- . Waste name: SPENT ABSORBENT AND WASTEWATER SEPARATOR SOLIDS FROM THE PRODUCTION OF METHYL BROMIDE.

- . Waste code: K136
- . Waste name: STILL BOTTOMS FROM THE PURIFICATION OF ETHYLENE DIBROMIDE IN THE PRODUCTION OF ETHYLENE DIBROMIDE VIA BROMINATION OF ETHENE.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: K141
- . Waste name: PROCESS RESIDUES FROM THE RECOVERY OF COAL TAR, INCLUDING, BUT NOT LIMITED TO, TAR COLLECTING SUMP RESIDUES FROM THE PRODUCTION OF COKE FROM COAL OR THE RECOVERY OF COKE BY-PRODUCTS PRODUCED FROM COAL. THIS LISTING DOES NOT INCLUDE K087 (DECANTER TANK SLUDGE FROM COKING OPERATIONS).

- . Waste code: K142
- . Waste name: TANK STORAGE RESIDUES FROM THE PRODUCTION OF COKE FROM COAL OR FROM THE RECOVERY OF COKE BY-PRODUCTS FROM COAL.

- . Waste code: K143
- . Waste name: PROCESS RESIDUES FROM THE RECOVERY OF LIGHT OIL, INCLUDING, BUT NOT LIMITED TO, THOSE GENERATED IN STILLs, DECANTERS, AND WASH OIL RECOVERY UNITS FROM THE RECOVERY OF COKE BY-PRODUCTS PRODUCED FROM COAL.

- . Waste code: K144
- . Waste name: WASTEWATER SUMP RESIDUES FROM LIGHT OIL REFINING, INCLUDING, BUT NOT LIMITED TO, INTERCEPTING OR CONTAMINATION SUMP SLUDGES FROM THE RECOVERY OF COKE BY-PRODUCTS PRODUCED FROM COAL.

- . Waste code: K145
- . Waste name: RESIDUES FROM NAPHTHALENE COLLECTION AND RECOVERY OPERATIONS FROM THE RECOVERY OF COKE BY-PRODUCTS PRODUCED FROM COAL.

- . Waste code: K147
- . Waste name: TAR STORAGE RESIDUES FROM COAL TAR REFINING.

- . Waste code: K148
- . Waste name: RESIDUES FROM COAL TAR DISTILLATION, INCLUDING, BUT NOT LIMITED TO, STILL BOTTOMS.

- . Waste code: K149
- . Waste name: DISTILLATION BOTTOMS FROM THE PRODUCTION OF ALPHA (OR METHYL-) CHLORINATED TOLUNES, RING-CHLORINATED TOLUNES, BENZOYL CHLORIDES, AND COMPOUNDS WITH MIXTURES OF THESE FUNCTIONAL GROUPS. [THIS WASTE DOES NOT INCLUDE STILL BOTTOMS FROM THE DISTILLATION OF BENZOYL CHLORIDE]

- . Waste code: K150
- . Waste name: ORGANIC RESIDUES EXCLUDING SPENT CARBON ADSORBENT, FROM THE SPENT CHLORINE GAS AND HYDROCHLORIC ACID RECOVERY PROCESSES ASSOCIATED WITH THE PRODUCTION OF ALPHA (OR METHYL-) CHLORINATED TOLUNES, BENZOYL CHLORIDES, AND COMPOUNDS WITH MIXTURES OF THESE FUNCTIONAL GROUPS.

- . Waste code: K151
- . Waste name: WASTEWATER TREATMENT SLUDGES, EXCLUDING NEUTRALIZATION AND BIOLOGICAL SLUDGES, GENERATED DURING THE TREATMENT OF WASTEWATERS FROM THE PRODUCTION OF ALPHA (OR METHYL-) CHLORINATED TOLUNES, BENZOYL CHLORIDES, AND COMPOUNDS WITH MIXTURES OF THESE FUNCTIONAL GROUPS.

- . Waste code: K156
- . Waste name: ORGANIC WASTE (INCLUDING HEAVY ENDS, STILL BOTTOMS, LIGHT ENDS, SPENT SOLVENTS, FILTRATES, AND DECANTATES) FROM THE PRODUCTION OF CARBAMATES AND CARBAMOYL OXIMES.

- . Waste code: K157

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste name: WASTEWATERS (INCLUDING SCRUBBER WATERS, CONDENSER WATERS, WASHWATERS, AND SEPARATION WATERS) FROM THE PRODUCTION OF CARBAMATES AND CARBAMOYL OXIMES.
- . Waste code: K158
- . Waste name: BAG HOUSE DUSTS AND FILTER/SEPARATION SOLIDS FROM THE PRODUCTION OF CARBAMATES AND CARBAMOYL OXIMES.
- . Waste code: K159
- . Waste name: ORGANICS FROM THE TREATMENT OF THIOCARBAMATE WASTES.
- . Waste code: K160
- . Waste name: SOLIDS (INCLUDING FILTER WASTES, SEPARATION SOLIDS, AND SPENT CATALYSTS) FROM THE PRODUCTION OF THIOCARBAMATES AND SOLIDS FROM THE TREATMENT OF THIOCARBAMATE WASTES.
- . Waste code: K161
- . Waste name: PURIFICATION SOLIDS (INCLUDING FILTRATION, EVAPORATION, AND CENTRIFUGATION SOLIDS), BAG HOUSE DUST AND FLOOR SWEEPINGS FROM THE PRODUCTION OF DITHIOCARBAMATE ACIDS AND THEIR SALTS. (THIS LISTING DOES NOT INCLUDE K125 OR K126).
- . Waste code: K169
- . Waste name: CRUDE OIL STORAGE TANK SEDIMENT FROM PETROLEUM REFINING OPERATIONS
- . Waste code: K170
- . Waste name: CLARIFIED SLURRY OIL TANK SEDIMENT AND/OR IN-LINE FILTER/SEPARATION SOLIDS FROM PETROLEUM REFINING OPERATIONS
- . Waste code: K171
- . Waste name: SPENT HYDROTREATING CATALYST FROM PETROLEUM REFINING OPERATIONS, INCLUDING GUARD BEDS USED TO DESULFURIZE FEEDS TO OTHER CATALYTIC REACTORS (THIS LISTING DOES NOT INCLUDE INERT SUPPORT MEDIA)
- . Waste code: K172
- . Waste name: SPENT HYDROREFINING CATALYST FROM PETROLEUM REFINING OPERATIONS, INCLUDING GUARD BEDS USED TO DESULFURIZE FEEDS TO OTHER CATALYTIC REACTORS (THIS LISTING DOES NOT INCLUDE INERT SUPPORT MEDIA)
- . Waste code: K174
- . Waste name: WASTEWATER TREATMENT SLUDGES FROM THE PRODUCTION OF ETHYLENE DICHLORIDE OR VINYL CHLORIDE
- . Waste code: K175
- . Waste name: WASTEWATER TREATMENT SLUDGE FROM THE PRODUCTION OF VINYL CHLORIDE MONOMER..
- . Waste code: P001
- . Waste name: 2H-1-BENZOPYRAN-2-ONE, 4-HYDROXY-3-(3-OXO-1-PHENYLBUTYL)-, & SALTS, WHEN PRESENT AT CONCENTRATIONS GREATER THAN 0.3% (OR) WARFARIN, & SALTS, WHEN PRESENT AT CONCENTRATIONS GREATER THAN 0.3%
- . Waste code: P002
- . Waste name: 1-ACETYL-2-THIOUREA (OR) ACETAMIDE, N-(AMINOTHIOXOMETHYL)-
- . Waste code: P003
- . Waste name: 2-PROPENAL (OR) ACROLEIN

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: P004
- . Waste name: 1,4,5,8-DIMETHANONAPHTHALENE,
1,2,3,4,10,10-HEXA-CHLORO-1,4,4A,5,8,8A,-HEXAHYDRO-, (1ALPHA, 4ALPHA,
4ABETA, 5ALPHA, 8ALPHA, 8ABETA)- (OR) ALDRIN

- . Waste code: P005
- . Waste name: 2-PROPEN-1-OL (OR) ALLYL ALCOHOL

- . Waste code: P006
- . Waste name: ALUMINUM PHOSPHIDE (R,T)

- . Waste code: P007
- . Waste name: 3(2H)-ISOXAZOLONE, 5-(AMINOMETHYL)- (OR) 5-(AMINOMETHYL)-3-ISOXAZOLOL

- . Waste code: P008
- . Waste name: 4-AMINOPYRIDINE (OR) 4-PYRIDINAMINE

- . Waste code: P009
- . Waste name: AMMONIUM PICRATE (R) (OR) PHENOL, 2,4,6-TRINITRO-, AMMONIUM SALT (R)

- . Waste code: P010
- . Waste name: ARSENIC ACID H3ASO4

- . Waste code: P011
- . Waste name: ARSENIC OXIDE AS2O5 (OR) ARSENIC PENTOXIDE

- . Waste code: P012
- . Waste name: ARSENIC OXIDE AS2O3 (OR) ARSENIC TRIOXIDE

- . Waste code: P013
- . Waste name: BARIUM CYANIDE

- . Waste code: P014
- . Waste name: BENZENETHIOL (OR) THIOPHENOL

- . Waste code: P015
- . Waste name: BERYLLIUM

- . Waste code: P016
- . Waste name: DICHLOROMETHYL ETHER (OR) METHANE, OXYBIS[CHLORO-

- . Waste code: P017
- . Waste name: 2-PROPANONE, 1-BROMO- (OR) BROMOACETONE

- . Waste code: P018
- . Waste name: BRUCINE (OR) STRYCHNIDIN-10-ONE, 2,3-DIMETHOXY-

- . Waste code: P020
- . Waste name: DINOSEB (OR) PHENOL, 2-(1-METHYLPROPYL)-4,6-DINITRO-

- . Waste code: P021
- . Waste name: CALCIUM CYANIDE (OR) CALCIUM CYANIDE CA(CN)2

- . Waste code: P022
- . Waste name: CARBON DISULFIDE

- . Waste code: P023

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

. Waste name: ACETALDEHYDE, CHLORO- (OR) CHLOROACETALDEHYDE
. Waste code: P024
. Waste name: BENZENAMINE, 4-CHLORO- (OR) P-CHLORANILINE
. Waste code: P026
. Waste name: 1-(O-CHLOROPHENYL)THIOUREA (OR) THIOUREA, (2-CHLOROPHENYL)-
. Waste code: P027
. Waste name: 3-CHLOROPROPIONITRILE (OR) PROPANENITRILE, 3-CHLORO-
. Waste code: P028
. Waste name: BENZENE, (CHLOROMETHYL)- (OR) BENZYL CHLORIDE
. Waste code: P029
. Waste name: COPPER CYANIDE (OR) COPPER CYANIDE CU(CN)
. Waste code: P030
. Waste name: CYANIDES (SOLUBLE CYANIDE SALTS), NOT OTHERWISE SPECIFIED
. Waste code: P031
. Waste name: CYANOGEN (OR) ETHANEDINITRILE
. Waste code: P033
. Waste name: CYANOGEN CHLORIDE (OR) CYANOGEN CHLORIDE (CN)CL
. Waste code: P034
. Waste name: 2-CYCLOHEXYL-4,6-DINITROPHENOL (OR) PHENOL, 2-CYCLOHEXYL-4,6-DINITRO-
. Waste code: P036
. Waste name: ARSONOUS DICHLORIDE, PHENYL- (OR) DICHLOROPHENYLARSINE
. Waste code: P037
. Waste name: 2,7:3,6-DIMETHANONAPHTH[2,3-B]OXIRENE,
3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7A-OCTAHYDRO-, (1AALPHA,
2BETA, 2AALPHA, 3BETA, 6BETA, 6AALPHA, 7BETA, 7AALPHA)- (OR) DIELDRIN
. Waste code: P038
. Waste name: ARSINE, DIETHYL- (OR) DIETHYLARSINE
. Waste code: P039
. Waste name: DISULFOTON (OR) PHOSPHORODITHIOIC ACID, O,O-DIETHYL
S-[2-(ETHYLTHIO)ETHYL] ESTER
. Waste code: P040
. Waste name: O,O-DIETHYL O-PYRAZINYL PHOSPHOROTHIOATE (OR) PHOSPHOROTHIOIC ACID,
O,O-DIETHYL O-PYRAZINYL ESTER
. Waste code: P041
. Waste name: DIETHYL-P-NITROPHENYL PHOSPHATE (OR) PHOSPHORIC ACID, DIETHYL
4-NITROPHENYL ESTER
. Waste code: P042
. Waste name: 1,2-BENZENEDIOL, 4-[1-HYDROXY-2-(METHYLAMINO)ETHYL]-, (R)- (OR)
EPINEPHRINE
. Waste code: P043

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste name: DIISOPROPYLFLUOROPHOSPHATE (DFP) (OR) PHOSPHOROFUORIDIC ACID, BIS(1-METHYLETHYL) ESTER
- . Waste code: P044
- . Waste name: DIMETHOATE (OR) PHOSPHORODITHIOIC ACID, O,O-DIMETHYL S-[2-(METHYLAMINO)-2-OXOETHYL] ESTER
- . Waste code: P045
- . Waste name: 2-BUTANONE, 3,3-DIMETHYL-1-(METHYLTHIO)-, O-[METHYLAMINO]CARBONYL OXIME (OR) THIOFANOX
- . Waste code: P046
- . Waste name: ALPHA,ALPHA-DIMETHYLPHENETHYLAMINE (OR) BENZENEETHANAMINE, ALPHA, ALPHA-DIMETHYL-
- . Waste code: P047
- . Waste name: 4,6-DINITRO-O-CRESOL, & SALTS (OR) PHENOL, 2-METHYL-4,6-DINITRO-, & SALTS
- . Waste code: P048
- . Waste name: 2,4-DINITROPHENOL (OR) PHENOL, 2,4-DINITRO-
- . Waste code: P049
- . Waste name: DITHIOBIURET (OR) THIOIMIDODICARBONIC DIAMIDE [(H2N)C(S)]2NH
- . Waste code: P050
- . Waste name: 6,9-METHANO-2,4,3-BENZODIOXATHIEPIN,6,7,8,9,10,10-HEXACHLORO-1,5,5A,6,9,9A-HEXAHYDRO-,3-OXIDE (OR) ENDOSULFAN
- . Waste code: P051
- . Waste name: 2,7:3,6-DIMETHANONAPHTH[2,3-B]OXIRENE, 3,4,5,6,9,9-HEXACHLORO-1A,2,2A,3,6,6A,7,7A-OCTAHYDRO-, (1AALPHA, 2BETA, 2ABETA, 3ALPHA, 6ALPHA, 6ABETA, 7BETA, 7AALPHA)- & METABOLITES (OR) ENDRIN (OR) ENDRIN, & METABOLITES
- . Waste code: P054
- . Waste name: AZIRIDINE (OR) ETHYLENEIMINE
- . Waste code: P056
- . Waste name: FLUORINE
- . Waste code: P057
- . Waste name: ACETAMIDE, 2-FLUORO- (OR) FLUOROACETAMIDE
- . Waste code: P058
- . Waste name: ACETIC ACID, FLUORO-, SODIUM SALT (OR) FLUOROACETIC ACID, SODIUM SALT
- . Waste code: P059
- . Waste name: 4,7-METHANO-1H-INDENE, 1,4,5,6,7,8,8-HEPTACHLORO-3A,4,7,7A-TETRAHYDRO- (OR) HEPTACHLOR
- . Waste code: P060
- . Waste name: 1,4,5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10-HEXA-CHLORO-1,4,4A,5,8,8A,-HEXAHYDRO-, (1ALPHA, 4ALPHA, 4ABETA, 5BETA, 8BETA, 8ABETA)- (OR) ISODRIN
- . Waste code: P062

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

. Waste name: HEXAETHYL TETRAPHOSPHATE (OR) TETRAPHOSPHORIC ACID, HEXAETHYL ESTER

. Waste code: P063

. Waste name: HYDROCYANIC ACID (OR) HYDROGEN CYANIDE

. Waste code: P064

. Waste name: METHANE, ISOCYANATO- (OR) METHYL ISOCYANATE

. Waste code: P065

. Waste name: FULMINIC ACID, MERCURY(2+) SALT (R,T) (OR) MERCURY FULMINATE (R,T)

. Waste code: P066

. Waste name: ETHANIMIDOTHIOIC ACID, N-[(METHYLAMINO)CARBONYL]OXY]-, METHYL ESTER (OR) METHOMYL

. Waste code: P067

. Waste name: 1,2-PROPYLENIMINE (OR) AZIRIDINE, 2-METHYL-

. Waste code: P068

. Waste name: HYDRAZINE, METHYL- (OR) METHYL HYDRAZINE

. Waste code: P069

. Waste name: 2-METHYLLACTONITRILE (OR) PROPANENITRILE, 2-HYDROXY-2-METHYL-

. Waste code: P070

. Waste name: ALDICARB (OR) PROPANAL, 2-METHYL-2-(METHYLTHIO)-, O-[(METHYLAMINO)CARBONYL]OXIME

. Waste code: P071

. Waste name: METHYL PARATHION (OR) PHOSPHOROTHIOIC ACID, O,O,-DIMETHYL O-(4-NITROPHENYL) ESTER

. Waste code: P072

. Waste name: ALPHA-NAPHTHYLTHIOUREA (OR) THIOUREA, 1-NAPHTHALENYL-

. Waste code: P073

. Waste name: NICKEL CARBONYL (OR) NICKEL CARBONYL NI(CO)4, (T-4)-

. Waste code: P074

. Waste name: NICKEL CYANIDE (OR) NICKEL CYANIDE NI(CN)2

. Waste code: P075

. Waste name: NICOTINE, & SALTS (OR) PYRIDINE, 3-(1-METHYL-2-PYRROLIDINYL)-,(S)-, & SALTS

. Waste code: P076

. Waste name: NITRIC OXIDE (OR) NITROGEN OXIDE NO

. Waste code: P077

. Waste name: BENZENAMINE, 4-NITRO- (OR) P-NITROANILINE

. Waste code: P078

. Waste name: NITROGEN DIOXIDE (OR) NITROGEN OXIDE NO2

. Waste code: P081

. Waste name: 1,2,3-PROPANETRIOL, TRINITRATE (R) (OR) NITROGLYCERINE (R)

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: P082
- . Waste name: METHANIMINE, N-METHYL-N-NITROSO- (OR) N-NITROSODIMETHYLAMINE

- . Waste code: P084
- . Waste name: N-NITROSOMETHYLVINYLAMINE (OR) VINYLAMINE, N-METHYL-N-NITROSO-

- . Waste code: P085
- . Waste name: DIPHOSPHORAMIDE, OCTAMETHYL- (OR) OCTAMETHYLPYROPHOSPHORAMIDE

- . Waste code: P087
- . Waste name: OSMIUM OXIDE OSO₄, (T-4)- (OR) OSMIUM TETROXIDE

- . Waste code: P088
- . Waste name: 7-OXABICYCLO[2.2.1]HEPTANE-2,3-DICARBOXYLIC ACID (OR) ENDOTHALL

- . Waste code: P089
- . Waste name: PARATHION (OR) PHOSPHOROTHIOIC ACID, O,O-DIETHYL-O-(4-NITROPHENYL) ESTER

- . Waste code: P092
- . Waste name: MERCURY, (ACETATO-O)PHENYL- (OR) PHENYLMERCURY ACETATE

- . Waste code: P093
- . Waste name: PHENYLTHIOUREA (OR) THIOUREA, PHENYL-

- . Waste code: P094
- . Waste name: PHORATE (OR) PHOSPHORODITHIOIC ACID, O,O-DIETHYL S-[(ETHYLTHIO)METHYL] ESTER

- . Waste code: P095
- . Waste name: CARBONIC DICHLORIDE (OR) PHOSGENE

- . Waste code: P096
- . Waste name: HYDROGEN PHOSPHIDE (OR) PHOSPHINE

- . Waste code: P097
- . Waste name: FAMPHUR (OR) PHOSPHOROTHIOIC ACID O-[4-{(DIMETHYLAMINO)SULFONYL}PHENYL] O,O-DIMETHYL ESTER

- . Waste code: P098
- . Waste name: POTASSIUM CYANIDE (OR) POTASSIUM CYANIDE K(CN)

- . Waste code: P099
- . Waste name: ARGENTATE (1-), BIS(CYANO-C)-, POTASSIUM (OR) POTASSIUM SILVER CYANIDE

- . Waste code: P101
- . Waste name: ETHYL CYANIDE (OR) PROPANENITRILE

- . Waste code: P102
- . Waste name: 2-PROPYN-1-OL (OR) PROPARGYL ALCOHOL

- . Waste code: P103
- . Waste name: SELENOUREA

- . Waste code: P104
- . Waste name: SILVER CYANIDE (OR) SILVER CYANIDE AG(CN)

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: P105
- . Waste name: SODIUM AZIDE

- . Waste code: P106
- . Waste name: SODIUM CYANIDE (OR) SODIUM CYANIDE NA(CN)

- . Waste code: P107
- . Waste name: STRONTIUM SULFIDE SRS

- . Waste code: P108
- . Waste name: STRYCHNIDIN-10-ONE, & SALTS (OR) STRYCHNINE, & SALTS

- . Waste code: P109
- . Waste name: TETRAETHYLDITHIOPYROPHOSPHATE (OR) THIODIPHOSPHORIC ACID, TETRAETHYL ESTER

- . Waste code: P110
- . Waste name: PLUMBANE, TETRAETHYL- (OR) TETRAETHYL LEAD

- . Waste code: P111
- . Waste name: DIPHOSPHORIC ACID, TETRAETHYL ESTER (OR) TETRAETHYL PYROPHOSPHATE

- . Waste code: P112
- . Waste name: METHANE, TETRANITRO- (R) (OR) TETRANITROMETHANE (R)

- . Waste code: P113
- . Waste name: THALLIC OXIDE (OR) THALLIUM OXIDE TL2O3

- . Waste code: P114
- . Waste name: SELENIOS ACID, DITHALLIUM (1+) SALT (OR) THALLIUM(I) SELENITE

- . Waste code: P115
- . Waste name: SULFURIC ACID, DITHALLIUM (1+) SALT (OR) THALLIUM(I) SULFATE

- . Waste code: P116
- . Waste name: HYDRAZINECARBOTHIOAMIDE (OR) THIOSEMICARBAZIDE

- . Waste code: P118
- . Waste name: METHANETHIOL, TRICHLORO- (OR) TRICHLOROMETHANETHIOL

- . Waste code: P119
- . Waste name: AMMONIUM VANADATE (OR) VANADIC ACID, AMMONIUM SALT

- . Waste code: P120
- . Waste name: VANADIUM OXIDE V2O5 (OR) VANADIUM PENTOXIDE

- . Waste code: P121
- . Waste name: ZINC CYANIDE (OR) ZINC CYANIDE ZN(CN)2

- . Waste code: P122
- . Waste name: ZINC PHOSPHIDE ZN3P2, WHEN PRESENT AT CONCENTRATIONS GREATER THAN 10% (R,T)

- . Waste code: P123
- . Waste name: TOXAPHENE

- . Waste code: P127

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste name: 7-BENZOFURANOL, 2,3-DIHYDRO-2,2-DIMETHYL-, METHYL CARBAMATE (OR) CARBOFURAN
- . Waste code: P128
- . Waste name: PHENOL, 4-(DIMETHYLAMINO)-3,5-DIMETHYL-, METHYL CARBAMATE (ESTER)
- . Waste code: P185
- . Waste name: 1,3-DITHIOLANE-2-CARBOXALDEHYDE, 2,4-DIMETHYL-, O-[(METHYLAMINO)-CARBONYL]OXIME (OR) TIRPATE
- . Waste code: P188
- . Waste name: BENZOIC ACID, 2-HYDROXY-, COMPD. WITH (3AS-CIS)-1,2,3,3A,8,8A-HEXAHYDRO-1,3A,8-TRIMETHYLPYRROLO[2,3-B]INDOL-5-YL METHYL CARBAMATE ESTER (1:1) (OR) PHYSOSTIGMINE SALICYLATE
- . Waste code: P189
- . Waste name: CARBAMIC ACID, [(DIBUTYLAMINO)-THIO]METHYL-, 2,3-DIHYDRO-2,2-DIMETHYL-7-BENZOFURANYL ESTER (OR) CARBOSULFAN
- . Waste code: P190
- . Waste name: CARBAMIC ACID, METHYL-, 3-METHYLPHENYL ESTER (OR) METOLCARB
- . Waste code: P191
- . Waste name: CARBAMIC ACID, DIMETHYL-, 1-[(DIMETHYL-AMINO)CARBONYL]- 5-METHYL-1H-PYRAZOL-3-YL ESTER (OR) DIMETILAN
- . Waste code: P192
- . Waste name: ISOLAN (OR) CARBAMIC ACID, DIMETHYL-, 3-METHYL-(1-METHYLETHYL)-1H-PYRAZOL-5-YL ESTER
- . Waste code: P194
- . Waste name: ETHANIMIDOTHIOIC ACID, 2-(DIMETHYLAMINO)-N-[(METHYLAMINO)CARBONYL]OXY]-2-OXO-, METHYL ESTER (OR) OXAMYL
- . Waste code: P196
- . Waste name: MANGANESE DIMETHYLDITHIOCARBAMATE (OR) MANGANESE, BIS(DIMETHYL CARBAMODITHIOATO-S,S')-,
- . Waste code: P197
- . Waste name: FORMPARANATE (OR) METHANIMIDAMIDE, N,N-DIMETHYL-N'-[2-METHYL-4-[(METHYLAMINO)CARBONYL]OXY]PHENYL]
- . Waste code: P198
- . Waste name: METHANIMIDAMIDE, N,N-DIMETHYL-N'-[3-[(METHYLAMINO)-CARBONYL]OXY]PHENYL]-, MONOHYDROCHLORIDE (OR) FORMETANATE HYDROCHLORIDE
- . Waste code: P199
- . Waste name: METHIOCARB (OR) MEXACARBATE (OR) PHENOL, (3,5-DIMETHYL-4-(METHYLTHIO)-, METHYL CARBAMATE
- . Waste code: P201
- . Waste name: PHENOL, 3-METHYL-5-(1-METHYLETHYL)-, METHYL CARBAMATE (OR) PROMECARB
- . Waste code: P202
- . Waste name: M-CUMENYL METHYL CARBAMATE (OR) 3-ISOPROPYLPHENYL N-METHYL CARBAMATE (OR) PHENOL, 3-(1-METHYLETHYL)-, METHYL CARBAMATE

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

INDUSTRIAL STORAGE WHSE CORP (Continued)

1007370583

- . Waste code: P203
- . Waste name: ALDICARB SULFONE (OR) PROPANAL, 2-METHYL-2-(METHYL-SULFONYL)-, O-[(METHYLAMINO)CARBONYL] OXIME

- . Waste code: P204
- . Waste name: PHYSOSTIGMINE (OR) PYRROLO[2,3-B]INDOL-5-OL, 1,2,3,3A,8,8A-HEXAHYDRO-1,3A,8-TRIMETHYL-METHYLCARBAMATE (ESTER), (3AS-CIS)-

- . Waste code: P205
- . Waste name: ZINC, BIS(DIMETHYLCARBAMODITHIOATO-S,S')-, (OR) ZIRAM

- Violation Status: No violations found

**H24
 NW
 1/8-1/4
 0.194 mi.
 1023 ft.**

**LC SQUARED
 4455 W RICE ST
 CHICAGO, IL 60622**

**IL UST U003152201
 N/A**

Site 1 of 4 in cluster H

**Relative:
 Lower**

UST:

Facility ID: 2035418
 Facility Status: INACTIVE/HEATING OIL
Facility Type: INDUSTRIAL / MANUFACTURING
 Owner Id: U0025222
 Owner Name: Lc Squared
 Owner Address: 14380 N Hayden Lane Rd
 Owner City,St,Zip: Hayden Lake, ID 83835

**Actual:
 609 ft.**

Tank Number: 1
Tank Status: Out of service
 Tank Capacity: 1615
 Tank Substance: Heating Oil
 Last Used Date: 1/1/1976
 OSFM First Notify Date: 11/22/1996
 Red Tag Issue Date: Not reported
 Install Date: 1/1/1938
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: \$0.00
 Motor Fuel Permit Inspection Date: Not reported
 Motor Fuel Permit Expiration Date: Not reported
 MOTOR FUEL TYPE: Not reported
 Pending Nov: N
 IEMA: Not reported
 Equipment Type: Not reported
 Equipment: Not reported
 Last Passing Date: Not reported
 Test Expire Date: Not reported

MAP FINDINGS

Map ID
Direction
Distance
Elevation

Site

Database(s)

EDR ID Number
EPA ID Number

H25
NW
1/8-1/4
0.197 mi.
1040 ft.

BRACHS CANDY FACTORY/DEMOLISHED
4545 RACE ST
CHICAGO, IL 60612

IL UST **U003042128**
N/A

Site 2 of 4 in cluster H

Relative:
Lower

UST:

Facility ID: 2034481
Facility Status: EXEMPT
Facility Type: OTHER
Owner Id: U0024367
Owner Name: J Brach Corp
Owner Address: 251 North West Ave C/O Hitchcock And Son
Owner City,St,Zip: Elmhurst, IL 60126

Actual:
609 ft.

Tank Number: 1
Tank Status: Exempt from registration
Tank Capacity: 1000
Tank Substance: Heating Oil
Last Used Date: 12/1/1973
OSFM First Notify Date: 11/8/1995
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

H26
NW
1/8-1/4
0.197 mi.
1040 ft.

BRACHS CANDY FACTORY
4545 RACE ST
CHICAGO, IL 60612

RCRA NonGen / NLR **1001076765**
FINDS **ILR000010843**
ECHO

Site 3 of 4 in cluster H

Relative:
Lower

RCRA NonGen / NLR:

Date form received by agency: 10/04/1995
Facility name: BRACHS CANDY FACTORY
Facility address: 4545 RACE ST
CHICAGO, IL 60612
EPA ID: ILR000010843
Mailing address: 251 NORTH WEST AVE
ELMHURST, IL 60126
Contact: RAY HITCHCOCK
Contact address: 251 NORTH WEST AVE
ELMHURST, IL 60126
Contact country: US
Contact telephone: 708-833-9600
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Actual:
609 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

BRACHS CANDY FACTORY (Continued)

1001076765

Owner/Operator Summary:

Owner/operator name: BRACH J CORP
Owner/operator address: 251 NORTH WEST AVE
ELMHURST, IL 60612
Owner/operator country: Not reported
Owner/operator telephone: 708-833-9600
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

FINDS:

Registry ID: 110005937068

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1001076765
Registry ID: 110005937068
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005937068>

MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Site

Database(s)

EDR ID Number
 EPA ID Number

H27 **BRACH & BROCK CONFECTIONS**
NW **4545 WEST RACE ST.**
1/8-1/4 **CHICAGO, IL 60612**
0.197 mi.
1040 ft. **Site 4 of 4 in cluster H**

IL LUST **S104002151**
 N/A

Relative: LUST:
Lower Incident Num: 960026
 IL EPA Id: 316286330
Actual: Product: Gasoline, Other Petroleum
609 ft. IEMA Date: 1996-01-05
 Project Manager: NOT ASSIGNED
 Project Manager Phone: Not reported
 Email: Not reported
 PRP Name: Brach & Brock Confections
 PRP Contact: Ron Lanser
 PRP Address: 401 North Cicero Ave.
 PRP City,St,Zip: Chicago, IL
 PRP Phone: Not reported
 Site Classification: Not reported
 Section 57.5(g) Letter: 732
 Date Section 57.5(g) Letter: 4/8/1997 0
 Non LUST Determination Letter: Not reported
 20 Report Received: 2/20/1996
 45 Report Received: Not reported
 NFA/NFR Letter: **Not reported**
 NFR Date Recorded: Not reported

Incident Num: 952139
 IL EPA Id: 316286330
 Product: Other Petroleum
 IEMA Date: 1995-10-16
 Project Manager: Harlow
 Project Manager Phone: Not reported
 Email: Not reported
 PRP Name: Brach & Brock Confections
 PRP Contact: Ron Lanser
 PRP Address: 401 North Cicero Ave.
 PRP City,St,Zip: Chicago, IL
 PRP Phone: Not reported
 Site Classification: Not reported
 Section 57.5(g) Letter: 732
 Date Section 57.5(g) Letter: Not reported
 Non LUST Determination Letter: Not reported
 20 Report Received: Not reported
 45 Report Received: Not reported
NFA/NFR Letter: **12/30/1996**
 NFR Date Recorded: Not reported

I28 **DUNBAR ARMORED**
WNW **4500 W. CHICAGO AVE.**
1/8-1/4 **CHICAGO, IL 60651**
0.203 mi.
1071 ft. **Site 1 of 2 in cluster I**

IL UST **U001629861**
 N/A

Relative: UST:
Higher Facility ID: 2032579
 Facility Status: ACTIVE
Actual: **Facility Type:** **PRIVATE INSTITUTION**
611 ft. Owner Id: U0033440

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

DUNBAR ARMORED (Continued)

U001629861

Owner Name: Dunbar Armored, Inc.
Owner Address: 4500 W. Chicago
Owner City,St,Zip: Chicago, IL 60651

Tank Number: 1
Tank Status: Currently in use
Tank Capacity: 10000
Tank Substance: Diesel Fuel
Last Used Date: Not reported
OSFM First Notify Date: 10/5/1993
Red Tag Issue Date: Not reported
Install Date: 10/25/1988
Green Tag Decal: R000787
Green Tag Issue Date: 10/5/2016
Green Tag Expire Date: 12/31/2018
Fee Due: \$0.00
Motor Fuel Permit Inspection Date: 11/17/2014
Motor Fuel Permit Expiration Date: 12/31/2016
MOTOR FUEL TYPE: Fleet
Pending Nov: N
IEMA: Not reported
Equipment Type: Corrosion Prot - Piping
Equipment: Sacrificial Anode Cathodic Protection
Last Passing Date: 5/11/2016
Test Expire Date: 5/11/2019

I29
WNW
1/8-1/4
0.203 mi.
1071 ft.

FEDERAL ARMORED EXPRESS
4500 W CHICAGO AVE
CHICAGO, IL 60651

RCRA-CESQG 1004692256
FINDS IL0000037317
ECHO

Site 2 of 2 in cluster I

Relative:
Higher

RCRA-CESQG:
Date form received by agency: 10/22/1993
Facility name: FEDERAL ARMORED EXPRESS INC
Facility address: 4500 W CHICAGO AVE
CHICAGO, IL 60610
EPA ID: IL0000037317
Contact: TONY TANKOWSKI
Contact address: 4500 W CHICAGO AVE
CHICAGO, IL 60610
Contact country: US
Contact telephone: 312-276-3132
Contact email: Not reported
EPA Region: 05
Classification: Conditionally Exempt Small Quantity Generator
Description: Handler: generates 100 kg or less of hazardous waste per calendar month, and accumulates 1000 kg or less of hazardous waste at any time; or generates 1 kg or less of acutely hazardous waste per calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste; or generates 100 kg or less of any residue or contaminated soil, waste or other debris resulting from the cleanup of a spill, into or on any land or water, of acutely hazardous waste during any calendar month, and accumulates at any time: 1 kg or less of acutely hazardous waste; or 100 kg or less of any residue or contaminated soil, waste or other debris resulting from

Actual:
611 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

FEDERAL ARMORED EXPRESS (Continued)

1004692256

the cleanup of a spill, into or on any land or water, of acutely hazardous waste

Owner/Operator Summary:

Owner/operator name: FCLS INVESTOR GROUP
Owner/operator address: 960 MAPLEWOOD DR
ITASCA, IL 60193
Owner/operator country: Not reported
Owner/operator telephone: 708-773-0050
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D008
. Waste name: LEAD

Violation Status: No violations found

FINDS:

Registry ID: 110005795194

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

FEDERAL ARMORED EXPRESS (Continued)

1004692256

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1004692256
Registry ID: 110005795194
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005795194>

J30
West
1/8-1/4
0.211 mi.
1112 ft.

NORTHWEST SORTING CTR
750 N KILBOURN AVE
CHICAGO, IL 60624

Site 1 of 2 in cluster J

RCRA-SQG 1000166292
ICIS ILD980260855
FINDS
ECHO
NY MANIFEST

Relative:
Higher

RCRA-SQG:

Date form received by agency: 07/22/1988
Facility name: CHICAGO CITY OF FLEET ADMIN
Facility address: 750 N KILBOURN
CHICAGO, IL 60624
EPA ID: ILD980260855
Mailing address: 306 W 37TH ST
CHICAGO, IL 60609
Contact: JAMES WARREN
Contact address: 306 W 37TH ST
CHICAGO, IL 60609
Contact country: US
Contact telephone: 312-744-5666
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Actual:
613 ft.

Owner/Operator Summary:

Owner/operator name: CHICAGO CITY OF
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Municipal
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

NORTHWEST SORTING CTR (Continued)

1000166292

Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Municipal
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D000
. Waste name: Not Defined

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

ICIS:

Enforcement Action ID: IL000A0000170310468500004
FRS ID: 110001372737
Action Name: NORTHWEST SORTING CTR 170310468500004
Facility Name: NORTHWEST SORTING CTR
Facility Address: 750 N KILBOURN AVE
CHICAGO, IL 60624

Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV
Facility SIC Code: 4953
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.89311
Longitude in Decimal Degrees: -87.73956
Permit Type Desc: Not reported
Program System Acronym: IL000031600FRR
Facility NAICS Code: 562212
Tribal Land Code: Not reported

Enforcement Action ID: IL000A0000170310147800022
FRS ID: 110001372737
Action Name: NORTHWEST WASTE TO ENERGY FACILITY 170310147800022
Facility Name: NORTHWEST WASTE TO ENERGY FACILITY

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

NORTHWEST SORTING CTR (Continued)

1000166292

Facility Address: 750 N. KILBOURN AVENUE
CHICAGO, IL 606241043

Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR

Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV

Facility SIC Code: 4953
Federal Facility ID: Not reported

Latitude in Decimal Degrees: 41.89311
Longitude in Decimal Degrees: -87.73956

Permit Type Desc: Not reported
Program System Acronym: IL000031600CDR

Facility NAICS Code: 562212
Tribal Land Code: Not reported

Enforcement Action ID: IL000A0000170310147800011
FRS ID: 110001372737

Action Name: NORTHWEST WASTE TO ENERGY FACILITY 170310147800011
Facility Name: NORTHWEST WASTE TO ENERGY FACILITY

Facility Address: 750 N. KILBOURN AVENUE
CHICAGO, IL 606241043

Enforcement Action Type: Notice of Violation
Facility County: COOK

Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV

Facility SIC Code: 4953
Federal Facility ID: Not reported

Latitude in Decimal Degrees: 41.89311
Longitude in Decimal Degrees: -87.73956

Permit Type Desc: Not reported
Program System Acronym: IL000031600CDR

Facility NAICS Code: 562212
Tribal Land Code: Not reported

Enforcement Action ID: 05-1999-A012
FRS ID: 110001372737

Action Name: NORTHWEST WASTE TO ENERGY FACILITY 170310147800058
Facility Name: NORTHWEST WASTE TO ENERGY FACILITY

Facility Address: 750 N. KILBOURN AVENUE
CHICAGO, IL 606241043

Enforcement Action Type: Civil Judicial Action
Facility County: COOK

Program System Acronym: AIR
Enforcement Action Forum Desc: Judicial

EA Type Code: CIV
Facility SIC Code: 4953

Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.89311

Longitude in Decimal Degrees: -87.73956
Permit Type Desc: Not reported

Program System Acronym: IL000031600CDR
Facility NAICS Code: 562212

Tribal Land Code: Not reported

Enforcement Action ID: 05-000F000170310147800036

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

NORTHWEST SORTING CTR (Continued)

1000166292

FRS ID: 110001372737
Action Name: NORTHWEST WASTE TO ENERGY FACILITY 170310147800036
Facility Name: NORTHWEST WASTE TO ENERGY FACILITY
Facility Address: 750 N. KILBOURN AVENUE
CHICAGO, IL 606241043
Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV
Facility SIC Code: 4953
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.89311
Longitude in Decimal Degrees: -87.73956
Permit Type Desc: Not reported
Program System Acronym: IL000031600CDR
Facility NAICS Code: 562212
Tribal Land Code: Not reported

FINDS:

Registry ID: 110001372737

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

AIR EMISSIONS CLASSIFICATION UNKNOWN

AIR MINOR

Registry ID: 110009372883

Environmental Interest/Information System

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

NORTHWEST SORTING CTR (Continued)

1000166292

ECHO:

Envid: 1000166292
Registry ID: 110009372883
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110009372883>

Envid: 1000166292
Registry ID: 110001372737
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110001372737>

NY MANIFEST:

Country: USA
EPA ID: ILD980260855
Facility Status: Not reported
Location Address 1: 700 N. KILBOURN
Code: BP
Location Address 2: Not reported
Total Tanks: Not reported
Location City: CHICAGO
Location State: IL
Location Zip: 60624
Location Zip 4: Not reported

NY MANIFEST:

EPAID: ILD980260855
Mailing Name: CHICAGO CITY OF
Mailing Contact: JOHN MADL
Mailing Address 1: 700 N. KILBOURN
Mailing Address 2: Not reported
Mailing City: CHICAGO
Mailing State: IL
Mailing Zip: 60624
Mailing Zip 4: Not reported
Mailing Country: USA
Mailing Phone: 3127447200

NY MANIFEST:

Document ID: NYB4950531
Manifest Status: C
seq: Not reported
Year: 1997
Trans1 State ID: 176963IL
Trans2 State ID: Not reported
Generator Ship Date: 06/09/1997
Trans1 Recv Date: 06/09/1997
Trans2 Recv Date: / /
TSD Site Recv Date: 06/10/1997
Part A Recv Date: 08/14/1997
Part B Recv Date: 06/24/1997
Generator EPA ID: ILD980260855
Trans1 EPA ID: ILD982067175
Trans2 EPA ID: Not reported
TSDF ID 1: NYD049836679
TSDF ID 2: Not reported
Manifest Tracking Number: Not reported
Import Indicator: Not reported
Export Indicator: Not reported

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

NORTHWEST SORTING CTR (Continued)

1000166292

Discr Quantity Indicator: Not reported
 Discr Type Indicator: Not reported
 Discr Residue Indicator: Not reported
 Discr Partial Reject Indicator: Not reported
 Discr Full Reject Indicator: Not reported
 Manifest Ref Number: Not reported
 Alt Facility RCRA ID: Not reported
 Alt Facility Sign Date: Not reported
 MGMT Method Type Code: Not reported
 Waste Code: B006 - PCB TRANSFORMERS WITH 500 PPM OR > PCB
 Waste Code: Not reported
 Waste Code: Not reported
 Waste Code: Not reported
 Waste Code: Not reported
 Waste Code: Not reported
 Quantity: 04730
 Units: K - Kilograms (2.2 pounds)
 Number of Containers: 001
 Container Type: TP - Tanks, portable
 Handling Method: B Incineration, heat recovery, burning.
 Specific Gravity: 100

[Click this hyperlink](#) while viewing on your computer to access additional NY_MANIFEST: detail in the EDR Site Report.

J31
 West
 1/8-1/4
 0.211 mi.
 1112 ft.

DEPT STREETS & SANITATION
750 N KILBOURN AVE
CHICAGO, IL 60624
 Site 2 of 2 in cluster J

IL UST U001142122
N/A

**Relative:
 Higher**

UST:
 Facility ID: 2018804
 Facility Status: CLOSED
Facility Type: NONE
 Owner Id: U0002849
 Owner Name: City of Chicago Department of Environment
 Owner Address: 30 North LaSalle Street, 2nd Floor
 Owner City,St,Zip: Chicago, IL 60602

**Actual:
 613 ft.**

Tank Number: 1
Tank Status: Removed
 Tank Capacity: 12000
 Tank Substance: Gasoline
 Last Used Date: Not reported
 OSFM First Notify Date: 5/8/1986
 Red Tag Issue Date: Not reported
 Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: \$0.00
 Motor Fuel Permit Inspection Date: Not reported
 Motor Fuel Permit Expiration Date: Not reported
 MOTOR FUEL TYPE: Not reported
 Pending Nov: N
 IEMA: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

DEPT STREETS & SANITATION (Continued)

U001142122

Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 2
Tank Status: Removed
Tank Capacity: 12000
Tank Substance: Diesel Fuel
Last Used Date: Not reported
OSFM First Notify Date: 5/8/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: \$0.00
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 3
Tank Status: Removed
Tank Capacity: 12000
Tank Substance: Diesel Fuel
Last Used Date: Not reported
OSFM First Notify Date: 5/8/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: \$0.00
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 4
Tank Status: Removed
Tank Capacity: 3000
Tank Substance: Used Oil
Last Used Date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

DEPT STREETS & SANITATION (Continued)

U001142122

OSFM First Notify Date: 5/8/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: \$0.00
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 5
Tank Status: Removed
Tank Capacity: 2000
Tank Substance: Used Oil
Last Used Date: Not reported
OSFM First Notify Date: 5/8/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: \$0.00
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 6
Tank Status: Removed
Tank Capacity: 2000
Tank Substance: Not reported
Last Used Date: Not reported
OSFM First Notify Date: 1/1/1902
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: \$0.00
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

DEPT STREETS & SANITATION (Continued)

U001142122

IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

K32
ENE
1/8-1/4
0.222 mi.
1171 ft.

COUNTRY DELIGHT
4201 W CHICAGO AVE
CHICAGO, IL 60651

IL UST U001142103
N/A

Site 1 of 3 in cluster K

Relative:
Lower

UST:

Facility ID: 2010448
Facility Status: CLOSED
Facility Type: **NONE**
Owner Id: U0003474
Owner Name: Certified Grocers Midwest Inc
Owner Address: 6800 Santa Fe Dr
Owner City,St,Zip: Hodgkins, IL 60625

Actual:
607 ft.

Tank Number: 1
Tank Status: Removed
Tank Capacity: 12000
Tank Substance: Diesel Fuel
Last Used Date: Not reported
OSFM First Notify Date: 4/23/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

Tank Number: 2
Tank Status: Removed
Tank Capacity: 12000
Tank Substance: Gasoline
Last Used Date: Not reported
OSFM First Notify Date: 4/23/1986
Red Tag Issue Date: Not reported
Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
Fee Due: Not reported
Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

COUNTRY DELIGHT (Continued)

U001142103

MOTOR FUEL TYPE: Not reported
 Pending Nov: N
 IEMA: Not reported
 Equipment Type: Not reported
 Equipment: Not reported
 Last Passing Date: Not reported
 Test Expire Date: Not reported

Tank Number: 3
Tank Status: Removed
 Tank Capacity: 12000
 Tank Substance: Diesel Fuel
 Last Used Date: Not reported
 OSFM First Notify Date: 8/12/1991
 Red Tag Issue Date: Not reported
 Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: Not reported
 Motor Fuel Permit Inspection Date: Not reported
 Motor Fuel Permit Expiration Date: Not reported
 MOTOR FUEL TYPE: Not reported
 Pending Nov: N
 IEMA: Not reported
 Equipment Type: Not reported
 Equipment: Not reported
 Last Passing Date: Not reported
 Test Expire Date: Not reported

K33
ENE
 1/8-1/4
 0.238 mi.
 1259 ft.

FORMER SWISS VALLEY DAIRY
4155 W. CHICAGO AVENUE
CHICAGO, IL 60651

IL UST U003987960
N/A

Site 2 of 3 in cluster K

Relative:
Lower

UST:
 Facility ID: 2042615
 Facility Status: EXEMPT
Facility Type: INDUSTRIAL / MANUFACTURING
 Owner Id: U0032461
 Owner Name: 4201 W. Augusta LLC
 Owner Address: 1639 W. Walnut c/o WSP
 Owner City,St,Zip: Chicago, IL 60612

Actual:
606 ft.

Tank Number: 1
Tank Status: Exempt from registration
 Tank Capacity: 550
 Tank Substance: Used Oil
 Last Used Date: 12/31/1973
 OSFM First Notify Date: 1/13/2005
 Red Tag Issue Date: Not reported
 Install Date: Not reported
Green Tag Decal: Not reported
Green Tag Issue Date: Not reported
Green Tag Expire Date: Not reported
 Fee Due: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

FORMER SWISS VALLEY DAIRY (Continued)

U003987960

Motor Fuel Permit Inspection Date: Not reported
Motor Fuel Permit Expiration Date: Not reported
MOTOR FUEL TYPE: Not reported
Pending Nov: N
IEMA: Not reported
Equipment Type: Not reported
Equipment: Not reported
Last Passing Date: Not reported
Test Expire Date: Not reported

**K34
ENE
1/8-1/4
0.241 mi.
1274 ft.**

**CERTIFIED GROCERS
4206 WEST CHICAGO AVE.
CHICAGO, IL 60651
Site 3 of 3 in cluster K**

**IL LUST S104525568
N/A**

**Relative:
Lower**

LUST:

Incident Num: 912797
IL EPA Id: 316235033
Product: Gasoline, Diesel
IEMA Date: 1991-10-02
Project Manager: Benanti
Project Manager Phone: (217) 524-4649
Email: Trent.Benanti@illinois.gov
PRP Name: Certified Grocers
PRP Contact: Ken Palubiak
PRP Address: 6800 Santa Fe Dr.
PRP City,St,Zip: Hodgkins, IL 60525
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 10/22/1991
45 Report Received: 11/13/1991
NFA/NFR Letter: 1/14/2002
NFR Date Recorded: 2/13/2002

**Actual:
605 ft.**

**35
ENE
1/4-1/2
0.280 mi.
1480 ft.**

**HOSPITAL LAUNDRY SERVICES
4141 WEST CHICAGO AVE.
CHICAGO, IL 60651**

**IL LUST S104523834
N/A**

**Relative:
Lower**

LUST:

Incident Num: 931621
IL EPA Id: 316235051
Product: Fuel Oil
IEMA Date: 1993-06-16
Project Manager: Nickell
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Hospital Laundry Services
PRP Contact: Joe Warant
PRP Address: 4141 West Chicago Ave.
PRP City,St,Zip: Chicago, IL 60651

**Actual:
605 ft.**

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

HOSPITAL LAUNDRY SERVICES (Continued)

S104523834

PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 7/12/1993
45 Report Received: 8/6/1993 0
NFA/NFR Letter: 8/18/1993
NFR Date Recorded: Not reported

36
NNW
1/4-1/2
0.281 mi.
1482 ft.

LIDLAW TRANSIT, INC.
902 KILBOURN ST.
CHICAGO, IL 60651

IL LUST S104002294
N/A

Relative:
Lower

LUST:

Incident Num: 921906
IL EPA Id: 316325145
Product: Unleaded Gas
IEMA Date: 1992-07-15
Project Manager: NOT ASSIGNED
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Laidlaw Transit, Inc.
PRP Contact: Donald MacFeely
PRP Address: 7501 Quincy St.
PRP City,St,Zip: Willowbrook, IL 60521
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 8/12/1992
45 Report Received: 10/5/1992
NFA/NFR Letter: 10/8/1992
NFR Date Recorded: Not reported

Actual:
608 ft.

37
WSW
1/4-1/2
0.300 mi.
1586 ft.

PROSPERITY TRUCKING
4600 WEST ERIE
CHICAGO, IL 60644

IL LUST S104523277
N/A

Relative:
Lower

LUST:

Incident Num: 940684
IL EPA Id: 316255093
Product: Other Petroleum
IEMA Date: 1994-03-31
Project Manager: Reuter
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Eleanor Rosland
PRP Contact: Frank Rosland
PRP Address: 4656 West Erie
PRP City,St,Zip: Chicago, IL 60644

Actual:
606 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PROSPERITY TRUCKING (Continued)

S104523277

PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 6/27/1994
45 Report Received: 6/27/1994
NFA/NFR Letter: 7/14/1994
NFR Date Recorded: Not reported

38
ENE
1/4-1/2
0.309 mi.
1631 ft.

L. PRITIKIN & BECKER
4224 WEST CHICAGO
CHICAGO, IL 60651

IL LUST S104529972
N/A

Relative:
Lower

LUST:

Actual:
606 ft.

Incident Num: 991926
IL EPA Id: 316255165
Product: Other Petroleum
IEMA Date: 1999-08-16
Project Manager: Heaton
Project Manager Phone: (217) 524-3312
Email: Mike.Heaton@illinois.gov
PRP Name: L. Pritikin & Becker
PRP Contact: Michael Garrett
PRP Address: 4224 West Chicago
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: 7732272404
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: 4/8/2014 0
Non LUST Determination Letter: Not reported
20 Report Received: Not reported
45 Report Received: Not reported
NFA/NFR Letter: Not reported
NFR Date Recorded: Not reported

39
North
1/4-1/2
0.313 mi.
1654 ft.

ST. FRANCIS OF ASSISI
932 KOSTNER RD.
CHICAGO, IL 60651

IL LUST S104564359
N/A

Relative:
Lower

LUST:

Actual:
607 ft.

Incident Num: 20001171
IL EPA Id: 316255185
Product: Other Petroleum
IEMA Date: 2000-06-19
Project Manager: Kuhlman
Project Manager Phone: (217) 785-5715
Email: Eric.Kuhlman@illinois.gov
PRP Name: St. Francis of Assisi
PRP Contact: Father Desmond
PRP Address: 930 Kostner Rd.
PRP City,St,Zip: Chicago, IL 60651

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ST. FRANCIS OF ASSISI (Continued)

S104564359

PRP Phone: 7732353132
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: Not reported
45 Report Received: Not reported
NFA/NFR Letter: Not reported
NFR Date Recorded: Not reported

40
SSE
1/4-1/2
0.328 mi.
1730 ft.

CITY OF CHICAGO
4233 W FERDINAND
CHICAGO, IL 60624

RCRA-SQG 1000979132
IL SRP IL0000993550
US AIRS
FINDS
ECHO

Relative:
Lower

RCRA-SQG:

Actual:
608 ft.

Date form received by agency: 12/21/1994
Facility name: CHICAGO CITY OF
Facility address: 4233 W FERDINAND
CHICAGO, IL 60651
EPA ID: IL0000993550
Mailing address: 1665 N TROOP
CHICAGO, IL 60622
Contact: S KOSSAKOWSKI
Contact address: 4233 W FERDINAND
CHICAGO, IL 60651
Contact country: US
Contact telephone: 312-638-8424
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name: CHICAGO CITY OF
Owner/operator address: 4233 W FERDINAND
CHICAGO, IL 60651
Owner/operator country: Not reported
Owner/operator telephone: 312-638-8434
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Municipal
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

CITY OF CHICAGO (Continued)

1000979132

Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
Used oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

Violation Status: No violations found

SRP:

IL EPA Id: 0316325300
US EPA Id: Not reported
Longitude: -87.625202
Latitude: 41.861519
Contact Name: Elizabeth Reyes
Contact Address: 4946 North Sheridan Road
Contact City,St,Zip: Chicago, IL 60640
Date Enrolled: 02/16/1999
Point Of Contact: Jeffrey A. Meyerhoff
Consultant Company: Mostardi-Platt Associates, Inc.
Consultant Address: 945 Oaklawn Avenue
Consultant City,St,Zip: Elmhurst, IL 60126-1012
Proj Mgr Assigned: Not assigned
Sec. 4 Letter Date: Not reported
Active: No
Remediation Applicant Co: Lakefront SRO Corporation
Remediation Applicant Name: Elizabeth Reyes
Remediation Applicant Company: Lakefront SRO Corporation
Remediation Applicant Address: 4946 North Sheridan Road
Remediation Applicant City,St,Zip: Chicago, IL 60640
Illinois EPA: 0316325300
Site Name: South Loop Apartments
NFR Letter: 1999-03-03
NFR Letter Date Recorded: 1999-05-06
Comprehensive/Focused: Focused
Worker Caution: No
Acres: 1
Land Use: Residential or Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: No
Industrial - Commercial: No
Slab on Grade: No
BCT: No
Building Slab: No
Asphalt Used: No
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

CITY OF CHICAGO (Continued)

1000979132

[Click here for IL SRP:](#)

US AIRS MINOR:

Envid: 1000979132
Region Code: 05
Programmatic ID: AIR IL000031600GUX
Facility Registry ID: 110005807289
D and B Number: Not reported
Primary SIC Code: 9199
NAICS Code: 921190
Default Air Classification Code: MIN
Facility Type of Ownership Code: POF
Air CMS Category Code: Not reported
HPV Status: Not reported

US AIRS MINOR:

Region Code: 05
Programmatic ID: AIR IL000031600GUX
Facility Registry ID: 110005807289
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2009-09-16 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

FINDS:

Registry ID: 110005807289

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

AIR EMISSIONS CLASSIFICATION UNKNOWN

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

CITY OF CHICAGO (Continued)

1000979132

AIR MINOR

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000979132
 Registry ID: 110005807289
 DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005807289>

**L41
 NNW
 1/4-1/2
 0.371 mi.
 1960 ft.**

**PLAYSKOOL, INC.-NORTH PARCEL
 4501 WEST AUGUSTA BOULEVARD
 CHICAGO, IL 60651
 Site 1 of 3 in cluster L**

**IL LUST
 IL ENG CONTROLS
 IL INST CONTROL
 IL SRP**

**S104523629
 N/A**

**Relative:
 Lower**

LUST:

Incident Num: 932448
 IL EPA Id: 316005348
 Product: Used Oil
 IEMA Date: 1993-09-13
 Project Manager: Lowder
 Project Manager Phone: (217) 785-5734
 Email: Mike.Lowder@illinois.gov
 PRP Name: F.C.L. Stava Group
 PRP Contact: Robert Stovall
 PRP Address: 950 Maplewood Dr.
 PRP City,St,Zip: Itasca, IL 60143
 PRP Phone: Not reported
 Site Classification: Not reported
 Section 57.5(g) Letter: 732
 Date Section 57.5(g) Letter: Not reported
 Non LUST Determination Letter: Not reported
 20 Report Received: 12/22/1993
 45 Report Received: Not reported
NFA/NFR Letter: 5/5/1994 0
 NFR Date Recorded: Not reported

**Actual:
 607 ft.**

ENGINEERING CONTROLS:

Illinois Epa Id: 0316005348
 NFR Letter: 10/25/2012
 Date NFR Recorded: 11/26/2012
 Comprehensive / Focused: Comprehensive
 Remediation Applicant Name: James Bolduc
 RA Company: Walnut Street Properties
 RA Address: 1639 West Walnut Street
 RA City,St,Zip: Chicago, IL 60612
 Worker Caution: Yes
 Acres: 4.292
 Land Use: Industrial/Commercial
 Ground Water Use Restriction: No
 Highway Authority Agreement: No
 Ordinance: Yes
 Industrial - Commercial: Yes
 Slab on Grade: No
 BCT: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL, INC.-NORTH PARCEL (Continued)

S104523629

Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

Illinois Epa Id: 0316005348
NFR Letter: 10/26/2012
Date NFR Recorded: 11/26/2012
Comprehensive / Focused: Comprehensive
Remediation Applicant Name: James Bolduc
RA Company: Walnut Street Properties
RA Address: 1639 West Walnut Street
RA City,St,Zip: Chicago, IL 60612
Worker Caution: Yes
Acres: 1.828
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

IL INSTUTIONAL CONTROL:

Illinois EPA Id: 0316005348
NFR Letter: 10/25/2012
Date NFR Recorded: 11/26/2012
Comprehensive / Focused: Comprehensive
Remediation Applicant Name: James Bolduc
RA Company: Walnut Street Properties
RA Address: 1639 West Walnut Street
RA City,St,Zip: Chicago, IL 60612
Worker Caution: Yes
Acres: 4.292
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

Illinois EPA Id: 0316005348

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL, INC.-NORTH PARCEL (Continued)

S104523629

NFR Letter: 10/26/2012
Date NFR Recorded: 11/26/2012
Comprehensive / Focused: Comprehensive
Remediation Applicant Name: James Bolduc
RA Company: Walnut Street Properties
RA Address: 1639 West Walnut Street
RA City,St,Zip: Chicago, IL 60612
Worker Caution: Yes
Acres: 1.828
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

SRP:

IL EPA Id: 0316005348
US EPA Id: ILD005122163
Longitude: -87.739054
Latitude: 41.896778
Contact Name: James Bolduc
Contact Address: 1639 West Walnut Street
Contact City,St,Zip: Chicago, IL 60612
Date Enrolled: 12/11/2007
Point Of Contact: F. Thomas DePaul
Consultant Company: DAI Environmental, Inc.
Consultant Address: 27834 North Irma Lee Circle
Consultant City,St,Zip: Lake Forest, IL 60045-5130
Proj Mgr Assigned: Jim Mergen
Sec. 4 Letter Date: Not reported
Active: No
Remediation Applicant Co: Walnut Street Properties
Remediation Applicant Name: James Bolduc
Remediation Applicant Company: Walnut Street Properties
Remediation Applicant Address: 1639 West Walnut Street
Remediation Applicant City,St,Zip: Chicago, IL 60612
Illinois EPA: 0316005348
Site Name: Playskool, Inc.-Southwest Parcel
NFR Letter: 2012-10-26
NFR Letter Date Recorded: 2012-11-26
Comprehensive/Focused: Comprehensive
Worker Caution: Yes
Acres: 1.828
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL, INC.-NORTH PARCEL (Continued)

S104523629

BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

Remediation Applicant Name: James Bolduc
Remediation Applicant Company: Walnut Street Properties
Remediation Applicant Address: 1639 West Walnut Street
Remediation Applicant City,St,Zip: Chicago, IL 60612
Illinois EPA: 0316005348
Site Name: Playskool, Inc.-North Parcel
NFR Letter: 2012-10-25
NFR Letter Date Recorded: 2012-11-26
Comprehensive/Focused: Comprehensive
Worker Caution: Yes
Acres: 4.292
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: Yes
Asphalt Used: Yes
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

[Click here for IL SRP:](#)

L42
NNW
1/4-1/2
0.371 mi.
1960 ft.

**PLAYSKOOL INC
4501 W AUGUSTA BLVD
CHICAGO, IL 60651**

**SEMS-ARCHIVE 1000442257
CORRACTS ILD005122163
RCRA NonGen / NLR**

Site 2 of 3 in cluster L

**Relative:
Lower**

SEMS-ARCHIVE:
Site ID: 507418
EPA ID: ILD005122163
Federal Facility: N
NPL: Not on the NPL
Non NPL Status: Deferred to RCRA

**Actual:
607 ft.**

Following information was gathered from the prior CERCLIS update completed in 10/2013:

Site ID: 0507418
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: Deferred to RCRA

CERCLIS-NFRAP Site Alias Name(s):

Alias Name: PLAYSKOOL INC

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL INC (Continued)

1000442257

Alias Address: Not reported
IL

Program Priority:
Description: RCRA Deferral Audit
Description: RCRA Deferral - Lead Confirmed

CERCLIS-NFRAP Assessment History:

Action: ARCHIVE SITE
Date Started: / /
Date Completed: 12/11/95
Priority Level: Not reported

Action: PRELIMINARY ASSESSMENT
Date Started: / /
Date Completed: 01/18/94
Priority Level: Deferred to RCRA (Subtitle C)

Action: DISCOVERY
Date Started: / /
Date Completed: 05/18/93
Priority Level: Not reported

CORRACTS:

EPA ID: ILD005122163
EPA Region: 05
Area Name: ENTIRE FACILITY
Actual Date: 20090501
Action: CA070NO - RFA Determination Of Need For An RFI, RFI is Not Necessary
NAICS Code(s): 339931 339932
Doll and Stuffed Toy Manufacturing
Game, Toy, and Children's Vehicle Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: ILD005122163
EPA Region: 05
Area Name: ENTIRE FACILITY
Actual Date: 19930930
Action: CA075LO - CA Prioritization, Facility or area was assigned a low
corrective action priority
NAICS Code(s): 339931 339932
Doll and Stuffed Toy Manufacturing
Game, Toy, and Children's Vehicle Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: ILD005122163
EPA Region: 05
Area Name: ENTIRE FACILITY
Actual Date: 19940331
Action: CA225NR - Stabilization Measures Evaluation, This facility is, not
amenable to stabilization activity at the, present time for reasons

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL INC (Continued)

1000442257

other than (1) it appears to be technically, infeasible or inappropriate (NF) or (2) there is a lack of technical, information (IN). Reasons for this conclusion may be the status of, closure at the facility, the degree of risk, timing considerations, the status of corrective action work at the facility, or other, administrative considerations

NAICS Code(s): 339931 339932
Doll and Stuffed Toy Manufacturing
Game, Toy, and Children's Vehicle Manufacturing
Original schedule date: Not reported
Schedule end date: Not reported

RCRA NonGen / NLR:

Date form received by agency: 11/19/1980
Facility name: PLAYSKOOL INC
Facility address: 4501 W AUGUSTA BLVD
CHICAGO, IL 60651
EPA ID: ILD005122163
Mailing address: P O BOX 3400
SPRINGFIELD, MA 01101
Contact: BRUCE ORAVEC
Contact address: P O BOX 3400
SPRINGFIELD, MA 01101
Contact country: US
Contact telephone: 413-525-6411
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: PLAYSKOOL INC
Owner/operator address: 4501 W AUGUSTA BLVD
CHICAGO, IL 60651
Owner/operator country: Not reported
Owner/operator telephone: 312-276-6700
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: PLAYSKOOL INC
Owner/operator address: 4501 W AUGUSTA BLVD
CITY NOT REPORTED, IL 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-276-6700
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL INC (Continued)

1000442257

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: F001
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F002
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F003
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F005
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL INC (Continued)

1000442257

THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Historical Generators:

Date form received by agency: 08/18/1980
Site name: PLAYSKOOL INC
Classification: Not a generator, verified

. Waste code: F001
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS USED IN DEGREASING: TETRACHLOROETHYLENE, TRICHLOROETHYLENE, METHYLENE CHLORIDE, 1,1,1-TRICHLOROETHANE, CARBON TETRACHLORIDE AND CHLORINATED FLUOROCARBONS; ALL SPENT SOLVENT MIXTURES/BLENDS USED IN DEGREASING CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F002
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F003
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: XYLENE, ACETONE, ETHYL ACETATE, ETHYL BENZENE, ETHYL ETHER, METHYL ISOBUTYL KETONE, N-BUTYL ALCOHOL, CYCLOHEXANONE, AND METHANOL; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONLY THE ABOVE SPENT NONHALOGENATED SOLVENTS; AND ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS, AND A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THOSE SOLVENTS LISTED IN F001, F002, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F005
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: TOLUENE, METHYL ETHYL KETONE, CARBON DISULFIDE, ISOBUTANOL, PYRIDINE, BENZENE, 2-ETHOXYETHANOL, AND 2-NITROPROPANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, OR F004; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F017
. Waste name: Not Defined

Corrective Action Summary:

Event date: 09/30/1993
Event: CA PRIORITIZATION-LOW CA PRIORITY

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

PLAYSKOOL INC (Continued)

1000442257

Event date: 03/31/1994
Event: STABILIZATION MEASURES EVALUATION-FACILITY NOT AMENABLE TO STABILIZATION

Event date: 05/01/2009
Event: DETERMINATION OF NEED FOR AN INVESTIGATION-INVESTIGATION IS NOT NECESSARY

Violation Status: No violations found

**L43
NNW
1/4-1/2
0.392 mi.
2070 ft.**

**HUDSON SCREW MACHINE PROD.
4500 WEST AUGUSTA BLVD.
CHICAGO, IL 60651
Site 3 of 3 in cluster L**

**IL LUST 1001653027
N/A**

**Relative:
Lower**

LUST:
Incident Num: 923161
IL EPA Id: 316235021
Product: Non-Petroleum Product
IEMA Date: 1992-11-10
Project Manager: Patton
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Hudson Screw Machine Prod.
PRP Contact: James Milder
PRP Address: 4500 West Augusta Blvd.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 1/15/1993
45 Report Received: 4/30/1993
NFA/NFR Letter: 7/15/1994
NFR Date Recorded: Not reported

**Actual:
607 ft.**

**44
NW
1/4-1/2
0.410 mi.
2167 ft.**

**SCENTEX INC.
4545 WEST AUGUSTA BLVD.
CHICAGO, IL 60651**

**IL LUST S104524870
N/A**

**Relative:
Lower**

LUST:
Incident Num: 921543
IL EPA Id: 316235070
Product: Fuel Oil
IEMA Date: 1992-06-08
Project Manager: Hale
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Freedman Building, LLC
PRP Contact: Crai Freedman
PRP Address: 4545 West Augusta Blvd.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: 7735242440

**Actual:
606 ft.**

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

SCENTEX INC. (Continued)

S104524870

Site Classification: Not reported
 Section 57.5(g) Letter: 734
 Date Section 57.5(g) Letter: Not reported
 Non LUST Determination Letter: Not reported
 20 Report Received: 7/15/1992
 45 Report Received: 8/28/1992
NFA/NFR Letter: 12/29/2009
 NFR Date Recorded: 2/9/2010 0

M45
South
1/4-1/2
0.413 mi.
2181 ft.

UNION PACIFIC RAILROAD
400 NORTH PULASKI ROAD
CHICAGO, IL 60624

IL LUST
IL CHICAGO ENV

S117496751
N/A

Site 1 of 2 in cluster M

Relative:
Lower

LUST:
 Incident Num: 20150815
 IL EPA Id: 316005912
 Product: Diesel, Used Oil
 IEMA Date: 2015-07-23
 Project Manager: Rossi
 Project Manager Phone: (217) 782-9285
 Email: Jenny.Rossi@illinois.gov
 PRP Name: Union Pacific Railroad
 PRP Contact: W. Lee Hammond
 PRP Address: 1400 Douglas Street
 PRP City,St,Zip: Omaha, NE 68179
 PRP Phone: 4025445000
 Site Classification: Not reported
 Section 57.5(g) Letter: 734
 Date Section 57.5(g) Letter: Not reported
 Non LUST Determination Letter: 8/25/2015
 20 Report Received: Not reported
 45 Report Received: Not reported
NFA/NFR Letter: Not reported
 NFR Date Recorded: Not reported

Actual:
608 ft.

CHICAGO ENV:

Map Location: 400 N PULASKI RD; CHICAGO, IL; (41.888285, -87.725867)
 Complaints: Y
 Neshaps and Demolition Notices: Y
 Enforcement: Not reported
 Inspections: Y
 Permits: Y
 Tanks: Y
 Holds and Lust Nfr: Not reported
 Latitude: 41.888285
 Longitude: -87.725867

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

M46
South
1/4-1/2
0.413 mi.
2181 ft.

UNION PACIFIC RAILROAD
400 NORTH PULASKI
CHICAGO, IL 60624

IL LUST **S108480388**
N/A

Site 2 of 2 in cluster M

Relative:
Lower

LUST:
 Incident Num: 20070188
 IL EPA Id: 316005912
 Product: Diesel
 IEMA Date: 2007-02-21
 Project Manager: Heaton
 Project Manager Phone: (217) 524-3312
 Email: Mike.Heaton@illinois.gov
 PRP Name: Union Pacific Railroad
 PRP Contact: W. Lee Hammond
 PRP Address: 1400 Douglas Street
 PRP City,St,Zip: Omaha, NE 68179
 PRP Phone: Not reported
 Site Classification: Not reported
 Section 57.5(g) Letter: 734
 Date Section 57.5(g) Letter: Not reported
 Non LUST Determination Letter: Not reported
 20 Report Received: 3/13/2007
 45 Report Received: 4/6/2007 0
NFA/NFR Letter: 10/23/2008
 NFR Date Recorded: 11/24/2008

Actual:
608 ft.

47
SE
1/4-1/2
0.418 mi.
2205 ft.

FERDINAND REALTY
4100 WEST FERDINAND STREET
CHICAGO, IL 60624

IL INST CONTROL **S104491615**
IL SRP **N/A**

Relative:
Lower

IL INSTUTIONAL CONTROL:
 Illinois EPA Id: 0316265090
 NFR Letter: 07/13/2001
 Date NFR Recorded: 08/21/2001
 Comprehensive / Focused: Comprehensive
 Remediation Applicant Name: Mary Nelson
 RA Company: Bethel New Life
 RA Address: 4952 West Thomas
 RA City,St,Zip: Chicago, IL 60651
 Worker Caution: Yes
 Acres: 6.3
 Land Use: Industrial/Commercial
 Ground Water Use Restriction: Yes
 Highway Authority Agreement: No
 Ordinance: No
 Industrial - Commercial: Yes
 Slab on Grade: No
 BCT: No
 Building Slab: No
 Asphalt Used: No
 Concrete Used: No
 Clean Soil 3ft: No
 Clean Soil 10ft: No
 Alternate Barrier: No

Actual:
609 ft.

Map ID
 Direction
 Distance
 Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
 EPA ID Number

FERDINAND REALTY (Continued)

S104491615

SRP:

IL EPA Id: 0316265090
 US EPA Id: ILR000028134
 Longitude: -87.728781
 Latitude: 41.890826
 Contact Name: Mary Nelson
 Contact Address: 4952 West Thomas Street
 Contact City,St,Zip: Chicago, IL 60651-6065
 Date Enrolled: 09/29/1999
 Point Of Contact: Waye Sheu, P.E.
 Consultant Company: URS
 Consultant Address: 1701 Golf Road
 Consultant City,St,Zip: Rolling Meadows, IL 60008
 Proj Mgr Assigned: Greg Dunn
 Sec. 4 Letter Date: Not reported
 Active: No
 Remediation Applicant Co: Bethel New Life
 Remediation Applicant Name: Mary Nelson
 Remediation Applicant Company: Bethel New Life
 Remediation Applicant Address: 4952 West Thomas
 Remediation Applicant City,St,Zip: Chicago, IL 60651
 Illinois EPA: 0316265090
 Site Name: Ferdinand Realty
 NFR Letter: 2001-07-13
 NFR Letter Date Recorded: 2001-08-21
 Comprehensive/Focused: Comprehensive
 Worker Caution: Yes
 Acres: 6.3
 Land Use: Industrial/Commercial
 Ground Water Use Restriction: Yes
 Highway Authority Agreement: No
 Ordinance: No
 Industrial - Commercial: Yes
 Slab on Grade: No
 BCT: No
 Building Slab: No
 Asphalt Used: No
 Concrete Used: No
 Clean Soil 3ft: No
 Clean Soil 10ft: No
 Alternate Barrier: No

[Click here for IL SRP:](#)

48
SE
1/4-1/2
0.432 mi.
2279 ft.

BETHEL NEW LIFE
4235 WEST FERDINAND STREET
CHICAGO, IL 60624

IL INST CONTROL **S106635121**
IL SRP **N/A**

Relative:
Lower

IL INSTUTIONAL CONTROL:
 Illinois EPA Id: 0316265114
 NFR Letter: 10/14/2004
 Date NFR Recorded: 11/02/2004
 Comprehensive / Focused: Comprehensive
 Remediation Applicant Name: Mary Nelson

Actual:
609 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

BETHEL NEW LIFE (Continued)

S106635121

RA Company: Bethel New Life
RA Address: 4950 West Thomas Street
RA City,St,Zip: Chicago, IL 60651
Worker Caution: No
Acres: 1.6
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: No
Asphalt Used: No
Concrete Used: No
Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

SRP:

IL EPA Id: 0316265114
US EPA Id: Not reported
Longitude: -87.729239
Latitude: 41.889845
Contact Name: Mary Nelson
Contact Address: 4952 West Thomas Street
Contact City,St,Zip: Chicago, IL 60651-6065
Date Enrolled: 10/10/2003
Point Of Contact: Not reported
Consultant Company: V3 Consultants
Consultant Address: 120 North LaSalle Street
Consultant City,St,Zip: Chicago, IL 60602
Proj Mgr Assigned: Greg Dunn
Sec. 4 Letter Date: Not reported
Active: No
Remediation Applicant Co: Bethel New Life
Remediation Applicant Name: Mary Nelson
Remediation Applicant Company: Bethel New Life
Remediation Applicant Address: 4950 West Thomas Street
Remediation Applicant City,St,Zip: Chicago, IL 60651
Illinois EPA: 0316265114
Site Name: Bethel New Life
NFR Letter: 2004-10-14
NFR Letter Date Recorded: 2004-11-02
Comprehensive/Focused: Comprehensive
Worker Caution: No
Acres: 1.6
Land Use: Industrial/Commercial
Ground Water Use Restriction: No
Highway Authority Agreement: No
Ordinance: Yes
Industrial - Commercial: Yes
Slab on Grade: No
BCT: No
Building Slab: No
Asphalt Used: No
Concrete Used: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

BETHEL NEW LIFE (Continued)

S106635121

Clean Soil 3ft: No
Clean Soil 10ft: No
Alternate Barrier: No

[Click here for IL SRP:](#)

**N49
NW
1/4-1/2
0.448 mi.
2365 ft.**

**WHOLESALE OIL CO.
4540 WEST AUGUSTA BLVD.
CHICAGO, IL 60651**

**IL LUST S104530097
N/A**

Site 1 of 2 in cluster N

**Relative:
Lower**

LUST:

Incident Num: 992412
IL EPA Id: 316255173
Product: Gasoline
IEMA Date: 1999-10-25
Project Manager: Jones
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Wholesale Oil Co.
PRP Contact: Alvin Stiglitz
PRP Address: 4340 West Division St.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: 7732522900
Site Classification: HIGH
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 11/9/1999
45 Report Received: 4/6/2000 0
NFA/NFR Letter: Not reported
NFR Date Recorded: Not reported

**Actual:
606 ft.**

**N50
NW
1/4-1/2
0.450 mi.
2376 ft.**

**WHOLESALE OIL CO.
4560 WEST AUGUSTA BLVD.
CHICAGO, IL 60651**

**IL LUST S104530096
N/A**

Site 2 of 2 in cluster N

**Relative:
Lower**

LUST:

Incident Num: 992411
IL EPA Id: 316255172
Product: Gasoline, Diesel
IEMA Date: 1999-10-25
Project Manager: Jones
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Wholesale Oil Co.
PRP Contact: Alvin Stiglitz
PRP Address: 4340 West Division St.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: 7732522900
Site Classification: HIGH
Section 57.5(g) Letter: 732

**Actual:
606 ft.**

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

WHOLESALE OIL CO. (Continued)

S104530096

Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 11/9/1999
45 Report Received: 3/10/2000
NFA/NFR Letter: Not reported
NFR Date Recorded: Not reported

O51
WNW
1/4-1/2
0.462 mi.
2440 ft.

INDUSTRIAL METAL ENTERPRISE INC
901 N KILPATRICK AVE
CHICAGO, IL 60651

IL LUST 1000324839
RCRA NonGen / NLR ILD984774315

Site 1 of 2 in cluster O

Relative:
Lower

LUST:

Actual:
606 ft.

Incident Num: 903302
IL EPA Id: 316255044
Product: Non-Petroleum Product
IEMA Date: 1990-11-08
Project Manager: Blumhorst
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Amco Corp.
PRP Contact: Jeff Welleck
PRP Address: 901 North Kilpatrick Ave.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: Not reported
45 Report Received: Not reported
NFA/NFR Letter: 7/14/1997
NFR Date Recorded: Not reported

Incident Num: 942667
IL EPA Id: 316255044
Product: Other Petroleum
IEMA Date: 1994-11-28
Project Manager: Davison
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Amco Corp.
PRP Contact: Richard Amend
PRP Address: 901 North Kilpatrick Ave.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 12/19/1994
45 Report Received: 2/9/1996 0
NFA/NFR Letter: 3/6/1996 0
NFR Date Recorded: Not reported

RCRA NonGen / NLR:

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL METAL ENTERPRISE INC (Continued)

1000324839

Date form received by agency: 04/11/2013
Facility name: INDUSTRIAL METAL ENTERPRISE INC
Facility address: 901 N KILPATRICK AVE
CHICAGO, IL 60651
EPA ID: ILD984774315
Mailing address: PO BOX 8556
BARTLETT, IL 60103
Contact: IREK M KOWALCZYK
Contact address: PO BOX 8556
BARTLETT, IL 60103
Contact country: US
Contact telephone: 708-610-0566
Contact email: ERIC@IMEINC.NET
EPA Region: 05
Land type: Private
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: INDUSTRIAL METAL ENTERPRISE INC
Owner/operator address: 901 N KILPATRICK AVE
CHICAGO, IL 60651
Owner/operator country: US
Owner/operator telephone: 708-610-0567
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/2007
Owner/Op end date: Not reported

Owner/operator name: 901 N KILPATRICK LLC
Owner/operator address: PO BOX 8556
BARTLETT, IL 60103
Owner/operator country: US
Owner/operator telephone: 708-610-0567
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 06/07/2006
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL METAL ENTERPRISE INC (Continued)

1000324839

User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Universal Waste Summary:

Waste type: Batteries
Accumulated waste on-site: Yes
Generated waste on-site: Not reported

Historical Generators:

Date form received by agency: 01/03/2003
Site name: AMCO-LEGGETT & PLATT CO
Classification: Conditionally Exempt Small Quantity Generator

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D002
. Waste name: CORROSIVE WASTE

Date form received by agency: 03/01/2002
Site name: AMCO CORP
Classification: Small Quantity Generator

Date form received by agency: 03/01/2000
Site name: AMCO CORP
Classification: Large Quantity Generator

Date form received by agency: 06/19/1997
Site name: AMCO CORPORATION
Classification: Not a generator, verified

Date form received by agency: 12/20/1996
Site name: AMCO CORPORATION
Classification: Not a generator, verified

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: F006
. Waste name: WASTEWATER TREATMENT SLUDGES FROM ELECTROPLATING OPERATIONS, EXCEPT FROM THE FOLLOWING PROCESSES: (1) SULFURIC ACID ANODIZING OF ALUMINUM; (2) TIN PLATING ON CARBON STEEL; (3) ZINC PLATING (SEGREGATED BASIS) ON CARBON STEEL; (4) ALUMINUM OR ZINC-ALUMINUM PLATING ON CARBON STEEL; (5) CLEANING/STRIPPING ASSOCIATED WITH TIN, ZINC, AND ALUMINUM PLATING ON CARBON STEEL; AND (6) CHEMICAL ETCHING AND MILLING OF ALUMINUM.

Date form received by agency: 03/01/1996
Site name: AMCO CORP
Classification: Large Quantity Generator

Date form received by agency: 03/01/1994
Site name: AMCO CORP

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

INDUSTRIAL METAL ENTERPRISE INC (Continued)

1000324839

Classification: Large Quantity Generator

Date form received by agency: 03/01/1992

Site name: AMCO CORP

Classification: Large Quantity Generator

Date form received by agency: 02/28/1990

Site name: AFCO CORP

Classification: Large Quantity Generator

Violation Status: No violations found

Evaluation Action Summary:

Evaluation date: 03/07/1997

Evaluation: COMPLIANCE ASSISTANCE VISIT

Area of violation: Not reported

Date achieved compliance: Not reported

Evaluation lead agency: State

52
NNW
1/4-1/2
0.463 mi.
2443 ft.

BEARINGS MFG
1033 N KOLMAR
CHICAGO, IL 60651

RCRA-SQG 1000362182
IL LUST ILD005475355
FINDS
ECHO

Relative:
Lower

RCRA-SQG:

Date form received by agency: 12/20/1999

Facility name: BEARINGS MFG

Facility address: 1033 N KOLMAR
CHICAGO, IL 60651

EPA ID: ILD005475355

Contact: DENNIS DRIEBERGER

Contact address: 1033 N KOLMAR
CHICAGO, IL 60651

Contact country: US

Contact telephone: 773-278-6200

Contact email: Not reported

EPA Region: 05

Classification: Small Small Quantity Generator

Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name: BEARINGS MFG
Owner/operator address: 1033 N KOLMAR AVE
CHICAGO, IL 60651

Owner/operator country: Not reported

Owner/operator telephone: 773-278-6200

Owner/operator email: Not reported

Owner/operator fax: Not reported

Owner/operator extension: Not reported

Legal status: Private

Owner/Operator Type: Owner

Owner/Op start date: Not reported

Owner/Op end date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

BEARINGS MFG (Continued)

1000362182

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D000
. Waste name: Not Defined

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: F002
. Waste name: THE FOLLOWING SPENT HALOGENATED SOLVENTS: TETRACHLOROETHYLENE, METHYLENE CHLORIDE, TRICHLOROETHYLENE, 1,1,1-TRICHLOROETHANE, CHLOROBENZENE, 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE, ORTHO-DICHLOROBENZENE, TRICHLOROFLUOROMETHANE, AND 1,1,2, TRICHLOROETHANE; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE HALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F004, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

. Waste code: F004
. Waste name: THE FOLLOWING SPENT NONHALOGENATED SOLVENTS: CRESOLS, CRESYLIC ACID, AND NITROBENZENE; AND THE STILL BOTTOMS FROM THE RECOVERY OF THESE SOLVENTS; ALL SPENT SOLVENT MIXTURES/BLENDS CONTAINING, BEFORE USE, A TOTAL OF TEN PERCENT OR MORE (BY VOLUME) OF ONE OR MORE OF THE ABOVE NONHALOGENATED SOLVENTS OR THOSE SOLVENTS LISTED IN F001, F002, AND F005; AND STILL BOTTOMS FROM THE RECOVERY OF THESE SPENT SOLVENTS AND SPENT SOLVENT MIXTURES.

Violation Status: No violations found

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

BEARINGS MFG (Continued)

1000362182

LUST:

Incident Num: 980158
IL EPA Id: 316000090
Product: Other Petroleum
IEMA Date: 1998-01-22
Project Manager: Haskins
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Bearings Mfg. Co.
PRP Contact: Dennie Drebergen
PRP Address: 1033 North Kolmar Ave.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: 7732786200
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: 3/17/1998
Non LUST Determination Letter: Not reported
20 Report Received: Not reported
45 Report Received: Not reported
NFA/NFR Letter: Not reported
NFR Date Recorded: Not reported

FINDS:

Registry ID: 110005818035

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000362182
Registry ID: 110005818035
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005818035>

53
NW
1/4-1/2
0.468 mi.
2470 ft.

**AE STALEY
4616 WEST AUGUSTA BLVD.
CHICAGO, IL 60651**

**IL LUST S104527792
N/A**

**Relative:
Lower
Actual:
606 ft.**

LUST:
Incident Num: 890973
IL EPA Id: 316235020
Product: Unleaded Gas

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

AE STALEY (Continued)

S104527792

IEMA Date: 1989-06-09
Project Manager: Davison
Project Manager Phone: Not reported
Email: Not reported
PRP Name: AE Staley
PRP Contact: Yony Sorenson
PRP Address: 4616 West Augusta Blvd.
PRP City,St,Zip: Chicago, IL 60651
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 732
Date Section 57.5(g) Letter: 3/26/1996
Non LUST Determination Letter: Not reported
20 Report Received: Not reported
45 Report Received: Not reported
NFA/NFR Letter: 5/7/1996 0
NFR Date Recorded: Not reported

**O54
WNW
1/4-1/2
0.469 mi.
2476 ft.**

**VAUGHN MFG CO
900 N KILPATRICK
CHICAGO, IL 60651**

Site 2 of 2 in cluster O

**IL LUST 1000688718
RCRA NonGen / NLR ILD984862821
FINDS
ECHO**

**Relative:
Lower**

LUST:

**Actual:
606 ft.**

Incident Num: 930007
IL EPA Id: 316003125
Product: Gasoline, Diesel
IEMA Date: 1993-01-04
Project Manager: Harlow
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Vaughn Mfg. Co.
PRP Contact: David Thollander
PRP Address: 1603 Orrington Ave., Suite 2080
PRP City,St,Zip: Evanston, IL 60204
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 1/28/1993
45 Report Received: 3/12/1993
NFA/NFR Letter: 8/30/1994
NFR Date Recorded: Not reported

RCRA NonGen / NLR:

Date form received by agency: 04/01/2006
Facility name: VAUGHN MFG CO
Facility address: 900 N KILPATRICK
CHICAGO, IL 60651
EPA ID: ILD984862821
Contact: ENV COORDINATOR
Contact address: Not reported
Not reported
Contact country: US
Contact telephone: 847-864-0070

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

VAUGHN MFG CO (Continued)

1000688718

Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: VAUGHN MFG CO
Owner/operator address: 900 N KILPATRICK
CHICAGO, IL 60651

Owner/operator country: Not reported
Owner/operator telephone: 708-864-0070
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: VAUGHN MFG CO
Owner/operator address: Not reported
Not reported

Owner/operator country: US
Owner/operator telephone: Not reported
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: 01/01/1900
Owner/Op end date: Not reported

Owner/operator name: VAUGHN MFG CO
Owner/operator address: Not reported
Not reported

Owner/operator country: US
Owner/operator telephone: Not reported
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: 01/01/1900
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

VAUGHN MFG CO (Continued)

1000688718

User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:

Date form received by agency: 04/16/1992
Site name: VAUGHN MFG CO
Classification: Large Quantity Generator

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D002
. Waste name: CORROSIVE WASTE

Violation Status: No violations found

FINDS:

Registry ID: 110005908795

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

HAZARDOUS WASTE BIENNIAL REPORTER

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000688718
Registry ID: 110005908795
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005908795>

55
ENE
1/4-1/2
0.479 mi.
2528 ft.

CHICAGO REAL ESTATE RESOURCES
4014 WEST CHICAGO AVENUE
CHICAGO, IL 60651

IL LUST S113427576
N/A

Relative:
Lower

LUST:

Incident Num: 20130109
IL EPA Id: 316235188
Product: Other Petroleum
IEMA Date: 2013-02-04
Project Manager: Wallace

Actual:
605 ft.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

CHICAGO REAL ESTATE RESOURCES (Continued)

S113427576

Project Manager Phone: Not reported
Email: Not reported
PRP Name: Chicago Real Estate Resources
PRP Contact: Eric Janssen (Court appointed Receiver)
PRP Address: 932 West Grace
PRP City,St,Zip: Chicago, IL 60613
PRP Phone: 3122284700
Site Classification: Not reported
Section 57.5(g) Letter: 734
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 2/13/2013
45 Report Received: 5/9/2013 0
NFA/NFR Letter: 5/21/2013
NFR Date Recorded: 6/13/2013

56
SSW
1/4-1/2
0.485 mi.
2561 ft.

KEMMERER BOTTLING
356 N KILBOURN
CHICAGO, IL 60624

IL LUST 1000614729
RCRA NonGen / NLR ILD984850446
FINDS
ECHO

Relative:
Lower

LUST:

Actual:
607 ft.

Incident Num: 900638
IL EPA Id: 316265028
Product: Gasoline
IEMA Date: 1990-03-09
Project Manager: D. Hollis
Project Manager Phone: Not reported
Email: Not reported
PRP Name: Kemmerer Bottling
PRP Contact: John Kenney
PRP Address: 777 Joyce Rd.
PRP City,St,Zip: Joliet, IL 60434
PRP Phone: Not reported
Site Classification: Not reported
Section 57.5(g) Letter: 731
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: Not reported
45 Report Received: Not reported
NFA/NFR Letter: 11/7/1994
NFR Date Recorded: Not reported

RCRA NonGen / NLR:

Date form received by agency: 02/01/1992
Facility name: KEMMERER BOTTLING CO
Facility address: 356 N KILBOURN
CHICAGO, IL 60624
EPA ID: ILD984850446
Mailing address: 777 JOYCE RD
JOLIET, IL 60436
Contact: JIM BONEBRAKE
Contact address: 777 JOYCE RD
JOLIET, IL 60436
Contact country: US
Contact telephone: 815-741-7777

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

KEMMERER BOTTLING (Continued)

1000614729

Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: KEMMERER BOTTLING GROUP INC
Owner/operator address: 777 JOYCE RD
JOLIET, IL 60436
Owner/operator country: Not reported
Owner/operator telephone: 815-741-7777
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: D001
. Waste name: IGNITABLE WASTE

. Waste code: D018
. Waste name: BENZENE

Violation Status: No violations found

FINDS:

Registry ID: 110005905244

Environmental Interest/Information System

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

KEMMERER BOTTLING (Continued)

1000614729

corrective action activities required under RCRA.

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000614729
Registry ID: 110005905244
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110005905244>

57
SSE
1/2-1
0.638 mi.
3369 ft.

ATLAS FINISHING CO
4118 W LAKE ST
CHICAGO, IL 60624

RCRA-SQG 1000157170
IL SSU ILD025039447
IL BROWNFIELDS
IL SPILLS
FINDS
ECHO

Relative:
Lower

RCRA-SQG:

Actual:
604 ft.

Date form received by agency: 08/06/1980
Facility name: ATLAS FINISHING CO INC
Facility address: 4118 W LAKE ST
CHICAGO, IL 60624
EPA ID: ILD025039447
Contact: ERWIN HERZ
Contact address: 4118 W LAKE ST
CHICAGO, IL 60624
Contact country: US
Contact telephone: 312-722-3617
Contact email: Not reported
EPA Region: 05
Classification: Small Small Quantity Generator
Description: Handler: generates more than 100 and less than 1000 kg of hazardous waste during any calendar month and accumulates less than 6000 kg of hazardous waste at any time; or generates 100 kg or less of hazardous waste during any calendar month, and accumulates more than 1000 kg of hazardous waste at any time

Owner/Operator Summary:

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998

Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ATLAS FINISHING CO (Continued)

1000157170

Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

. Waste code: F009
. Waste name: SPENT STRIPPING AND CLEANING BATH SOLUTIONS FROM ELECTROPLATING OPERATIONS IN WHICH CYANIDES ARE USED IN THE PROCESS.

Violation Status: No violations found

SSU:

Facility ID: 0316005987
Facility Type: Metal Finisher
Lat/Long: 41.8859329 / -87.728820
Directions: Take I-55 North.
Region: Des Plaines
Current Program: SRP
Project Manager: Smith
Community Relations: Not reported
SSU Status: Transferred
FOS: Not reported
Year Completed: 1990
Site Size: 1

BROWNFIELDS:

IL EPA ID: 0316005987
Region: 2
Acreage: 1
Completion Date: 01/30/1997
Lat/Long: 41.8859 / -87.7288
Contaminants: Hazardous Substances
Epaid Link: http://epadata.epa.state.il.us/land/ose/ose-site-evaluations-EPAID.asp?IEPA_ID=0316005987

SPILLS:

Incident ID: NL881355

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ATLAS FINISHING CO (Continued)

1000157170

Incident Date: Not reported
Date Received: 10/11/1988
Lust Ind: Not reported
Facility Address: 4118 WEST LAKE STREET
Facility City: CHICAGO
PRP Name: UNKNOWN
AC: Not reported
Source Table: dbo_OCIN_INDCIDENTHIS

FINDS:

Registry ID: 110001820708

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

AIR MINOR

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000157170
Registry ID: 110001820708
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110001820708>

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

58
NNW
1/2-1
0.655 mi.
3457 ft.

ALLIED METAL COMPANY
4528 WEST DIVISION STREET
CHICAGO, IL 60651

SEMS-ARCHIVE 1000175105
CORRACTS 60651LLDMT4528W
RCRA NonGen / NLR
TRIS
ICIS
LEAD SMELTERS
US AIRS
FINDS
ECHO

Relative:
Lower

Actual:
606 ft.

SEMS-ARCHIVE:
Site ID: 507096
EPA ID: ILD005096532
Federal Facility: N
NPL: Not on the NPL
Non NPL Status: Deferred to RCRA

Following information was gathered from the prior CERCLIS update completed in 10/2013:

Site ID: 0507096
Federal Facility: Not a Federal Facility
NPL Status: Not on the NPL
Non NPL Status: Deferred to RCRA

CERCLIS-NFRAP Site Alias Name(s):

Alias Name: HARCO ALUMINUM COMPANY
Alias Address: Not reported
IL

Program Priority:

Description: RCRA Deferral Audit
Description: RCRA Deferral - Lead Confirmed

CERCLIS-NFRAP Assessment History:

Action: ARCHIVE SITE
Date Started: / /
Date Completed: 12/01/95
Priority Level: Not reported
Action: PRELIMINARY ASSESSMENT
Date Started: / /
Date Completed: 02/05/93
Priority Level: Deferred to RCRA (Subtitle C)
Action: DISCOVERY
Date Started: / /
Date Completed: 10/20/92
Priority Level: Not reported

CORRACTS:

EPA ID: ILD005096532
EPA Region: 05
Area Name: ENTIRE FACILITY
Actual Date: 20090501
Action: CA070NO - RFA Determination Of Need For An RFI, RFI is Not Necessary
NAICS Code(s): Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Original schedule date: Not reported
Schedule end date: Not reported

EPA ID: ILD005096532
EPA Region: 05
Area Name: ENTIRE FACILITY
Actual Date: 19920331
Action: CA075LO - CA Prioritization, Facility or area was assigned a low
corrective action priority
NAICS Code(s): Not reported
Original schedule date: Not reported
Schedule end date: Not reported

RCRA NonGen / NLR:

Date form received by agency: 11/19/1980
Facility name: HARCO ALUMINUM INC
Facility address: 4528 W DIVISION
CHICAGO, IL 60651
EPA ID: ILD005096532
Contact: ENVIRONMENTAL COORDINATOR
Contact address: 4528 W DIVISION
CHICAGO, IL 60651
Contact country: US
Contact telephone: 312-555-1212
Contact email: Not reported
EPA Region: 05
Classification: Non-Generator
Description: Handler: Non-Generators do not presently generate hazardous waste

Owner/Operator Summary:

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Operator
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Owner/operator name: NAME NOT REPORTED
Owner/operator address: ADDRESS NOT REPORTED
CITY NOT REPORTED, AK 99998
Owner/operator country: Not reported
Owner/operator telephone: 312-555-1212
Owner/operator email: Not reported
Owner/operator fax: Not reported
Owner/operator extension: Not reported
Legal status: Private
Owner/Operator Type: Owner
Owner/Op start date: Not reported
Owner/Op end date: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Handler Activities Summary:

U.S. importer of hazardous waste: No
Mixed waste (haz. and radioactive): No
Recycler of hazardous waste: No
Transporter of hazardous waste: No
Treater, storer or disposer of HW: No
Underground injection activity: No
On-site burner exemption: No
Furnace exemption: No
Used oil fuel burner: No
Used oil processor: No
User oil refiner: No
Used oil fuel marketer to burner: No
Used oil Specification marketer: No
Used oil transfer facility: No
Used oil transporter: No

Historical Generators:

Date form received by agency: 11/19/1980
Site name: HARCO ALUMINUM INC
Classification: Not a generator, verified

Corrective Action Summary:

Event date: 03/31/1992
Event: CA PRIORITIZATION-LOW CA PRIORITY

Event date: 05/01/2009
Event: DETERMINATION OF NEED FOR AN INVESTIGATION-INVESTIGATION IS NOT NECESSARY

Violation Status: No violations found

TRIS:

[Click this hyperlink](#) while viewing on your computer to access
4 additional US_TRIS: record(s) in the EDR Site Report.

ICIS:

Enforcement Action ID: IL000A0000170310118700045
FRS ID: 110000435949
Action Name: ALLIED METAL CO 170310118700045
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632
Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133
Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP
Facility NAICS Code: 331420
Tribal Land Code: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Enforcement Action ID: IL000A0000170310118700020
FRS ID: 110000435949
Action Name: ALLIED METAL CO 170310118700020
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632

Enforcement Action Type: Administrative Order
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Formal
EA Type Code: SCAAO
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133
Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP
Facility NAICS Code: 331420
Tribal Land Code: Not reported

Enforcement Action ID: IL000A0000170310118700018
FRS ID: 110000435949
Action Name: ALLIED METAL CO 170310118700018
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632

Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133
Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP
Facility NAICS Code: 331420
Tribal Land Code: Not reported

Enforcement Action ID: IL000A0000170310118700002
FRS ID: 110000435949
Action Name: ALLIED METAL CO 170310118700002
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632

Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133
Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Facility NAICS Code: 331420
Tribal Land Code: Not reported

Enforcement Action ID: 05-2011-A109
FRS ID: 110000435949
Action Name: ALLIED METAL CO 170310118700059
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632

Enforcement Action Type: Civil Judicial Action
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Judicial
EA Type Code: CIV
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133
Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP
Facility NAICS Code: 331420
Tribal Land Code: Not reported

Enforcement Action ID: 05-2005-5013
FRS ID: 110000435949
Action Name: ALLIED METAL CO.
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632

Enforcement Action Type: Civil Judicial Action
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Judicial
EA Type Code: CIV
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133
Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP
Facility NAICS Code: 331420
Tribal Land Code: Not reported

Enforcement Action ID: 05-000F000170310118700029
FRS ID: 110000435949
Action Name: ALLIED METAL CO 170310118700029
Facility Name: ALLIED METAL CO
Facility Address: 4528 W DIVISION ST
CHICAGO, IL 60651-1632

Enforcement Action Type: Notice of Violation
Facility County: COOK
Program System Acronym: AIR
Enforcement Action Forum Desc: Administrative - Informal
EA Type Code: NOV
Facility SIC Code: 3341
Federal Facility ID: Not reported
Latitude in Decimal Degrees: 41.903133

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Longitude in Decimal Degrees: -87.739426
Permit Type Desc: Not reported
Program System Acronym: IL000031600ADP
Facility NAICS Code: 331420
Tribal Land Code: Not reported

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Facility Name: ALLIED METAL CO
Address: 4528 W. DIVISION ST.
Tribal Indicator: N
Fed Facility: No
NAIC Code: Not reported
SIC Code: 3341

Lead Smelter Sites:

Site ID: 0507096
Facility Region Id: 05
Latitude: Not reported
Longitude: Not reported
CoC Ind: Not reported
Contaminant Name: Not reported
FF Ind: N
NAI: N
Non-Primary Site-Sub Type: Not reported
NPL: Not on the NPL
Primary Site-Sub Type: Not reported
Special Initiative: Unrecognized Smelter per 2001 Report

US AIRS MINOR:

Envid: 1000175105
Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
D and B Number: Not reported
Primary SIC Code: 3341
NAICS Code: 331420
Default Air Classification Code: MIN
Facility Type of Ownership Code: POF
Air CMS Category Code: OTH
HPV Status: Not reported

US AIRS MINOR:

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: Not reported
Activity Status Date: 2011-07-27 00:00:00
Activity Group: Case File

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Type: Case File
Activity Status: Resolved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2004-08-04 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Information Request
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2004-09-09 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Information Request
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2008-07-03 00:00:00
Activity Status Date: 2008-10-05 21:28:42
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2015-02-09 00:00:00
Activity Status Date: 2015-02-11 16:45:56
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Date: 2015-03-26 00:00:00
Activity Status Date: 2015-03-30 16:14:27
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2004-04-22 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2008-07-03 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2011-11-21 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2012-06-22 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2012-08-10 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2012-08-13 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2013-04-02 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2013-08-26 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2013-10-17 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2014-07-14 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2014-10-14 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2015-12-21 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2004-09-22 00:00:00
Activity Status Date: 2004-09-22 00:00:00
Activity Group: Enforcement Action
Activity Type: Administrative - Informal
Activity Status: Achieved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: MACT Standards (40 CFR Part 63)
Activity Date: 2011-07-27 00:00:00
Activity Status Date: 2011-07-27 00:00:00
Activity Group: Enforcement Action

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Type: Judicial
Activity Status: Closed

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: National Emission Standards for Hazardous Air Pollutants (40 CFR Part 61)
Activity Date: 2011-07-27 00:00:00
Activity Status Date: 2011-07-27 00:00:00
Activity Group: Enforcement Action
Activity Type: Judicial
Activity Status: Final Order Entered

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: *** No Data ***
Activity Date: Not reported
Activity Status Date: 2004-08-23 12:16:22
Activity Group: Case File
Activity Type: Case File
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: Not reported
Activity Status Date: 2011-10-20 00:00:00
Activity Group: Case File
Activity Type: Case File
Activity Status: Resolved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2014-08-28 00:00:00
Activity Status Date: 2015-02-26 10:09:16
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Date: 2014-08-28 00:00:00
Activity Status Date: 2015-06-02 09:46:30
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2014-08-28 00:00:00
Activity Status Date: 2015-06-17 14:19:53
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Active

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1986-02-03 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1988-02-25 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1990-11-01 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1992-08-19 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1993-02-11 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1993-10-01 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1994-12-21 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1996-08-20 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1996-08-29 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 1997-01-28 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2001-03-29 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2004-09-21 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2005-09-28 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2005-09-30 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2006-04-03 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2011-10-21 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2015-12-21 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Date: 1986-02-05 00:00:00
Activity Status Date: 1986-02-05 00:00:00
Activity Group: Enforcement Action
Activity Type: Administrative - Informal
Activity Status: Achieved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: State Implementation Plan for National Primary and Secondary Ambient Air Quality Standards
Activity Date: 2006-05-04 00:00:00
Activity Status Date: 2006-05-04 00:00:00
Activity Group: Enforcement Action
Activity Type: Administrative - Informal
Activity Status: Achieved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: Not reported
Activity Status Date: 2003-04-16 00:00:00
Activity Group: Case File
Activity Type: Case File
Activity Status: Resolved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: Not reported
Activity Status Date: 2011-10-20 00:00:00
Activity Group: Case File
Activity Type: Case File
Activity Status: Resolved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2006-04-03 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2008-04-30 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2008-07-19 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2009-05-01 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2009-06-07 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2010-04-30 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2010-05-10 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2011-04-29 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2011-05-15 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2012-05-01 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring
Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2012-05-17 00:00:00
Activity Status Date: Not reported
Activity Group: Compliance Monitoring

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

Activity Type: Inspection/Evaluation
Activity Status: Not reported

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2002-12-02 00:00:00
Activity Status Date: 2002-12-02 00:00:00
Activity Group: Enforcement Action
Activity Type: Administrative - Formal
Activity Status: Final Order Issued

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2002-10-28 00:00:00
Activity Status Date: 2002-10-28 00:00:00
Activity Group: Enforcement Action
Activity Type: Administrative - Informal
Activity Status: Achieved

Region Code: 05
Programmatic ID: AIR IL000031600ADP
Facility Registry ID: 110000435949
Air Operating Status Code: OPR
Default Air Classification Code: MIN
Air Program: Title V Permits
Activity Date: 2006-05-04 00:00:00
Activity Status Date: 2006-05-04 00:00:00
Activity Group: Enforcement Action
Activity Type: Administrative - Informal
Activity Status: Achieved

FINDS:

Registry ID: 110000435949

Environmental Interest/Information System

AFS (Aerometric Information Retrieval System (AIRS) Facility Subsystem) replaces the former Compliance Data System (CDS), the National Emission Data System (NEDS), and the Storage and Retrieval of Aerometric Data (SAROAD). AIRS is the national repository for information concerning airborne pollution in the United States. AFS is used to track emissions and compliance data from industrial plants. AFS data are utilized by states to prepare State Implementation Plans to comply with regulatory programs and by EPA as an input for the estimation of total national emissions. AFS is undergoing a major redesign to support facility operating permits required under Title V of the Clean Air Act.

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

ALLIED METAL COMPANY (Continued)

1000175105

ACES (Illinois - Agency Compliance And Enforcement System) is the Illinois EPA Project to facilitate the permitting operations

TSCA SUBMITTER

AIR EMISSIONS CLASSIFICATION UNKNOWN

US EPA TRIS (Toxics Release Inventory System) contains information from facilities on the amounts of over 300 listed toxic chemicals that these facilities release directly to air, water, land, or that are transported off-site.

RCRAInfo is a national information system that supports the Resource Conservation and Recovery Act (RCRA) program through the tracking of events and activities related to facilities that generate, transport, and treat, store, or dispose of hazardous waste. RCRAInfo allows RCRA program staff to track the notification, permit, compliance, and corrective action activities required under RCRA.

AIR MINOR

[Click this hyperlink](#) while viewing on your computer to access additional FINDS: detail in the EDR Site Report.

ECHO:

Envid: 1000175105
Registry ID: 110000435949
DFR URL: <http://echo.epa.gov/detailed-facility-report?fid=110000435949>

59
NNE
1/2-1
0.667 mi.
3520 ft.

**DIVISION PAINT
4150 W DIVISION ST
CHICAGO, IL 60624**

**IL SSU S101467194
IL BOL N/A**

**Relative:
Lower**

SSU:

Facility ID: 0316230005
Facility Type: Manufacturer - Paint
Lat/Long: 41.8859176 / -87.728797
Directions: Take I-55 North.
Region: Des Plaines
Current Program: SSU
Project Manager: Not Assigned
Community Relations: NA
SSU Status: Archived
FOS: NA
Year Completed: 1989
Site Size: Not reported

**Actual:
605 ft.**

BOL:

Site Id: 170000511765
Inv Num: 0316230005
Interest Name: Division Paint
Interest Type: BOL
Media Code: LAND

Map ID
Direction
Distance
Elevation

MAP FINDINGS

Site

Database(s)

EDR ID Number
EPA ID Number

60
SSE
1/2-1
0.931 mi.
4914 ft.

BULK PETROLEUM
4049 W WASHINGTON BLVD
CHICAGO, IL 60624

IL SSU S104872097
IL LUST N/A
IL BOL

Relative:
Lower

SSU:
Facility ID: 0316235123
Facility Type: ARRA
Lat/Long: Not reported
Directions: Not reported
Region: Des Plaines
Current Program: SSU-ARRA
Project Manager: Frierdich
Community Relations: Not reported
SSU Status: Completed
FOS: Not reported
Year Completed: 2011
Site Size: 0.38

Actual:
603 ft.

LUST:
Incident Num: 20010040
IL EPA Id: 316235123
Product: Gasoline
IEMA Date: 2001-01-08
Project Manager: Davis
Project Manager Phone: (217) 785-7492
Email: Valerie.A.Davis@illinois.gov
PRP Name: Bulk Petroleum
PRP Contact: Jason Williams
PRP Address: 9653 North Granville
PRP City,St,Zip: Mequon, WI 53092
PRP Phone: 2622424800
Site Classification: Not reported
Section 57.5(g) Letter: 734
Date Section 57.5(g) Letter: Not reported
Non LUST Determination Letter: Not reported
20 Report Received: 2/26/2001
45 Report Received: 3/12/2007
NFA/NFR Letter: 12/23/2011
NFR Date Recorded: 3/26/2012

BOL:
Site Id: 170000512274
Inv Num: 0316235123
Interest Name: Bulk Petroleum
Interest Type: BOL
Media Code: LAND

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
NO SITES FOUND					

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
** - Indicates location may or may not be in requested radius. Site has not been assigned a latitude/longitude coordinate. Further review recommended.								
60624	S108112569		OHIO ST/TRUMBULL AVE		**	CHICAGO	IL	SWF/LF
60624	1014940756				**	CHICAGO	IL	DOT OPS
60624	1014940792				**	CHICAGO	IL	DOT OPS
60624	1014940746				**	CHICAGO	IL	DOT OPS
60624	S108112795		RAPID DISPOSAL			PALOS HEIGHTS	IL	SWF/LF
60624	1014940734				**	CHICAGO	IL	DOT OPS
60624	1014940788				**	CHICAGO	IL	DOT OPS
60624	1011853589	110037157732	3435 W 111TH	3435 W 111TH ST		CHICAGO	IL	FINDS
60624	S113269066		GARFIELD PARK	RTE 290 & INDEPENDENCE AV	**	CHICAGO	IL	
60624	S110278140		PUBLIC BLDG COMMISSION	3201 W 5TH AVE		CHICAGO	IL	
60624	S110122193		PUBLIC BUILDING COMMISSION OF CHIC.	3201 WEST 5TH AVENUE		CHICAGO	IL	LUST
60624	S108480257		MARSHALL FARADAY CAMPUS PARK	3300 WEST 5TH AVENUE		CHICAGO	IL	SRP
60624	1010317341	ILR000144741	MARSHALL FARADAY CAMPUS PARK	3300-3312 W 5TH AVE		CHICAGO	IL	RCRA-NonGen
60624	1010018479	110027985704	MARSHALL FARADAY CAMPUS PARK	3300-3312 W 5TH AVE		CHICAGO	IL	FINDS
60624	S110363704		MARSHALL FARADAY CAMPUS PARK	3300-3312 W 5TH AVE		CHICAGO	IL	
60624	S108255641		PUBLIC BUILDING COMMISSION OF CHIC.	3300-3312 WEST 5TH AVENUE		CHICAGO	IL	LUST
60624	1017811947	110064368526	HARVEST HOMES	3514-3544 W 5TH AVE		CHICAGO	IL	FINDS
60624	S119026627		HARVEST HOMES APARTMENTS LP	3514-3544 W 5TH AVE		CHICAGO	IL	
60624	S118096535		HARVEST HOMES	3514-3544 WEST 5TH AVENUE		CHICAGO	IL	Inst Control, SRP
60624	U004249445		HARVEST HOMES	3528 W. 5TH AVE.		CHICAGO	IL	UST
60624	S113269737		LEIF ERICSON SCHOLASTIC ACADEM	3600 W 5TH AVE		CHICAGO	IL	
60624	1021223710		RABIN SUPER SERVICE	3751 W 5TH AVE	**	CHICAGO	IL	
60624	1016440663	110055957889	SUMNER ELEM	4230 W 5TH		CHICAGO	IL	FINDS
60624	S107746391	3434	SUMNER SCHOOL	4320 W 5TH AVE		CHICAGO	IL	AIRS
60624	S111882980		NORTHWESTERN SALT CO	4343 W 5TH AVE		CHICAGO	IL	
60624	1008139792	110018365071	NORTHWESTERN SALT CO	4343 W 5TH AVE		CHICAGO	IL	FINDS
60624	U000865623	2005958	NORTHWESTERN SALT CO	4343 W 5TH ST		CHICAGO	IL	UST
60624	S113269755		JOES DRUM SVC	4400 W 5TH AVE		CHICAGO	IL	
60624	S108891424		GF OFFICE FURNITURE LTD., L.P.	4401 WEST 5TH AVENUE		CHICAGO	IL	LUST
60624	S113269756		VACANT LOT	4417 W 5TH AVE		CHICAGO	IL	
60624	1006047942	110001687577	AMERICAN STEEL CONTAINER CO. - PAIL	4441 W. 5TH AVE.		CHICAGO	IL	ICIS, FINDS
60624	U000790771	2012167	AMERICAN STEEL CONTAINER CO	4445 W 5TH AVE		CHICAGO	IL	AIRS, UST
60624	1000359836	ILD093163004	AMERICAN STEEL CONTAINER CO	4445 W 5TH AVE		CHICAGO	IL	RCRA-NonGen
60624	1016209480	110005842794	AMERICAN STEEL CONTAINER CO.	4445 W. 5TH AVE.		CHICAGO	IL	ICIS, FINDS
60624	S104528576		ASC PROPERTIES, LLC	4445 WEST 5TH AVE.		CHICAGO	IL	LUST
60624	S109092998		ESQUERRA, MARCELINO	4448 W 5TH ST		CHICAGO	IL	
60624	U004123091		ESQUERRA, MARCEL	4448 W. 5TH AVENUE		CHICAGO	IL	UST
60624	S109027248		ESQUERRA, MARCELINO	4448 WEST 5TH STREET		CHICAGO	IL	LUST
60624	U000865999	2006367	VETERAN TRUCKING COMPANY	4452 W 5TH AVE		CHICAGO	IL	UST
60624	1001213778	110005960530	VETERAN'S TRUCKING CORP.	4452 WEST 5TH AVE.		CHICAGO	IL	RCRA-NonGen, FINDS, LUST
60624	1019997687		GRAHAM & DANIELS INC	<	**	CHICAGO	IL	
60624	1000612338	110009378459	MARSHALL METROPOLITAN HS	3250 W ADAMS ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1011852875	110037150454	KEDZIE CO	3456 W ADAMS		CHICAGO	IL	FINDS
60624	1008134450	110018311361	AMERITECH	3456 W ADAMS		CHICAGO	IL	FINDS
60624	S113269704		AMERITECH	3456 W ADAMS		CHICAGO	IL	TIER 2
60624	U000173708	2007789	KEDZIE CENTRAL OFFICE	3456 WEST ADAMS		CHICAGO	IL	UST
60624	S110153560		ILLINOIS BELL TELEPHONE COMPANY D/I	3456 WEST ADAMS		CHICAGO	IL	TIER 2
60624	S107742351	3349	GOLDBLATT SCHOOL	4257 W ADAMS		CHICAGO	IL	AIRS
60624	1001116610	110009384237	GOLDBLATT NATHAN SCHOOL	4257 W ADAMS ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S105225777		CITY OF CHICAGO	4532 WEST ADAMS STREET		CHICAGO	IL	SRP, LUST
60624	1016352067	110039544874	SCOTT PETERSON MEATS	4532-52 WEST ADAMS STREET		CHICAGO	IL	FINDS
60624	U003667981	2036820	CHICAGO CITY OF DEPT OF ENVIROMEN'	4532-56 W ADAMS ST		CHICAGO	IL	UST
60624	1006322342	110012619540	SMG INC	4551 W ADAMS		CHICAGO	IL	AIRS, FINDS
60624	2011973021			4551 WEST ADAMS BLVD		CHICAGO	IL	ERNS
60624	1022132303		DENNIS SUNOCO SERVICE	4926 W ADAMS		CHICAGO	IL	
60624	U003668586	2038708	ALBANY PARK TOWNHOUSES	1632-1642 SOUTH ALBANY AVENUE		CHICAGO	IL	UST
60624	1008151605	110018484335	KREL LABORATORIES INC	388 AND 383 AND 382 N AVERS AVE		CHICAGO	IL	AIRS, FINDS
60624	S111907712		KREL LABORATORIES INC	388 AND 383 AND 382 N AVERS AVE		CHICAGO	IL	
60624	1008134502	110018311888	HOMAN ARTHINGTON FOUNDATION	3245 W ARTHINGTON		CHICAGO	IL	FINDS
60624	S113269727		HOMAN ARTHINGTON FOUNDATION	3245 W ARTHINGTON		CHICAGO	IL	
60624	1008123974	110018206181	HOMAN ARTHINGTON FOUNDATION	3301 W ARTHINGTON		CHICAGO	IL	FINDS
60624	S113269728		HOMAN ARTHINGTON FOUNDATION	3301 W ARTHINGTON		CHICAGO	IL	
60624	U004245953		STERLING PARK APARTMENTS	3301 W. ARTHINGTON		CHICAGO	IL	UST
60624	S118837850		NEW STERLING PARK, LLC	3301 WEST ARTHINGTON		CHICAGO	IL	LUST
60624	S113269729		HOMAN ARTHINGTON FOUNDATION	3333 W ARTHINGTON		CHICAGO	IL	
60624	1008123978	110018206225	HOMAN ARTHINGTON FOUNDATION	3333 W ARTHINGTON		CHICAGO	IL	FINDS
60624	U000792086	2031093	SEARS ROEBUCK AND CO	3333 W ARTHINGTON		CHICAGO	IL	UST
60624	S113269726		SEARS ROEBUCK & CO	3425-3545 W ARTHINGTON		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	1016280201	110009365070	SEARS ROEBUCK AND CO	3425-3545 W ARTHINGTON ST		CHICAGO	IL	FINDS
60624	1019967429		CUT RATE CLEANERS	3759 ARTHINGTON		CHICAGO	IL	
60624	S113269739		DANIEL WEBSTER SCHOOL	4055 W ARTHINGTON ST		CHICAGO	IL	
60624	1004696958	110003048620	DANIEL WEBSTER SCHOOL	4055 W ARTHINGTON ST		CHICAGO	IL	RCRA-CESQG, FINDS
60624	1012131552	110039126503	INK PARTNERS CORP	4243 W ARTHINGTON ST		CHICAGO	IL	FINDS
60624	1012178786	ILR000158626	INK PARTNERS CORP	4243 W ARTHINGTON ST		CHICAGO	IL	RCRA-NonGen
60624	S113270519		INK PARTNERS CORP	4243 W ARTHINGTON ST		CHICAGO	IL	
60624	S110153979		KREL LABORATORIES, INC.	382 N. AVERS AVE.		CHICAGO	IL	TIER 2
60624	S110153980		KREL LABORATORIES, INC.	383 N. AVERS AVE.		CHICAGO	IL	TIER 2
60624	1000274472	ILD005432935	KREL LABORATORIES INC	388 N AVERS AVE		CHICAGO	IL	RCRAInfo-SQG
60624	S110153981		KREL LABORATORIES, INC.	388 N. AVERS AVE.		CHICAGO	IL	TIER 2
60624	1016096750	110000768642	KREL LABORATORIES INC	388 NORTH AVERS AVENUE		CHICAGO	IL	FINDS
60624	S113269881		VACANT LOT	719 N AVERS		CHICAGO	IL	
60624	S113270521		VACANT LOT	728 N AVERS		CHICAGO	IL	
60624	S113269714		ANDYS AUTO REPAIR	743 N AVERS		CHICAGO	IL	
60624	1000614223	110005901621	ANDYS AUTO RPR	743 N AVERS		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S113269763		R&M TRUCKING (SPILL)	4300 W BELMONT		CHICAGO	IL	
60624	1010034916	110028262485	R&M TRUCKING (SPILL)	4300 W BELMONT		CHICAGO	IL	FINDS
60624	S111884785		GATEWAY FOUNDATION	3800 BLOCK OF W TAYLOR ST	**	CHICAGO	IL	
60624	1008133637	110018303183	GATEWAY FOUNDATION	3800 BLOCK OF W TAYLOR ST		CHICAGO	IL	FINDS
60624	S103292384		GATEWAY FOUNDATION	3800 BLOCK OF WEST TAYLOR ST.		CHICAGO	IL	LUST
60624	S113269732		CSX TRANSPORTATION INC	BRDG CROSS AT INDEPEN BLV	**	CHICAGO	IL	
60624	1008108474	110018050311	CSX TRANSPORTATION INC	BRDG CROSS AT INDEPEN BLV	**	CHICAGO	IL	FINDS
60624	1016227462	110007555181	CSX TRANSPORTATION	BRDG CROSS AT INDEPENDENCE BLV	**	CHICAGO	IL	FINDS
60624	1001112224	ILR000022525	CSX TRANSPORTATION	BRDG CROSS AT INDEPENDENCE BLV	**	CHICAGO	IL	RCRA-NonGen
60624	U003715267	2039578	VACANT BUILDING	3052 W CARROLL		CHICAGO	IL	UST
60624	S116677459		FAMILY PLEX	3219 W CARROLL ST		CHICAGO	IL	
60624	1016868658	110059654379	FAMILY PLEX	3219 W CARROLL ST		CHICAGO	IL	FINDS
60624	S116623140		FAMILY PLEX	3219 WEST CARROLL AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	1004698119	110003062328	COLOREASE ADVANTAGE PRODUCTS LT	3311 W CARROLL AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60624	S113269138		COLOREASE ADVANTAGE PROD LTD	3311 W CARROLL AVE		CHICAGO	IL	
60624	S116677470		JOSHUA CENTER	3320 W CARROLL ST		CHICAGO	IL	
60624	1016868659	110059654388	JOSHUA CENTER	3320 W CARROLL ST		CHICAGO	IL	FINDS
60624	S117490245		JOSHUA CENTER	3320 W. CARROLL AVE		CHICAGO	IL	UIC
60624	S116623141		JOSHUA CENTER	3320 WEST CARROLL AVENUE		CHICAGO	IL	SRP
60624	U004223333		JOSHUA CENTER	3320-3324 W. CARROLL AVE.		CHICAGO	IL	UST
60624	S113269744		VACANT LOT	4027/4037 W CARROLL		CHICAGO	IL	
60624	1014886292	110043824546	4258 W CARROLL	4258 W CARROLL		CHICAGO	IL	FINDS
60624	U003762951	2040182	ARLINGTON WIRE & METAL PRODUCTS	4318 W CARROLL AVE		CHICAGO	IL	UST
60624	S113269709		BRUMUND FOUNDRY INC	4400 W CARROLL AVE		CHICAGO	IL	
60624	1016209653	110005885202	BRUMUND FOUNDRY INC	4400 WEST CARROLL AVENUE #12		CHICAGO	IL	FINDS
60624	1004698333	110001684053	STUTZ CO	4450 W CARROLL AVE		CHICAGO	IL	AIRS, RCRA-NonGen, FINDS
60624	S110156571		THE STUTZ COMPANY	4450 WEST CARROLL AVENUE		CHICAGO	IL	TIER 2
60624	S113269745		VACANT LOT	4525-4541 W CARROLL		CHICAGO	IL	
60624	S113269751		HARMON MOTOR SERVICE INC	4542-52 W CARROLL AVE		CHICAGO	IL	
60624	S113269794		CHICAGO PARK DIST GARFIELD PK	100-300 N CENTRAL PARK	**	CHICAGO	IL	
60624	1008109725	110018063129	CHICAGO PARK DIST GARFIELD PK	100-300 N CENTRAL PARK		CHICAGO	IL	FINDS
60624	1000229282	110064143859	GARFIELD PARK CONSERVATORY	100-300 N CENTRAL PK BLVD		CHICAGO	IL	RCRA-CESQG, FINDS
60624	1012307051	110040444374	CHICAGO, CITY OF-CENTRAL PK PUMP S	1015 S CENTRAL AVE		CHICAGO	IL	FINDS
60624	1012210786	ILR000160804	CHICAGO, CITY OF-CENTRAL PK PUMP S	1015 S CENTRAL AVE		CHICAGO	IL	RCRAInfo-SQG
60624	1008128247	2892	CHICAGO DEPARTMENT OF WATER	1015 S CENTRAL PARK AVE		CHICAGO	IL	AIRS
60624	1004477154	110001809963	CHICAGO DEPARTMENT OF WATER	1015 S CENTRAL PARK AVE		CHICAGO	IL	FINDS
60624	S113269114		SEARS ROEBUCK & CO	1106 S CENTRAL PARK AVE		CHICAGO	IL	
60624	1008123738	110018203825	SEARS ROEBUCK & CO	1106 S CENTRAL PARK AVE		CHICAGO	IL	FINDS
60624	S104871792		SEARS, ROEBUCK & CO.	1106 SOUTH CENTRAL PARK AVE.		CHICAGO	IL	LUST
60624	S113269100		PROVIDENCE-ST MEL SCHOOL	119 CENTRAL PARK BLVD	**	CHICAGO	IL	
60624	S113269063		PROVIDENCE-ST MEL SCHOOL	119 CENTRAL PARK BLVD	**	CHICAGO	IL	
60624	S113269752		GARFIELD PARK CONSERVATORY	300 N CENTRAL PARK AVE		CHICAGO	IL	
60624	1012178959	ILR000160358	GARFIELD PARK	300 N CENTRAL PARK AVE-B		CHICAGO	IL	RCRAInfo-SQG
60624	S110859908		GARFIELD PARK	300 N CENTRAL PARK AVE-B		CHICAGO	IL	
60624	1016209513	110005853905	GARFIELD PARK CONSERVATORY	300 N CENTRAL PK BLVD		CHICAGO	IL	FINDS
60624	S113269720		OUR LADY OF THE RESURRECTION	3522 N CENTRAL		CHICAGO	IL	
60624	1008134476	110018311628	OUR LADY OF THE RESURRECTION	3522 N CENTRAL		CHICAGO	IL	FINDS
60624	U000864979	2030917	COLUMBUS PARK	500 S CENTRAL		CHICAGO	IL	UST
60624	1015937048		UJIMA GARDEN	545 N CENTRAL PARK		CHICAGO	IL	US BROWNFIELDS
60624	1016367411	110046094418	UJIMA GARDEN	545 N CENTRAL PARK AVE		CHICAGO	IL	FINDS
60624	S113708651		UJIMA GARDENS	545 N CENTRAL PARK AVE		CHICAGO	IL	
60624	S111872526		UJIMA GARDENS	545 NORTH CENTRAL PARK AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	U004128303		APARTMENT BUILDING	341 SOUTH CHRISTIANA AVENUE THIRD I		CHICAGO	IL	UST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	U004155168		BUDDY BEAR CAR WASH	818 S. CICERO AVENUE		CHICAGO	IL	UST
60624	S113269135		CHICAGO HOUSING AUTHORITY-GARF	3700 W CONGRESS		CHICAGO	IL	
60624	U001142197	2030477	GARFIELD PARK APTS IL 2-44C	3700 W CONGRESS		CHICAGO	IL	UST
60624	S113269615		VACANT LOT	4108 W CONGRESS		CHICAGO	IL	
60624	1015830966	110046379281	VACANT LOT	4354 W CONGRESS PKWY		CHICAGO	IL	FINDS
60624	S113708652		VACANT LOT	4354 W CONGRESS PKWY		CHICAGO	IL	
60624	1011852529	110037146987	6633 S COTTAGE	6633 S COTTAGE		CHICAGO	IL	FINDS
60624	1021433905		RAYBON LEE JR	4401 W CRENSHAW	**	CHICAGO	IL	
60624	1008211638	110020868300	MONITOR LOCATED 9 M FROM NORTH EI	CTA TRAINING CNTR, 642 N. PULASKI RD		CHICAGO	IL	FINDS
60624	1010494563	110032651342	CHICAGO DOT	100 E DIVERSEY PKWY		CHICAGO	IL	FINDS
60624	1010563387	ILR000148007	CHICAGO DOT	100 E DIVERSEY PKWY		CHICAGO	IL	RCRA-NonGen
60624	S113270509		CHICAGO DEPT OF TRANSPORTATION	100 E DIVERSEY PKWY		CHICAGO	IL	
60624	1010366896	110030823973	CHICAGO DEPT OF TRANSPORTATION	100 E DIVERSEY PKWY		CHICAGO	IL	FINDS
60624	1008133590	110018302718	DIVISION PAINT	4150 W DIVISION ST		CHICAGO	IL	FINDS
60624	1008391348	110022525383	CHICAGO, CITY OF ABANDONMENT	421 N DRAKE		CHICAGO	IL	FINDS
60624	S113269761		CHICAGO, CITY OF ABANDONMENT	421 N DRAKE		CHICAGO	IL	
60624	1008372899	ILR000136390	CHICAGO, CITY OF ABANDONMENT	421 N DRAKE		CHICAGO	IL	RCRAInfo-SQG
60624	U001142194	2030479	FRANKLIN BLVD APTS IL 2-45A	440 NORTH DRAKE ST		CHICAGO	IL	UST
60624	S111884927		BETHEL NEWLIFE CORP	4300 W END AVE		CHICAGO	IL	
60624	1008123966	110018206109	BETHEL NEWLIFE CORP	4300 W END AVE		CHICAGO	IL	FINDS
60624	S104524670		BETHEL NEW LIFE CORP.	4300 WEST END AVE.		CHICAGO	IL	LUST
60624	S113269735		FERDINAND REALTY INC	4100 W FERDINAND		CHICAGO	IL	
60624	1001116788	110005948635	FERDINAND REALTY INC	4100 W FERDINAND ST		CHICAGO	IL	RCRA-NonGen, FINDS
60624	S104491615		FERDINAND REALTY	4100 WEST FERDINAND STREET	47, SE, 1/4 - 1/2	CHICAGO	IL	Inst Control, SRP
60624	S113269768		CHICAGO, CITY OF	4211 W FERDINAND ST		CHICAGO	IL	
60624	U003715239	2039528	VACANT LOT	4221 W FERDINAND		CHICAGO	IL	UST
60624	U003795526	2036929	FS003 NORTHWEST	4233 W. FERDINAND ST.		CHICAGO	IL	UST
60624	S110154859		NORTHWEST FS03	4233 WEST FERDINAND AVE		CHICAGO	IL	TIER 2
60624	1016352052	110039544696	4311 WEST FERDINAND	4311 WEST FERDINAND		CHICAGO	IL	FINDS
60624	U001142607	2007806	IL BELL TELEPHONE CO	4400 FERDINAND		CHICAGO	IL	UST
60624	1000689089	110005911399	IL BELL	4400 W FERDINAND ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113269717		IL BELL	4400 W FERDINAND ST		CHICAGO	IL	
60624	S110150947		AT&T INC	4400 WEST FERDINAND ST		CHICAGO	IL	TIER 2
60624	U004149045		MARSHALL CAMPUS PARK	3201 W. FIFTH AVENUE		CHICAGO	IL	UST
60624	1014949154		MARSHALL FARADAY CAMPUS PARK	3300-3312 WEST FIFTH AVENUE		CHICAGO	IL	US BROWNFIELDS
60624	1016215067	110006408253	LEIF ERICSON SCHOLASTIC ACADEM	3600 W FIFTH		CHICAGO	IL	FINDS
60624	1001123596	ILR000033001	RICSON	3600 W FIFTH		CHICAGO	IL	RCRAInfo-SQG
60624	1001116592	110009384219	SUMNER CHARLES SCHOOL	4320 W FIFTH AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1011296543	110036145463	USE 0316230003	4401 W FIFTH AVE		CHICAGO	IL	FINDS
60624	S110151724		FILLMORE HUB	3301 W FILLMORE ST		CHICAGO	IL	TIER 2
60624	S117489941		FILLMORE HEADEND	3301 W FILLMORE ST		CHICAGO	IL	TIER 2
60624	A100393303		COMCAST TANK# 1-2,500	3301 WEST FILLMORE STREET		CHICAGO	IL	AST
60624	S113266110		TRW INC	3440 W FILLMORE		CHICAGO	IL	
60624	1008150707	110018475274	TRW INC	3440 W FILLMORE		CHICAGO	IL	FINDS
60624	A100411400		UCAN THERAPEUTIC YOUTH HOMETANK;	3600 WEST FILLMORE STREET		CHICAGO	IL	AST
60624	A100415838		UCAN PROGRAM SERV. HQ-TANK#1-300	3605 WEST FILLMORE STREET		CHICAGO	IL	AST
60624	S111897285		SEARS ROEBUCK & CO	3611 W FILLMORE		CHICAGO	IL	
60624	1008133684	110018303655	SEARS ROEBUCK & CO	3611 W FILLMORE		CHICAGO	IL	FINDS
60624	S104521808		SEARS, ROEBUCK & CO.	3611 WEST FILLMORE		CHICAGO	IL	LUST
60624	1017376213	110061091214	UCAN NEW PROJECT CAMPUS	3640 W FILLMORE		CHICAGO	IL	FINDS
60624	S117534138		UCAN NEW PROJECT CAMPUS	3640 WEST FILLMORE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	1000380714	110005929852	LEASEWAY TRUCKING INC	3641 W FILLMORE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1004475697	110001318093	E3 THERMAL REMEDIATION	3661 W. FILLMORE		CHICAGO	IL	FINDS
60624	U003152211	2035381	SEARS ROEBUCK & CO	3661 WEST FILLMORE		CHICAGO	IL	UST
60624	1008133701	110018303824	SEARS ROEBUCK & CO	3700 W FILLMORE		CHICAGO	IL	FINDS
60624	U003667742	2036537	SEARS ROEBUCK & CO	3700 W FILLMORE		CHICAGO	IL	UST
60624	S104521464		SEARS ROEBUCK & COMPANY	3700 WEST FILLMORE STREET		CHICAGO	IL	Inst Control, SRP, LUST
60624	1000978946	IL0000917278	COLOR COMMUNICATIONS INC	4000 W FILLMORE		CHICAGO	IL	AIRS, ICIS, TIER 2, RCRAInfo-SQG
60624	1016186305	110002458714	COLOR COMMUNICATIONS, INC	4000 WEST FILLMORE STREET		CHICAGO	IL	ICIS, FINDS
60624	S110151707		COLOR COMMUNICATIONS INC.	4019 W. FILLMORE		CHICAGO	IL	TIER 2
60624	1000213486	ILD059420877	COLOR COMMUNICATIONS INC	4100 W FILLMORE ST		CHICAGO	IL	RCRAInfo-LQG
60624	U001142495	2008445	GENERAL FOODS MFG CORP	4100 W FILLMORE ST		CHICAGO	IL	UST
60624	S117497789		COLOR COMMUNICATIONS INC	4100 W FILLMORE ST		CHICAGO	IL	
60624	S113266001		COLOR COMMUNICATIONS, INC.	4100 W. FILLMORE		CHICAGO	IL	TIER 2
60624	1000340356	60624CLRCM42	COLOR COMMUNICATIONS INC	4242 W FILLMORE ST		CHICAGO	IL	FCTS, TIER 2, RCRAInfo-LQG, TRIS
60624	1017793065	110058116729	COLOR COMMUNICATIONS, INC.	4242 W. FILLMORE ST.		CHICAGO	IL	ICIS, FINDS
60624	U003667832	2036652	RODMAN DRYWALL	4401 WEST FILLMORE		CHICAGO	IL	UST
60624	1003872925	ILD984774976	HEPPERS ELLSTON ROOFING CO.	4440 FILLMORE		CHICAGO	IL	CERCLIS-NFRAP

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	S113269065		HEPPES-NELSON ROOFING CO	4440 FILLMORE ST		CHICAGO	IL	
60624	1018638231		YELLOW MAGIC	4441 W FILLMORE ST		CHICAGO	IL	
60624	1000241807	110005817991	WASHINGTON PAINT PRODUCTS CO	4525 W FILLMORE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113270491		WE TOAST BREAD CO	4539 W FILLMORE ST		CHICAGO	IL	
60624	1001232065	110003046436	POLICE UNITS CONSOLIDATION	3340 W FILLMORE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113269131		POLICE UNITS CONSOLIDATION	3340 W FILMORE		CHICAGO	IL	
60624	S113269134		CHICAGO, CITY O-DEPT OF GENER	3400 W FILLMORE		CHICAGO	IL	
60624	1016209457	110005833848	COLOR COMMUNICATIONS INC	4100 WEST FILMORE STREET		CHICAGO	IL	FINDS
60624	1011854147	110037163324	ELGIN DAIRY	3712 W FLOURNOY		CHICAGO	IL	FINDS
60624	1008134442	110018311281	IEPA	4340 FLOURNOY		CHICAGO	IL	FINDS
60624	S113269703		IEPA	4340 FLOURNOY		CHICAGO	IL	
60624	S113270522		CHICAGO POLICE DEPT	1817 N FRANCISCO RD		CHICAGO	IL	
60624	S111919550		PUBLIC BLDG COMMISSION CHICAGO	3223 W FRANKLIN BLVD		CHICAGO	IL	
60624	S108048286		PUBLIC BUILDING COMMISSION OF CHIC,	3223 WEST FRANKLIN BOULEVARD		CHICAGO	IL	LUST
60624	1009459920	110024834330	WESTINGHOUSE HIGH SCHOOL	3225 W FRANKLIN BLVD		CHICAGO	IL	FINDS
60624	S113269765		WESTINGHOUSE HIGH SCHOOL	3225 W FRANKLIN BLVD		CHICAGO	IL	
60624	1009398680	ILR000141192	WESTINGHOUSE HIGH SCHOOL	3225 W FRANKLIN BLVD		CHICAGO	IL	RCRA-CESQG
60624	U004051801	2043185	WESTINGHOUSE HIGH SCHOOL	3225 W. FRANKLIN BLVD.		CHICAGO	IL	UST
60624	U001965203	2033202	SACRED HEART HOSPITAL	3240 W FRANKLIN BLVD		CHICAGO	IL	AIRS, UST
60624	1001207724		FRANKLIN BLVD COMMUNITY HOSPITAL	3240 WEST FRANKLIN BOULEVARD		CHICAGO	IL	MLTS
60624	1000708858	110005892070	CHICAGO TRADE SHOW LEASING INC	3300 W FRANKLIN BLVD		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1000612513	ILF984827444	CHICAGO TRADE SHOW LEASING INC	3300 W FRANKLIN BLVD		CHICAGO	IL	RCRA-NonGen
60624	S113269711		CHICAGO TRADE SHOW LEASING INC	3300 W FRANKLIN BLVD		CHICAGO	IL	
60624	1011465580	110036035689	WESTINGHOUSE ACHIEVEMENT ACAD H	3301 W FRANKLIN BL		CHICAGO	IL	FINDS
60624	1001213668	ILR000044081	WESTINGHOUSE HIGH SCHOOL	3301 W FRANKLIN BLVD		CHICAGO	IL	RCRA-CESQG
60624	S107747279	3552	WESTINGHOUSE VOCATIONAL H S-CHGC	3301 W FRANKLIN BLVD		CHICAGO	IL	AIRS
60624	U003995165	2042799	APARTMENT BUILDING	3550 W. FRANKLIN BLVD.		CHICAGO	IL	UST
60624	S111912411		CHICAGO, CITY OF ABANDONMENT	3216 FULTON		CHICAGO	IL	
60624	1001112219	ILR000022475	FLOWER LUCY VOCATIONAL HIGH SCHO	3545 W FULTON		CHICAGO	IL	RCRA-CESQG
60624	S107742038	3663	FLOWER HIGH SCHOOL	3545 W FULTON BLVD		CHICAGO	IL	AIRS
60624	1004479141	110011703727	MCLAREN OCCUPATIONAL HS	3545 W FULTON BLVD		CHICAGO	IL	FINDS
60624	1016086887	110001684160	FLOWER HIGH SCHOOL-CHGO BD ED	3545 W FULTON BLVD		CHICAGO	IL	FINDS
60624	U004223347		AL RABY HIGH SCHOOL	3545 W. FULTON BLVD.		CHICAGO	IL	UST
60624	1004479846	110001821627	ARCHIBALD AND KENDALL INC	4537 W FULTON		CHICAGO	IL	AIRS, FINDS
60624	U000791038	2026344	CHECKLINE	4550 W FULTON ST		CHICAGO	IL	UST
60624	1005636019	110001342994	CHECKLINE INC	4550 W FULTON ST		CHICAGO	IL	AIRS, FINDS
60624	S103688160		ILLINOIS DEPT. OF TRANSPORTATION	FULTON & UNION ST.		CHICAGO	IL	LUST
60624	1008134489	110018311753	IDOT	FULTON & UNION STS		CHICAGO	IL	FINDS
60624	S113269722		IDOT	FULTON & UNION STS		CHICAGO	IL	
60624	S120932724		4000 W GLADYS	4000 W GLADYS		CHICAGO	IL	
60624	S113269747		VACANT LOT	4001 W GLADYS		CHICAGO	IL	
60624	U003995122	2042714	CA DESIGN & IRON, INC. WAREHOUSE BL	3733 W. GRAND AVENUE		CHICAGO	IL	UST
60624	1001127046	110005952139	FRAZIER	4027 W GREENSHAW		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1018663365		PRICE CLEANERS	3400 W GREENSHAW		CHICAGO	IL	
60624	S113269766		36-700 W GREENSHAW BLOCK CLUB	3644 W GREENSHAW ST		CHICAGO	IL	
60624	1008127883	110018245380	EDWARD FRANKLIN FRASIER SCHOOL	4027 W GREENSHAW ST		CHICAGO	IL	FINDS
60624	S113269113		EDWARD FRANKLIN FRASIER SCHOOL	4027 W GREENSHAW ST		CHICAGO	IL	
60624	S113269698		RAYBONS AUTO REPAIR SVC	4401 W GREENSHAW		CHICAGO	IL	
60624	1000164246	110005856662	RAYBONS AUTO REPAIR SVC	4401 W GREENSHAW		CHICAGO	IL	ICIS, RCRAInfo-SQG, FINDS
60624	S113270506		CHICAGO, CITY OF	4146 S HALSTED		CHICAGO	IL	
60624	1016792108	110058384145	440 N HALSTED	440 N HALSTED		CHICAGO	IL	FINDS
60624	1009073391		BROOKS AUTO REPAIR	7100 S HALSTED		CHICAGO	IL	
60624	S117495811		GARFIELD PARK	389 N HAMLIN		CHICAGO	IL	
60624	1017770242	ILR000187351	GARFIELD PARK BOILER HOUSE	389 N HAMLIN		CHICAGO	IL	RCRA-CESQG
60624	1017412744	110063270892	GARFIELD PARK	389 N HAMLIN		CHICAGO	IL	FINDS
60624	U003298583	2036365	MIKE'S AUTO	601 N. HAMLIN STREET		CHICAGO	IL	UST
60624	1020761382		ORELL LEWIS	656 N HAMLIN		CHICAGO	IL	
60624	S108046580		ASSAF, SUHAIL	656 N HAMLIN		CHICAGO	IL	
60624	S106655954		ASSAF, SUHAIL	656 NORTH HAMLIN		CHICAGO	IL	LUST
60624	1008122050	16750	SPECIFIED PLATING CO	320 N HARDING		CHICAGO	IL	AIRS
60624	1000171622	ILT180011611	SPECIFIED PLATING CO	320 N HARDING AVE		CHICAGO	IL	RCRA-CESQG
60624	1015818249	110054833702	SPECIFIED PLATING CO	320 N HARDING AVE		CHICAGO	IL	ICIS, FINDS, TRIS
60624	S110156159		SPECIFIED PLATING COMPANY	320 NORTH HARDING AVE.		CHICAGO	IL	TIER 2
60624	1008133595	110018302763	G&K SCRAP	360 N HARDING AVE-A		CHICAGO	IL	FINDS
60624	S113269058		G&K SCRAP	360 N HARDING AVE-A		CHICAGO	IL	
60624	1008124207	110018208535	VALSPAR CORP	360 N HARDING AVE-B		CHICAGO	IL	FINDS
60624	S113270468		VALSPAR CORP	360 N HARDING AVE-B		CHICAGO	IL	
60624	1004696999	110003048942	RICHARD WRIGHT ELEM SCHOOL	627 N HARDING AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S109092984		RICHARD WRIGHT ELEM SCHOOL	627 N HARDING AVE		CHICAGO	IL	
60624	1000110871	110005809367	TOP DISPOSAL SERVICE	2855 W HARRISON		CHICAGO	IL	RCRA-NonGen, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	1008123967	110018206118	WEBMARK	3249 W HARRISON ST		CHICAGO	IL	FINDS
60624	S111887891		WEBMARK	3249 W HARRISON ST		CHICAGO	IL	
60624	U001386515	2032013	GLEN EAGLE	3249 W HARRISON ST		CHICAGO	IL	UST
60624	S104523865		WEBMARK	3249 WEST HARRISON ST.		CHICAGO	IL	LUST
60624	U001386517	2032012	WEBER LITHOGRAPHING CO	3305 W HARRISON ST		CHICAGO	IL	UST
60624	1000210534	ILD005474887	WEBER GRAPHICS CORP	3305 W HARRISON ST		CHICAGO	IL	RCRAInfo-SQG
60624	S104523854		WEB MARK CORP.	3305 WEST HARRISON		CHICAGO	IL	LUST
60624	U000865743	2013628	ROSCOE COMPANY	3333 W. HARRISON ST.		CHICAGO	IL	AIRS, TIER 2, UST
60624	S108046130		MINUTEMAN GAS STATION	3357 W HARRISON		CHICAGO	IL	
60624	U003971839	2025448	DANISH GAS & FOOD MART, INC.	3357 W. HARRISON STREET		CHICAGO	IL	UST
60624	S106402058		MINUTEMAN GAS STATION	3357 WEST HARRISON		CHICAGO	IL	LUST
60624	2010957040			3500 WEST HARRISON ST		CHICAGO	IL	ERNS
60624	1020076937		ROSCOE COMPANY THE*	3535 W HARRISON		CHICAGO	IL	
60624	U001143019	2013629	ROSCOE CO	3535 W HARRISON ST		CHICAGO	IL	UST
60624	S110156565		THE ROSCOE COMPANY	3535 W. HARRISON		CHICAGO	IL	TIER 2
60624	S113270504		RAGS AUTO & TRUCK	3557 W HARRISON		CHICAGO	IL	
60624	S118661278		FRIENDS OF THE ENVIRONMENT NFP	3609-3623 W HARRISON ST	**	CHICAGO	IL	
60624	U004162253		FORMER GARAGE/STORAGE FACILITY	3609-3623 W. HARRISON STREET		CHICAGO	IL	UST
60624	S118455667		FRIENDS OF THE ENVIRONMENT, NFP	3609-3623 WEST HARRISON STREET		CHICAGO	IL	LUST TRUST, LUST
60624	S117323629		MUEHLFELDER, YOLANDA	3627 W HARRISON ST		CHICAGO	IL	
60624	1017371331	110060380948	MUEHLFELDER, YOLANDA	3627 W HARRISON ST		CHICAGO	IL	FINDS
60624	U004227534		B F CARTAGE CO	3627 W. HARRISON ST.		CHICAGO	IL	UST
60624	S117322722		B F CARTAGE CO.	3627 WEST HARRISON STREET		CHICAGO	IL	LUST TRUST, LUST
60624	S111900827		ELGIN DAIRY FOODS	3707 W HARRISON		CHICAGO	IL	
60624	1012210774	ILR000160689	ELGIN DAIRY FOODS	3707 W HARRISON		CHICAGO	IL	RCRA-CESQG
60624	1004474971	110010723556	ELGIN DAIRY FOODS	3707 W HARRISON ST		CHICAGO	IL	FINDS
60624	S110152359		ELGIN DAIRY FOODS, INC.	3707 W. HARRISON ST.		CHICAGO	IL	TIER 2
60624	U000173443	2000982	ELGIN HONEY HILL CORP.	3707 W. HARRISON STREET		CHICAGO	IL	UST
60624	1001648894		ELGIN DAIRY FOODS	3707 WEST HARRISON		CHICAGO	IL	LUST
60624	S111876051		EQUIVA SERVICES LLC	3801 W HARRISON		CHICAGO	IL	
60624	1008123821	110018204646	EQUIVA SERVICES LLC	3801 W HARRISON		CHICAGO	IL	FINDS
60624	U001143070	2021030	SHELL SER STATION	3801 W HARRISON INDEPENDENCE		CHICAGO	IL	UST
60624	S104527017		SHELL OIL CO.	3801 WEST HARRISON		CHICAGO	IL	LUST
60624	1017403206	110063031035	GRAHAM & DANIEL CO *	3909 W HARRISON		CHICAGO	IL	FINDS
60624	1019997686		GRAHAM & DANIEL CO *	4235 W HARRISON ST		CHICAGO	IL	
60624	1010563424	ILR000148361	COM ED	HARRISON & KOLMAR		CHICAGO	IL	RCRAInfo-SQG
60624	1010367865	110030824598	COMED-MANHOLE	HARRISON ST & KOLMAR AVE		CHICAGO	IL	FINDS
60624	S113270511		COMED-MANHOLE	HARRISON ST & KOLMAR AVE	**	CHICAGO	IL	
60624	1000119076	110005837121	TRW INC	1026 S HOMAN		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1005905020	110012575141	ART SPACE LP	15 S HOMAN AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60624	S113269144		ARTSPACE LIMITED PARTNERSHIP	15 S HOMAN AVE		CHICAGO	IL	
60624	1021451734		CLARK RETAIL ENTERPRISES INC	413 S HOMAN AVE		CHICAGO	IL	
60624	1009074244		ROCKWELL MAPLEWOOD COOP*	43 N HOMAN		CHICAGO	IL	
60624	1008134462	110018311487	KING PETROLEUM	43 N HOMAN & WASHINGTON		CHICAGO	IL	
60624	U001142695	2026986	GARFIELD GAS, INC.	43 N. HOMAN AVENUE		CHICAGO	IL	FINDS
60624	S103688320		MOBIL OIL CORP.	43 NORTH HOMAN & WASHINGTON		CHICAGO	IL	UST
60624	S104528954		KING PETROLEUM	43 NORTH HOMAN AVE.		CHICAGO	IL	LUST
60624	S113269712		FALCON FUELS	43 NORTH HOMAN AVENUE		CHICAGO	IL	LUST
60624	1008134493	110018311799	ADAMS PLASTICS LP	501 N HOMAN AVE		CHICAGO	IL	FINDS
60624	U003042113	2034752	ADAMS PLASTICS	501 N HOMAN AVE		CHICAGO	IL	UST
60624	S104522571		ADAMS PLASTICS	501 NORTH HOMAN AVE.		CHICAGO	IL	LUST
60624	U002112798	2033815	FOOD & LIQUORS	600 S HOMAN		CHICAGO	IL	UST
60624	S113269900		VACANT LOT	726 N HOMAN AVE		CHICAGO	IL	
60624	S113269730		HOMAN ARTHINGTON FOUNDATION	924 S HOMAN AVE		CHICAGO	IL	
60624	1008134504	110018311904	HOMAN ARTHINGTON FOUNDATION	924 S HOMAN AVE		CHICAGO	IL	FINDS
60624	1006056354	110001809810	HOMAN ARTHINGTON FOUNDATION	931 S HOMAN		CHICAGO	IL	AIRS, FINDS
60624	S107745920	15494	HOMAN ARTHINGTON FOUNDATION	931 S HOMAN		CHICAGO	IL	AIRS
60624	1009398705	ILR000141440	HOMAN SQUARE	931 S HOMAN AVE		CHICAGO	IL	RCRAInfo-SQG
60624	S108046814		HOMAN ARTHINGTON FOUNDATION	931 SOUTH HOMAN AVENUE		CHICAGO	IL	SRP, LUST
60624	1014886455	110043832546	3302 W HURON	3302 W HURON		CHICAGO	IL	FINDS
60624	1020643448		BROOKS AMOCO	601 S INDEPENDENCE BLVD		CHICAGO	IL	
60624	S111885905		AMOCO 15491	603 S INDEPENDENCE		CHICAGO	IL	
60624	1009072611		B&B AMOCO	603 S INDEPENDENCE BLVD		CHICAGO	IL	
60624	1000862556	ILD984924597	AMOCO 15491	603 S INDEPENDENCE BLVD		CHICAGO	IL	RCRA-NonGen
60624	U000790822	2023041	BP	603 S. INDEPENDENCE		CHICAGO	IL	UST
60624	S104524385		AMOCO OIL CO. #15491	603 SOUTH INDEPENDENCE		CHICAGO	IL	LUST
60624	1008123735	110018203781	SEARS ROEBUCK & CO	927 S INDEPENDENCE BLVD		CHICAGO	IL	FINDS
60624	S111897762		SEARS ROEBUCK & CO	927 S INDEPENDENCE BLVD		CHICAGO	IL	
60624	S104521685		SEARS, ROEBUCK & CO.	927 SOUTH INDEPENDENCE BLVD.		CHICAGO	IL	LUST
60624	U004149034		MARSHAL CAMPUSE PARK	3200 W. JACKSON		CHICAGO	IL	UST
60624	S111925491		PUBLIC BLDG COMMISSION	3236 W JACKSON		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	S110062711		PUBLIC BUILDING COMMISSION OF CHIC,	3236 WEST JACKSON		CHICAGO	IL	LUST
60624	S113269754		BP OIL NORTH AMERICA	3300 W JACKSON BLVD		CHICAGO	IL	
60624	1017739245	110063670969	3456 W JACKSON	3456 W JACKSON		CHICAGO	IL	FINDS
60624	1009071967		J AND P CUSTOM AUTO	4001 W JACKSON BLVD		CHICAGO	IL	
60624	U001143052	2028162	SCOTT PETERSON & CO	4550 W JACKSON BLVD		CHICAGO	IL	UST
60624	S117502596		SPECIALTY SAUSAGE CO LLC	4550 W JACKSON BLVD		CHICAGO	IL	AIRS
60624	1004479843		SPECIALTY SAUSAGE CO LLC	4550 W JACKSON BLVD		CHICAGO	IL	
60624	1017409003	110063230659	SPECIALTY SAUSAGE CO LLC	4550 W JACKSON BLVD		CHICAGO	IL	FINDS
60624	S107746072	2695	SMG/SCOTT PETERSEN	4550 W JACKSON BLVD		CHICAGO	IL	AIRS
60624	1011837031		SFG/SCOTT PETERSEN	4550 WEST JACKSON BLVD		CHICAGO	IL	RMP
60624	1011837341		SMG/ SCOTT PETERSEN	4550 WEST JACKSON BLVD		CHICAGO	IL	RMP
60624	S104525477		SPECIALTY SAUSAGE COMPANY LLC	4550 WEST JACKSON BLVD.		CHICAGO	IL	TIER 2, LUST
60624	1016070666	110002390948	SFG/SCOTT PETERSEN	4550 WEST JACKSON BOULEVARD		CHICAGO	IL	ICIS, FINDS
60624	1020072628		RED CLEANERS	1175 S KARLOV AVE		CHICAGO	IL	
60624	S113269702		367 N KARLOV	367 N KARLOV		CHICAGO	IL	
60624	1008134439	110018311254	367 N KARLOV	367 N KARLOV		CHICAGO	IL	FINDS
60624	1010317546	ILR000146795	LAWNDALE H&A BOND LTD PTNSHP	1455 S KEDVALE		CHICAGO	IL	RCRA-CESQG
60624	S113270507		LAWNDALE H&A BOND LP	1455 S KEDVALE AVE		CHICAGO	IL	
60624	1018821342		NEIGHBORHOOD VARIETY SHOP	803 S KEDVALE AVE		CHICAGO	IL	
60624	U004014222	2042913	AIDS CARE RESIDENCE	1214-1234 S. KEDZIE		CHICAGO	IL	UST
60624	S113269846		JUDSON RUBBER	4107 W KEDZIE	**	CHICAGO	IL	
60624	1008149230	110018460495	JUDSON RUBBER	4107 W KEDZIE		CHICAGO	IL	FINDS
60624	1016392681	110055264592	411 N KEDZIE	411 N KEDZIE		CHICAGO	IL	US BROWNFIELDS, FINDS
60624	1016392649	110055264226	417 N KEDZIE	417 N KEDZIE		CHICAGO	IL	US BROWNFIELDS, FINDS
60624	S107746613	3486	TILTON SCHOOL	223 N KEELER		CHICAGO	IL	AIRS
60624	1004696970	110009386379	TILTON GEORGE W SCHOOL	223 N KEELER AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60624	1009515096		GEORGE W TILTON SCHOOL	223 N KEELER AVE		CHICAGO	IL	FTTS
60624	S113269734		MELODY	412 S KEELER		CHICAGO	IL	
60624	1001116709	110005948092	MELODY	412 S KEELER		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1022055003		SALEH GABER INC	10 N KILBOURN AVE		CHICAGO	IL	
60624	1000210180	ILD980614531	PAPER CUSTOMIZING CO	1101 S KILBOURN		CHICAGO	IL	RCRA-NonGen
60624	S113266099		PAPER CUSTOMIZING CO	1101 S KILBOURN		CHICAGO	IL	
60624	1000210171	110009373034	PAPER CUSTOMIZING CO	1101 S KILBOURN		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1000226055	110001812352	ABBEY FINISHING CORP	1108 S KILBOURN		CHICAGO	IL	ICIS, RCRAInfo-SQG, FINDS
60624	U001142674	2007496	KEMMERER BOTTLING GROUP INC	356 N KILBOURN		CHICAGO	IL	UST
60624	1000614729	110005905244	KEMMERER BOTTLING	356 NORTH KILBOURN	56, SSW, 1/2 - 1	CHICAGO	IL	RCRA-NonGen, FINDS, LUST
60624	1016352043	110039544525	434-480 NORTH KILBOURN AVENUE	434-480 NORTH KILBOURN AVENUE		CHICAGO	IL	FINDS
60624	S110151563		CHICAGO BEVERAGE SYSTEMS	441 N KILBOURN		CHICAGO	IL	TIER 2
60624	1000612743	110005893676	CHICAGO BEVERAGE	441 N KILBOURN AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S117500978		CHICAGO BEVERAGE SYSTEMS, LLC	441 N. KILBOURN AVE		CHICAGO	IL	TIER 2
60624	U001142117	2029014	CHICAGO BEVERAGE SYSTEM, INC.	441 N. KILBOURN AVE.		CHICAGO	IL	UST
60624	S111889059		CHICAGO, CITY OF	700 N KILBOURN		CHICAGO	IL	
60624	1008134435	110018311209	CHICAGO, CITY OF	700 N KILBOURN		CHICAGO	IL	FINDS
60624	S105225790		CHICAGO, CITY OF	700 NORTH KILBOURN AVE.	D, West, 1/8 - 1/4	CHICAGO	IL	LUST
60624	S105225786		CHICAGO, CITY OF	715 NORTH KILBOURN	D, WNW, 1/8 - 1/4	CHICAGO	IL	LUST
60624	U002222602	2033951	RAIL IT PROPERTY	733 N KILBOURN	22, WNW, 1/8 - 1/4	CHICAGO	IL	UST
60624	S113269107		CHAMBER DEV CO INC	733 N KILBOURN		CHICAGO	IL	
60624	1008123734	110018203772	CHAMBER DEV CO INC	733 N KILBOURN		CHICAGO	IL	FINDS
60624	S107744751	13065	NORTHWEST SORTING CTR	750 N KILBOURN AVE		CHICAGO	IL	AIRS
60624	1000166292	110009372883	NORTHWEST SORTING CTR	750 N KILBOURN AVE	J, WNW, 1/8 - 1/4	CHICAGO	IL	ICIS, RCRAInfo-SQG, FINDS
60624	U001142122	2018804	DEPT STREETS & SANITATION	750 N KILBOURN AVE	J, WNW, 1/8 - 1/4	CHICAGO	IL	UST
60624	1010317488	ILR000146209	COM ED	KILBOURN & MILWAUKEE	**	CHICAGO	IL	RCRAInfo-SQG
60624	S113269721		METRA NE IL REGIONAL RAILROAD	N KILBOURN & W BYRON	**	CHICAGO	IL	
60624	1008134485	110018311726	METRA NE IL REGIONAL RAILROAD	N KILBOURN & W BYRON		CHICAGO	IL	FINDS
60624	S104002310		METRA	NORTH KILBOURN & WEST BYRON		CHICAGO	IL	LUST
60624	1017376118	110061090260	RESOURCE CENTER COMPOSTING FAC	700 N KILBOURNE AVE		CHICAGO	IL	FINDS
60624	S113270501		RESOURCE CENTER COMPOSTING FAC	700 N KILBOURNE AVE		CHICAGO	IL	
60624	1008133643	110018303254	CHICAGO, CITY OF	715 N KILBOURNE		CHICAGO	IL	FINDS
60624	S111890018		CHICAGO, CITY OF	715 N KILBOURNE		CHICAGO	IL	
60624	1005635968	110001368010	LAWRENCE ELEMENTARY SCHOOL-CHG	1 N KILDARE		CHICAGO	IL	AIRS, FINDS
60624	1008125084	110018217348	LEININGER MIDSTATES	1042 S KILDARE		CHICAGO	IL	AIRS, ICIS, FINDS
60624	S113270516		CHICAGO, CITY OF-FORMERLY	1131 S KILDARE AVE-SPILL		CHICAGO	IL	
60624	1005635957	110001343154	ELMER LARSON INC	1156 SOUTH KILDARE		CHICAGO	IL	FINDS
60624	1008133635	110018303174	SINCLAIR CARTAGE INC	22 N KILDARE		CHICAGO	IL	FINDS
60624	S113269090		SINCLAIR CARTAGE INC	22 N KILDARE		CHICAGO	IL	
60624	U003668244	2037259	SINCLAIR CARTAGE, INC.	22 NORTH KILDARE AVE.		CHICAGO	IL	LUST, UST
60624	S113269140		VACANT LOT	915 S KILDARE		CHICAGO	IL	
60624	1008124226	110018208722	COLOR COMMUNICATIONS INC	917 S KILDARE		CHICAGO	IL	AIRS, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	S103687396		ADVANCED CONCRETE	4201 WEST KINSEY		CHICAGO	IL	LUST
60624	1004694215	110005914724	CHICAGO PK DIST GARFIELD PARK GARP	3700 W KINZIE		CHICAGO	IL	RCRA-CESQG, FINDS
60624	1008136970	110018336674	CHICAGO PARK DIST GARFIELD	3700 W KINZIE		CHICAGO	IL	FINDS
60624	S113269719		CHICAGO PARK DIST GARFIELD	3700 W KINZIE		CHICAGO	IL	
60624	S113270498		CHICAGO, CITY OF, PARK DIST	3701 W KINZIE		CHICAGO	IL	
60624	S106132112		CHICAGO PARK DISTRICT	3701 WEST KINZIE		CHICAGO	IL	
60624	U003971802	2020371	GARFIELD PARK SERVICE YARD	3701-3749 W. KINZIE STREET		CHICAGO	IL	LUST
60624	1016956518	ILR000184267	CHICAGO PARK DIST MAINT YARD	3737 W KINZIE		CHICAGO	IL	UST
60624	S117494590		CHICAGO PARK DISTRICT	3737 W KINZIE		CHICAGO	IL	RCRA-CESQG
60624	1000127446	110001820281	ABC PATTERN & FOUNDRY CO	4021 W KINZIE ST		CHICAGO	IL	
60624	1000369419	110005815298	POERSCH METAL MFG CO	4027 W KINZIE		CHICAGO	IL	AIRS, RCRA-NonGen, FINDS
60624	1008120336	110018169612	POERSCH METAL MFG CO	4029 W KINZIE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113269068		POERSCH METAL MFG CO	4029 W KINZIE ST		CHICAGO	IL	FINDS
60624	S107741251	3588	CUDNER & O'CONNOR CO	4035 W KINZIE ST		CHICAGO	IL	
60624	U003104582	2034974	JUDSEN BROTHER RUBBER CO	4107 W KINZIE ST		CHICAGO	IL	AIRS
60624	S113269137		UNION PACIFIC RAILROAD	4200 W KINZIE ST		CHICAGO	IL	UST
60624	S113269130		ADVANCED CONCRETE	4201 W KINZIE		CHICAGO	IL	
60624	U000172736	2015857	ADVANCE CONCRETE BREAKING/EXC	4201 W KINZIE ST		CHICAGO	IL	UST
60624	S113269127		WILLIAM BUFF CO	4243 W KINZIE		CHICAGO	IL	
60624	1008124255	110018209026	WILLIAM BUFF CO	4243 W KINZIE		CHICAGO	IL	FINDS
60624	1001218710	110005961904	WM BUFF CO	4243 W KINZIE		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1000271633	110005813147	WHY NOT IRON	4425 W KINZIE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1008151577	110018484040	VAC PROCESSING LLC	1038 S KOLMAR AVE		CHICAGO	IL	AIRS, FINDS
60624	S113269143		TRUCK KING INC	1135 S KOLMAR		CHICAGO	IL	
60624	S113269738		GUGLIELMO MARCONI SCHOOL	230 N KOLMAR		CHICAGO	IL	
60624	1008134509	110018311959	GUGLIELMO MARCONI SCHOOL	230 N KOLMAR		CHICAGO	IL	FINDS
60624	S113266068		NATIONAL FINISHING	516 S KOLMAR		CHICAGO	IL	
60624	1008150694	110018475149	NATIONAL FINISHING	516 S KOLMAR		CHICAGO	IL	FINDS
60624	S113270499		VACANT LOT	614 S KOLMAR		CHICAGO	IL	
60624	1008127807	110018244639	ELECTRO GLO CO	621 S KOLMAR AVE		CHICAGO	IL	AIRS, FINDS
60624	1000181618	ILD005473913	ELECTRO GLO CO	621-25 S KOLMAR		CHICAGO	IL	RCRAInfo-SQG
60624	1010370674	110030823090	1000 S KOSTNER AVE	1000 S KOSTNER AVE		CHICAGO	IL	FINDS
60624	S109528240		GF OFFICE FURNITURE	1000-1034 SOUTH KOSTNER AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	1004472634	110001286714	GF OFFICE FURNITURE LTD LP	1034 S KOSTNER		CHICAGO	IL	AIRS, FINDS
60624	1008128497	110018251577	GF OFFICE FURNITURE LTD LP	1034 S KOSTNER		CHICAGO	IL	AIRS, FINDS
60624	1018287681		OSI	1034 S KOSTNER		CHICAGO	IL	ICIS
60624	1000246833	ILD148309990	GF OFFICE FURNITURE LTD LP	1034 S KOSTNER		CHICAGO	IL	RCRA-NonGen
60624	U004123147		GF OFFICE FURNITURE LTD., L.P.	1034 SOUTH KOSTNER		CHICAGO	IL	LUST, UST
60624	1008133692	110018303744	RODMAN DRYWALL INC	1100 S KOSTNER		CHICAGO	IL	FINDS
60624	S111898148		RODMAN DRYWALL INC	1100 S KOSTNER		CHICAGO	IL	
60624	S104521593		RODMAN DRYWALL SUPPLY	1100 SOUTH KOSTNER		CHICAGO	IL	LUST
60624	1004473947	110001683731	ELMER LARSON, INC.	1151 SOUTH KOSTNER		CHICAGO	IL	FINDS
60624	S113270483		UNITED DEMOLITION	1240 S KOSTNER		CHICAGO	IL	
60624	U003929768	2041931	VACANT LOT	1601 S KOSTNER AVE		CHICAGO	IL	UST
60624	1008136162	110018328576	PUBLIC BLDG COMM OF CHICAGO	2710 S KOSTNER		CHICAGO	IL	FINDS
60624	S113271401		PUBLIC BLDG COMM OF CHICAGO	2710 S KOSTNER		CHICAGO	IL	
60624	S112363931		AMOCO, ROBERT BROOKS	414 S KOSTNER		CHICAGO	IL	
60624	1008134474	110018311600	AMOCO, ROBERT BROOKS	414 S KOSTNER		CHICAGO	IL	FINDS
60624	1008134395	110018310816	MOBIL OIL 05-BDJ	414 S KOSTNER & CONGRESS		CHICAGO	IL	FINDS
60624	S113269686		MOBIL OIL 05-BDJ	414 S KOSTNER & CONGRESS	**	CHICAGO	IL	
60624	1009074334		JABS INC	414 S KOSTNER AVE		CHICAGO	IL	
60624	U001142834	2008999	WESTBOUND GAS AND FOOD, INC.	414 SOUTH KOSTNER		CHICAGO	IL	UST
60624	S104002321		MOBIL OIL #05BDJ	414 SOUTH KOSTNER & CONGRESS		CHICAGO	IL	LUST
60624	1021275950		DENNIS SUNOCO	500 S KOSTNER		CHICAGO	IL	
60624	1000141299	110006403043	PPG/SS CORP	2800 W LAKE ST		MELROSE PARK	IL	RCRA-NonGen, FINDS
60624	S107741285	3314	D & W MANUFACTURING CO INC	3237 W LAKE ST		CHICAGO	IL	AIRS
60624	1000123435	ILD005223318	D & W MFG CO INC	3237 W LAKE ST		CHICAGO	IL	RCRAInfo-SQG
60624	1016079574	110001376163	D & W MANUFACTURING CO INC	3237 WEST LAKE STREET		CHICAGO	IL	FINDS
60624	U000173697	2007805	AMERITECH GARAGE	3333 W LAKE		CHICAGO	IL	UST
60624	1008137691	110018343924	ILLINOIS BELL DBA AT&T IL	3333 W LAKE ST		CHICAGO	IL	FINDS
60624	1000689217	110005912343	ILL BELL TEL CO	3333 W LAKE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S111881650		ILLINOIS BELL DBA AT&T IL	3333 W LAKE ST		CHICAGO	IL	
60624	S104525617		ILLINOIS BELL TELEPHONE	3333 WEST LAKE ST.		CHICAGO	IL	LUST
60624	S113269723		QUICK WAY TIRE SERVICE	3410 W LAKE ST		CHICAGO	IL	
60624	1000862708	110005929745	QUICK WAY TIRE SERVICE	3410 W LAKE ST		CHICAGO	IL	RCRA-NonGen, FINDS
60624	S113270518		PALM REALTY	3504 W LAKE ST		CHICAGO	IL	
60624	U004142123		PALM REALTY	3504 W LAKE STREET		CHICAGO	IL	UST
60624	S109685136		PALM REALTY PROPERTY	3504 WEST LAKE STREET		CHICAGO	IL	Inst Control, SRP
60624	U000864852	2018840	DEPT OF WATER	3560 W LAKE ST		CHICAGO	IL	UST
60624	1008133648	110018303290	CHICAGO DEPT OF WATER	3560 W LAKE ST		CHICAGO	IL	FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	S111890580		CHICAGO DEPT OF WATER	3560 W LAKE ST		CHICAGO	IL	
60624	S104523253		CHICAGO DEPT. OF WATER	3560 WEST LAKE ST.		CHICAGO	IL	LUST
60624	1018314772	110069221247	LAKE TECH AUTO REPAIR	3821 W LAKE AVE		CHICAGO	IL	ICIS, FINDS
60624	1000703693	110000866288	ABLE CASTINGS INC	3825 W LAKE ST		CHICAGO	IL	RCRA-NonGen, FINDS
60624	S113269718		ABLE CASTING	3825 W LAKE ST		CHICAGO	IL	
60624	1015970663	110046148637	CTA	3910 W LAKE ST		CHICAGO	IL	FINDS
60624	S111908331		HECKMANN BUILDING PRODUCTS	4008 W LAKE ST		CHICAGO	IL	
60624	S104792968		HECKMANN BLDG. PRODUCTS	4008 WEST LAKE ST.		CHICAGO	IL	LUST
60624	U003762942	2040163	VACANT LOT	4008-4018 W LAKE		CHICAGO	IL	UST
60624	U004082469	2043579	AUTO REPAIR SHOP	4011 W. LAKE		CHICAGO	IL	UST
60624	S113270525		AKKADE INC	4101-4109 W LAKE ST		CHICAGO	IL	
60624	S112355245		ELECTRONIC PLATING CO	4106 W LAKE ST		CHICAGO	IL	
60624	1008150848	110018476692	ELECTRONIC PLATING CO	4106 W LAKE ST		CHICAGO	IL	FINDS
60624	S113269696		CHICAGO CONSUMER SVC	4109 W LAKE		CHICAGO	IL	
60624	1008134412	110018310987	CHICAGO CONSUMER SVC	4109 W LAKE		CHICAGO	IL	FINDS
60624	1000166197	ILD005155577	CHICAGO ANODIZING CO	4112 W LAKE ST		CHICAGO	IL	RCRA-NonGen
60624	S107740742	3834	CHICAGO ANODIZING	4112 W LAKE ST		CHICAGO	IL	AIRS
60624	1016082425	110000434799	CHICAGO ANODIZING	4112 W. LAKE ST.		CHICAGO	IL	FINDS
60624	S110151559		CHICAGO ANODIZING CO.	4112 W. LAKE ST.		CHICAGO	IL	AIRS, TIER 2
60624	1004477568	110006552747	ADA SPINNING & POLISHING	4112 WEST LAKE STREET		CHICAGO	IL	FINDS
60624	S107739990	3115	ATLAS FINISHING CO	4118 W LAKE ST		CHICAGO	IL	AIRS
60624	1000157170	110001820708	ATLAS FINISHING CO	4118 W LAKE ST	57, SSE, 1/2 - 1	CHICAGO	IL	BROWNFIELDS, RCRAInfo-SQG, SHWS, FINDS
60624	S104780071		ATLAS FINISHING COMPANY, INC.	4118-4140 WEST LAKE STREET		CHICAGO	IL	SRP
60624	U003762832	2040000	CAMEX GRINDING COMPANY	4137 W LAKE ST		CHICAGO	IL	UST
60624	S113269694		PRECISION ANODIZING CORP	4139 LAKE ST		CHICAGO	IL	
60624	1008134699	110018313859	PRECISION ANODIZING CORP	4139 LAKE ST		CHICAGO	IL	FINDS
60624	S113269104		MILWAUKEE SERVICE	4148 W LAKE ST		CHICAGO	IL	
60624	1000978982	110005806253	MILWAUKEE SVC	4148 W LAKE ST		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1006518361	110001344787	LAKE POINT FOODS INC	4151 W LAKE ST		CHICAGO	IL	AIRS, FINDS
60624	1008134456	110018311414	MULTI-ELECTRIC MFG INC	4215 W LAKE ST		CHICAGO	IL	FINDS
60624	S111878969		MULTI-ELECTRIC MFG INC	4215 W LAKE ST		CHICAGO	IL	
60624	S104526338		MULTI-ELECTRIC MFG. INC.	4215 WEST LAKE ST.		CHICAGO	IL	LUST
60624	S112224952		MULTI ELECTRIC MANUFACTURING, INC.	4215-4243 WEST LAKE STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S113269695		MULTI ELECTRIC MFG INC	4223 W LAKE ST		CHICAGO	IL	
60624	S111884544		CHICAGO ROLLER SKATE CO	4255 W LAKE ST		CHICAGO	IL	
60624	1000101297	110005817955	CHICAGO ROLLER SKATE CO	4255 W LAKE ST		CHICAGO	IL	CERCLIS-NFRAP, RCRA-NonGen, FINDS, LUST
60624	U001142269	2030237	CHICAGO ROLLER SKATE	4255 W LAKE ST		CHICAGO	IL	UST
60624	S111914427		N S C CORP	4300 W LAKE ST		CHICAGO	IL	
60624	1000109168	110005850542	NSC CORP	4300 W LAKE ST		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1010014471	110028285594	4300 W LAKE ST	4300 W LAKE ST		CHICAGO	IL	FINDS
60624	S106346404		NSC CORPORATION	4300 WEST LAKE STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	U003975123	2042314	4300 WEST LAKE STREET	4300 WEST LAKE STREET		CHICAGO	IL	UST
60624	S113269701		JEN ROB PLATING CO	4305 W LAKE ST		CHICAGO	IL	
60624	1008134424	110018311101	JEN ROB PLATING CO	4305 W LAKE ST		CHICAGO	IL	FINDS
60624	S113270517		VACANT LOT	4307 W LAKE ST		CHICAGO	IL	
60624	1000403539	110005837559	JANUSZ PROPERTY	4309 W LAKE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S110154008		LAKE AND KEELER	4309 W. LAKE STREET		CHICAGO	IL	TIER 2
60624	S109685133		JANUSZ PROPERTY	4309 WEST LAKE STREET		CHICAGO	IL	SRP
60624	S113269749		VACANT LOT	4319 W LAKE ST		CHICAGO	IL	
60624	1016440310	110055954141	4426 W LAKE	4426 W LAKE		CHICAGO	IL	FINDS
60624	U004217777		MIDWEST CANVAS	4426-4458 W. LAKE STREET		CHICAGO	IL	UST
60624	1006517988		CHICAGO TURNRITE CO	4431 W LAKE ST		CHICAGO	IL	
60624	1008122419	16468	CHICAGO TURNRITE CO	4431 W LAKE ST		CHICAGO	IL	AIRS
60624	S107740784	3395	CHICAGO ROLLER SKATE CO	4450 W LAKE ST		CHICAGO	IL	AIRS
60624	1016180394	110001228047	CHICAGO ROLLER SKATE CO	4450 WEST LAKE STREET		CHICAGO	IL	FINDS
60624	1016180852	110001340184	CHICAGO TURNRITE CO. INC	4459 W LAKE ST		CHICAGO	IL	ICIS, FINDS
60624	S111888982		CHICAGO, CITY OF	4501 W LAKE AVE		CHICAGO	IL	
60624	1008134508	110018311940	CHICAGO, CITY OF	4501 W LAKE AVE		CHICAGO	IL	FINDS
60624	S104491614		4501 WEST LAKE STREET	4501 WEST LAKE STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S113269713		FIRST CLASS CUSTOMS	4519 W LAKE ST		CHICAGO	IL	
60624	1000614178	110005901284	FIRST CLASS CUSTOMS	4519 W LAKE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1004697987	110009284078	US EPA/NORTH LAWNSDALE MERCURY	635 N LAWNSDALE		CHICAGO	IL	RCRA-CESQG, FINDS
60624	1003108934	ILN000508128	NORTH LAWNSDALE MERCURY SPILL	635 NORTH LAWNSDALE		CHICAGO	IL	CERCLIS-NFRAP
60624	S113269119		RYERSON ELEMENTARY SCHOOL	646 N LAWNSDALE		CHICAGO	IL	
60624	1004696700	110003045277	RYERSON ELEMENTARY SCHOOL	646 N LAWNSDALE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60624	1016402845	110055367945	UNITED IMPORTS, INC.	3911 W. LAWRENCE AVENUE		CHICAGO	IL	ICIS, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	S113270514		EDDIES AUTO REPAIR	4701 W LENOYNE	**	CHICAGO	IL	
60624	1011853878	110037160639	3911 W LEXINGTON	3911 W LEXINGTON		CHICAGO	IL	FINDS
60624	94271608			3921 WEST LEXINGTON ST		CHICAGO	IL	ERNS
60624	1006807429	110014371704	CHICAGO, CITY OF ABANDONMENT	4500 W LEXINGTON		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S111913266		CHICAGO, CITY OF ABANDONMENT	4500 W LEXINGTON		CHICAGO	IL	
60624	1008150787	110018476077	ARCHER DEMOLITION	4535 W LEXINGTON		CHICAGO	IL	FINDS
60624	S113266217		ARCHER DEMOLITION	4535 W LEXINGTON		CHICAGO	IL	
60624	S113270524		MARTIN LUTHER KING JR PLZ APTS	3220 W MADISON ST		CHICAGO	IL	
60624	1017794175	110063750819	3423 W MADISON	3423 W MADISON		CHICAGO	IL	FINDS
60624	S117491504		GARFIELD PARK SERVICES	3433 W MADISON ST		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S111914735		COX, DONNA	3801 W MADISON AVE		CHICAGO	IL	
60624	U003914188	2041814	FORMER SERVICE STATION	3801 W MADISON ST		CHICAGO	IL	UST
60624	S106058381		COX, DONNA	3801 WEST MADISON AVE.		CHICAGO	IL	LUST
60624	1016441029	110055962016	3854 W MADISON	3854 W MADISON		CHICAGO	IL	FINDS
60624	1008122388	110018190269	FIRESTONE	3912 W MADISON		CHICAGO	IL	FINDS
60624	S113266189		FIRESTONE	3912 W MADISON		CHICAGO	IL	Inst Control, SRP
60624	U004110628	2043745	MAD-PAL PLAZA	3913-3999 W. MADISON STREET		CHICAGO	IL	UST
60624	1018450695		PARK JONG SOO	3942 W MADISON ST		CHICAGO	IL	
60624	1016443344	110056036739	MCDONALDS	4048 W MADISON		CHICAGO	IL	FINDS
60624	1008134113	110018307973	WOOLWORTH 31261	4055 W MADISON AVE		CHICAGO	IL	FINDS
60624	S113269126		WOOLWORTH 31261	4055 W MADISON AVE		CHICAGO	IL	
60624	U003668751	2038951	FOOT LOCKER	4055 W MADISON ST		CHICAGO	IL	UST
60624	S111927167		S&J PROPERTIES INC	4111-4119 W MADISON		CHICAGO	IL	
60624	S111286658		S & J PROPERTIES INC.	4111-4119 WEST MADISON		CHICAGO	IL	LUST
60624	U004183456		VACANT STORE IN STRIP MALL	4117 W. MADISON		CHICAGO	IL	UST
60624	1010563390	ILR000148023	COM ED	4130 W MADISON		CHICAGO	IL	RCRAInfo-SQG
60624	1010370668	110030823036	COMED-MANHOLE	4130 W MADISON		CHICAGO	IL	FINDS
60624	S113270508		COMED-MANHOLE	4130 W MADISON		CHICAGO	IL	
60624	1009185768		DAVES CLEANERS & TAILORS	4131 W MADISON		CHICAGO	IL	
60624	1020098845		SUNSHINE CLEANERS	4156 MADISON		CHICAGO	IL	
60624	1020098847		SUNSHINE CLEANERS	4158 W MADISON ST		CHICAGO	IL	
60624	U001141816	2008493	VACANT LOT	4400 W MADISON		CHICAGO	IL	UST
60624	S108047888		GORECKI, MITCH	4400 W MADISON ST		CHICAGO	IL	
60624	S106984532		GORECKI, MITCH	4400 WEST MADISON STREET		CHICAGO	IL	LUST
60624	S111912467		KING, JOHNNIE	4415 W MADISON ST		CHICAGO	IL	
60624	U003877565	2041408	KINGS ACE HARDWARE INC	4415 W MADISON ST THRID PARTY REMC		CHICAGO	IL	UST
60624	S105620859		KING, JOHNNIE	4415 WEST MADISON STREET		CHICAGO	IL	LUST
60624	S113269715		NEW PUBLIX CLEANERS	4432 W MADISON		CHICAGO	IL	
60624	U001143326	2008770	LIDLAW TRANSIT, INC	4510 W. MADISON STREET		CHICAGO	IL	UST
60624	1009072505		JOHNSON TRANSMISSIONS CORP	4528 W MADISON ST		CHICAGO	IL	
60624	U003668813	2039088	LIDLAW TRANSIT INC	4534 W MADISON		CHICAGO	IL	UST
60624	1008125179	110018218294	LIDLAW TRANSIT COMPANY	4540 W MADISON		CHICAGO	IL	FINDS
60624	S111891539		AMOCO OIL CO	4700 W MADISON AVE		CHICAGO	IL	
60624	1008134448	110018311343	AMOCO OIL CO	4700 W MADISON AVE		CHICAGO	IL	FINDS
60624	S104527864		AMOCO OIL CO. #16502	4700 WEST MADISON		CHICAGO	IL	LUST
60624	1008134400	110018310861	IEPA OER	4701 W MADISON		CHICAGO	IL	FINDS
60624	S113269691		IEPA OER	4701 W MADISON		CHICAGO	IL	
60624	1000166347	ILD984774141	CTA-WEST SHOPS	3900 W MAYPOLE		CHICAGO	IL	PADS, RCRAInfo-SQG
60624	1008129490	110018261557	CTA-WEST SHOPS	3900 W MAYPOLE		CHICAGO	IL	FINDS
60624	U000791253	2020711	WEST SHOPS	3900 W MAYPOLE AVE		CHICAGO	IL	UST
60624	1005635716	110001304650	CHICAGO TRANSIT AUTHORITY	3900 W MAYPOLE AVE		CHICAGO	IL	AIRS, FINDS
60624	S104525707		CHICAGO TRANSIT AUTHORITY	3901 WEST MAYPOLE AVE.		CHICAGO	IL	LUST
60624	1016186278	110002455110	CHICAGO TRANSIT AUTHORITY	3915 WEST MAYPOLE		CHICAGO	IL	ICIS, FINDS
60624	S113272356		WILLIAMS TIRE SHOP,JOHNNIE MAE	10342 S MICHIGAN AVE		CHICAGO	IL	
60624	1011853091	110037152611	2931-33 N MILWAUKEE AVE	2931-33 N MILWAUKEE AVE		CHICAGO	IL	FINDS
60624	1001127036	110005952059	MICHAEL FARADAY SCHOOL	3250 W MONROE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113269736		MICHAEL FARADAY SCHOOL	3250 W MONROE		CHICAGO	IL	
60624	1016696999	110056306929	3414 W MONROE	3414 W MONROE		CHICAGO	IL	FINDS
60624	S113269748		VACANT LOT	4106 W MONROE ST		CHICAGO	IL	
60624	S113269064		LAURA S WARD SCHOOL	410 N MONTICELLO AVE		CHICAGO	IL	
60624	1003870003	ILD100620707	LAURA WARD ELEMENTARY SCHOOL	410 N MONTICELLO AVE		CHICAGO	IL	CERCLIS-NFRAP
60624	1004696962	ILR000061010	WARD LAURA SCHOOL	410 N MONTICELLO AVE		CHICAGO	IL	RCRA-CESQG
60624	1008292966	110021843264	WARD LAURA SCHOOL	410 N MONTICELLO AVE		CHICAGO	IL	FINDS
60624	S113269771		VACANT LOT	749 N MONTICELLO		CHICAGO	IL	
60624	S113270842		GARCIA USED AUTO PARTS	2101 S MORGAN		CHICAGO	IL	
60624	S113258467		FALKNER BUMPER INC	14810 S MYRTLE ST	**	HARVEY	IL	
60624	1014705876	110040762065	521 -23 N HAMLIN	521 -23 N HAMLIN		CHICAGO	IL	FINDS
60624	1003870319	ILD980998405	CHICAGO PARK DIST GARFIELD PARK	NEAR RTE 290 & INDEPENDENCE	**	CHICAGO	IL	CERCLIS-NFRAP
60624	U003667951	2036788	HABITAT CO	3314 W NMAYPOLE		CHICAGO	IL	UST
60624	S113269383		AUSTIN, KATIE	3347 W OHIO		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	1007370583	ILR000128660	INDUSTRIAL STORAGE WHSE CORP	4343 W OHIO ST	23, SSE, 1/8 - 1/4	CHICAGO	IL	RCRA-NonGen
60624	S110704425		INDUSTRIAL STORAGE WAREHOUSE C	4343 W. OHIO STREET		CHICAGO	IL	NPDES
60624	1005579963	110010011851	INDUSTRIAL STORAGE WAREHOUSE C	4343 W. OHIO STREET		CHICAGO	IL	FINDS
60624	1000338276	110005830244	STRONA WAREHOUSE	4350 W OHIO	F, South, 1/8 - 1/4	CHICAGO	IL	RCRA-NonGen, FINDS
60624	1000119742	ILD049816796	PPG INDUSTRIES INC STRONA WAREHOL	4350 W OHIO ST	F, South, 1/8 - 1/4	CHICAGO	IL	RCRA-NonGen
60624	S117500835		US ART	4400 W OHIO ST		CHICAGO	IL	
60624	1000291621	ILD026330969	U. S. ART	4400 W OHIO ST	C, South, 1/8 - 1/4	CHICAGO	IL	RCRA-NonGen
60624	1008134449	110018311352	KEMMERER BOTTLING	4433 W OHIO ST		CHICAGO	IL	FINDS
60624	U000791671	2007495	JOYCE BEVERAGES	4433 W OHIO ST	G, SSW, 1/8 - 1/4	CHICAGO	IL	UST
60624	S112363308		KEMMERER BOTTLING	4433 W OHIO ST		CHICAGO	IL	
60624	S104527796		KEMMERER BOTTLING	4433 WEST OHIO ST.	G, SSW, 1/8 - 1/4	CHICAGO	IL	LUST
60624	S110685041		AMERICAN ENVELOPE	4440 WEST OHIO STREET	C, South, 1/8 - 1/4	CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	U001142336	2030245	COLOVOS CO	4444 W OHIO	G, SSW, 1/8 - 1/4	CHICAGO	IL	UST
60624	1004474532	110006819210	MIDWEST SOIL REMEDIATION INC.	4444 WEST OHIO STREET		CHICAGO	IL	FINDS
60624	S113269693		ADM CO	4350 W OHIO-A		CHICAGO	IL	
60624	1008134694	110018313813	ADM CO	4350 W OHIO-A		CHICAGO	IL	FINDS
60624	S113269697		CHEVRON CHEMICAL CO	4350 W OHIO-B		CHICAGO	IL	
60624	1008115016	110018116242	CHEVRON CHEMICAL CO	4350 W OHIO-B		CHICAGO	IL	FINDS
60624	1014703180	110041357439	3308 W POLK	3308 W POLK		CHICAGO	IL	FINDS
60624	U003868506	2038581	THE SHAW COMPANY	3645 W POLK		CHICAGO	IL	UST
60624	S113269733		GREGORY	3715 W POLK ST		CHICAGO	IL	
60624	1001116603	110005947342	GREGORY	3715 W POLK ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113269139		CHICAGO, CITY OF ABANDONMENT	4547 POLK ST		CHICAGO	IL	
60624	1008111100	110018076892	CHICAGO, CITY OF ABANDONMENT	4547 POLK ST		CHICAGO	IL	FINDS
60624	1004698436	ILR000106849	CHICAGO, CITY OF (ABANDONMENT)	4547 POLK ST		CHICAGO	IL	RCRA-NonGen
60624	1004654445	ILN000508200	POLK STREET DRUMS	4547 POLK ST.		CHICAGO	IL	CERCLIS
60624	S113270487		FLOOD BROTHERS-OPEN LOT	1001-05 S PULASKI		CHICAGO	IL	
60624	S113269699		ECONOMY AUTOPARTS	1031 S PULASKI		CHICAGO	IL	
60624	1008134414	110018311003	ECONOMY AUTOPARTS	1031 S PULASKI		CHICAGO	IL	FINDS
60624	1000143545	110001812691	COCA-COLA USA	1032 S PULASKI RD		CHICAGO	IL	RCRA-CESQG, FINDS
60624	U001142334	2005530	COCA-COLA USA DIV OF COCA-COLA	1032 S PULASKI RD		CHICAGO	IL	UST
60624	1009075421		MELLEEE CORP	105 N PULASKI RD		CHICAGO	IL	
60624	S113269141		MEINEKE MUFFLER & BRAKE	105 N PULASKI RD		CHICAGO	IL	
60624	S105151696		MEINEKE MUFFLER & BRAKE	105 NORTH PULASKI ROAD		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S113269685		ROS CLEANERS	1133 S PULASKI RD		CHICAGO	IL	
60624	1009185436		ROS CLEANERS	1133 S PULASKI RD		CHICAGO	IL	
60624	1000107612	110005872948	ROS CLEANERS	1133 S PULASKI RD		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113270510		CHICAGO, CITY OF	115 S PULASKI AVE		CHICAGO	IL	
60624	1010563417	ILR000148296	CHICAGO, CITY OF	115 S PULASKI AVE		CHICAGO	IL	RCRAInfo-SQG
60624	S113269700		ELITE CLEANERS	1420 S PULASKI		CHICAGO	IL	
60624	1008134418	110018311049	ELITE CLEANERS	1420 S PULASKI		CHICAGO	IL	FINDS
60624	1017402822	110063027040	15 N PULASKI	15 N PULASKI		CHICAGO	IL	FINDS
60624	1018539456		ELLIS SUNSHINE CLRS LAUNDROMAT	209 S PULASKI		CHICAGO	IL	
60624	1020096105		STOCKHOLM CLEANERS INC	216-228 N PULASKI		CHICAGO	IL	
60624	S113269070		NICK & CHICK CLEANERS	271 N PULASKI		CHICAGO	IL	
60624	1008123816	110018204593	NICK & CHICK CLEANERS	271 N PULASKI		CHICAGO	IL	FINDS
60624	1009187117		NICKS CLEANERS & SHOE REPAIR	271 N PULASKI RP		CHICAGO	IL	
60624	1020049636		NICK & CHICK CLEANERS	271 PULASKI	**	CHICAGO	IL	
60624	S113269150		VACANT LOT	277 N PULASKI		CHICAGO	IL	
60624	1009188647		LAKE & PULASKI CLEANERS	277 N PULASKI RD		CHICAGO	IL	
60624	1014704414	110041358633	301 N PULASKI ST	301 N PULASKI ST		CHICAGO	IL	FINDS
60624	S113270496		BETHEL NEW LIFE	304-316 N PULASKI	**	CHICAGO	IL	
60624	1009457239	110024854246	BETHEL NEW LIFE	304-316 N PULASKI		CHICAGO	IL	FINDS
60624	U003914160	2041755	COMMUNITY BUILDING	308 N PULASKI		CHICAGO	IL	UST
60624	1020468993		CRAWFORD & LAKE SUPER SERVICE	308 N PULASKI		CHICAGO	IL	
60624	S105958684		BETHEL NEW LIFE CHURCH	308 NORTH PULASKI RD.		CHICAGO	IL	LUST
60624	S113269148		VACANT LOT	329 N PULASKI RD		CHICAGO	IL	
60624	1016227271	110007551540	AMOCO 5061	39 N PULASKI RD		CHICAGO	IL	FINDS
60624	U000790794	2023172	BP PRODUCTS #5061	39 NORTH PULASKI		CHICAGO	IL	LUST, UST
60624	S107746803	19310	UNION PACIFIC RAILROAD	400 N PULASKI AVE		CHICAGO	IL	AIRS
60624	1004694947	ILR000002816	UNION PACIFIC RR/METRA	400 N PULASKI RD		CHICAGO	IL	RCRAInfo-SQG
60624	S110156849		UNION PACIFIC R.R. - CHICAGO M19A	400 N. PULASKI AVE		CHICAGO	IL	TIER 2
60624	U003152222	2035442	UNION PACIFIC RR - CHICAGO M19A	400 N. PULASKI AVE		CHICAGO	IL	TIER 2, UST
60624	S108480388		UNION PACIFIC RAILROAD	400 NORTH PULASKI	M, South, 1/4 - 1/2	CHICAGO	IL	LUST
60624	S117496751		UNION PACIFIC RAILROAD	400 NORTH PULASKI ROAD	M, South, 1/4 - 1/2	CHICAGO	IL	LUST
60624	1017371700	110060384702	V4 PETROLEUM	415 S PULASKI RD		CHICAGO	IL	FINDS
60624	U003763037	2040365	CITGO	415 S. PULASKI		CHICAGO	IL	UST
60624	S117322777		V4 PETROLEUM	415 SOUTH PULASKI ROAD		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	S113270503		IL STUDENT TRANSPORT	459 N PULASKI		CHICAGO	IL	
60624	1001116344	ILR000023648	NEWARK ELECTRONICS	500 N PULASKI B		CHICAGO	IL	RCRAInfo-SQG
60624	1004695661	110005945219	NEWARK ELECTRONICS	500 N PULASKI B		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S113266224		UNION PACIFIC RAILROAD	500 N PULASKI RD		CHICAGO	IL	
60624	1008140241	110018369576	UNION PACIFIC RAILROAD	500 N PULASKI RD		CHICAGO	IL	FINDS
60624	U000865692	2026826	NEWARK ELECTRONICS	500 N PULASKI ST		CHICAGO	IL	UST
60624	S107739238		NEWARK ELECTRONICS	500 NORTH PULASKI ROAD		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S113269769		CHICAGO DOT	55 N PULASKI		CHICAGO	IL	
60624	1010784271	ILR000152546	CHICAGO DOT	55 N PULASKI		CHICAGO	IL	RCRA-NonGen
60624	1010729403	110033599416	CHICAGO DOT	55 N PULASKI		CHICAGO	IL	FINDS
60624	S113266066		STROMBECKER CORP	600 N PULASKI RD		CHICAGO	IL	
60624	U000865910	2027290	STROMBECKER CORP	600 N PULASKI RD		CHICAGO	IL	AIRS, UST
60624	1000334566	110001131347	STROMBECKER CORPORATION	600 N. PULASKI		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1018287485		STROMBECKER CORPORATION	600 N. PULASKI ROAD		CHICAGO	IL	
60624	1000907653	110012152507	CTA BUS GARAGE	642 N PULASKI		CHICAGO	IL	AIRS, UST
60624	U002112783	2033762	CHI/PULASKI BUS GARAGE	642 N PULASKI		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1009398711	ILR000141507	CHICAGO TRANSIT AUTHORITY	642 N PULASKI		CHICAGO	IL	UST
60624	U001473586	2032345	CHICAGO TRANSIT AUTHORITY	650 N PULASKI		CHICAGO	IL	RCRAInfo-SQG
60624	1020987355		CRAWFORD SERVICE & IGNITION	653-59 N PULASKI		CHICAGO	IL	UST
60624	1018626504		DJ WELL CLEANERS	709-11 S PULASKI RD		CHICAGO	IL	
60624	S113270520		SPRINT NEXTEL CORP	713-717 N PULASKI	**	CHICAGO	IL	
60624	S118150297		PULASKI FD BLDG LLC	729 N PULASKI		CHICAGO	IL	LUST
60624	U004228827		PULASKI & CHICAGO BUILDING, LLC	729 N. PULASKI		CHICAGO	IL	UST
60624	1008129229	110018258927	CHICAGO BOARD OF EDUCATION	730 N PULASKI AVE		CHICAGO	IL	FINDS
60624	S113269073		CHICAGO BOARD OF EDUCATION	730 N PULASKI AVE		CHICAGO	IL	
60624	1004696872	ILR000059402	ORR COMMUNITY ACADEMY HIGH	730 N PULASKI RD		CHICAGO	IL	RCRA-CESQG
60624	1008302552	110021945467	ORR COMMUNITY ACADEMY HIGH SCHOOL	730 N PULASKI RD		CHICAGO	IL	FINDS
60624	1019953477		CHICAGOLAND IDEAL CLEANERS*	733 N PULASKI RD		CHICAGO	IL	
60624	U003907978	2041659	VACANT	743-745 N PULASKI	**	CHICAGO	IL	UST
60624	S111913902		PULASKI & CHICAGO BLDG LLC	743-745 N PULASKI		CHICAGO	IL	
60624	S105815995		PULASKI & CHICAGO BUILDING LLC	743-745 NORTH PULASKI		CHICAGO	IL	LUST
60624	1020043064		MODERN CLEANERS	745 S PULASKI RD		CHICAGO	IL	
60624	S111905353		CHICAGO DEPT OF ENV	826 PULASKI ST		CHICAGO	IL	
60624	1012301154	110040148694	CHICAGO DEPT OF ENV	826 PULASKI ST		CHICAGO	IL	FINDS
60624	S105815812		CHICAGO, CITY OF DEPT. OF ENVIRONME	826 PULASKI ST.		CHICAGO	IL	LUST
60624	S113269731		HARMONS MOTOR SERVICE	921 S PULASKI RD		CHICAGO	IL	
60624	S113269770		CHICAGO, CITY OF-FORMERLY	PULASKI & 79TH ST (SPILL)	**	CHICAGO	IL	
60624	S113269708		NEWARK ELECTRONICS	500 N PULASKI-B		CHICAGO	IL	
60624	S113269764		MURRAYS 421	3310 W ROOSEVELT RD		CHICAGO	IL	
60624	U004158208		3351 W. ROOSEVELT RESIDENTIAL BUILD	3351 W. ROOSEVELT ROAD		CHICAGO	IL	UST
60624	S113269123		WALGREENS 3395	3401 W ROOSEVELT RD		CHICAGO	IL	
60624	1001213689	110005959542	WALGREENS 3395	3401 W ROOSEVELT RD		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1020052694		OBIS	3408 W ROOSEVELT		CHICAGO	IL	
60624	1008133717	110018303986	BOULEVARD MANAGEMENT	3434 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	S111910807		BOULEVARD MANAGEMENT	3434 W ROOSEVELT RD		CHICAGO	IL	
60624	U003853394	2041034	VACANT LOT	3434 W ROOSEVELT ROAD		CHICAGO	IL	UST
60624	S105226790		BOULEVARD REALITY SERVICES CORP.	3434 WEST ROOSEVELT RD.		CHICAGO	IL	LUST
60624	S113270486		VACANT LOT	3451 W ROOSEVELT RD		CHICAGO	IL	
60624	S113270485		VACANT LOT	3458 W ROOSEVELT RD		CHICAGO	IL	
60624	1009188630		LAWNDALE CLEANERS INC	3618 W ROOSEVELT RD		CHICAGO	IL	
60624	1000310189	110005861638	LAWNDALE CLEANERS	3618 W ROOSEVELT RD		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S113270466		LAWNDALE CLEANERS	3618 W ROOSEVELT RD		CHICAGO	IL	
60624	1016868627	110059654020	3625 W ROOSEVELT	3625 W ROOSEVELT		CHICAGO	IL	FINDS
60624	S111891516		SPEEDWAY-FORMERLY	3731 W ROOSEVELT RD		CHICAGO	IL	
60624	1008127624	110018242800	SPEEDWAY-FORMERLY	3731 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	1014704327	110043420919	FORMER SPEEDWAY 8321	3731 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	U000865511	2017666	M & S GAS & FOOD INC	3731 W ROOSEVELT RD		CHICAGO	IL	UST
60624	1004695989	ILR000035006	FORMER SPEEDWAY 8321	3731 W ROOSEVELT RD		CHICAGO	IL	RCRA-NonGen
60624	S104529146		SPEEDWAY SUPERAMERICA	3731 WEST ROOSEVELT		CHICAGO	IL	LUST
60624	1019939510		BIG ALS CLEANERS	3800 W ROOSEVELT		CHICAGO	IL	
60624	1000689011	110005910915	AMOCO 1543	3803 W ROOSEVELT RD		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S111887049		AMOCO 1543	3803 W ROOSEVELT RD		CHICAGO	IL	
60624	U003971820	2023008	AMOCO OIL CO. #15430	3803 WEST ROOSEVELT RD.		CHICAGO	IL	LUST, UST
60624	1021663248		PHILLIPS AUTO SALES	3814-26 W ROOSEVELT		CHICAGO	IL	
60624	U003668673	2038811	DONMEZ SELCUK	3818 W. ROOSEVELT RD.		CHICAGO	IL	UST
60624	S113270465		IVORY CLEANERS	3857 W ROOSEVELT		CHICAGO	IL	
60624	1000372153	110005845844	IVORY CLEANERS	3857 W ROOSEVELT		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	S106541014	3422-8918-01	IVORY CLEANERS	3857 WEST ROOSEVELT ROAD		CHICAGO	IL	DRYCLEANERS
60624	1004479140	110011811432	DIVINITY CHRISTIAN ACADEMY	3915 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	1021816586		WEST TOWN MOBIL	3942 W ROOSEVELT RD		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	U003971932	2042122	WEST TOWN MOBIL, INC.	3942 W. ROOSEVELT RD.		CHICAGO	IL	UST
60624	S116677471		DOLLAR GENERAL STORE 12061	4046 W ROOSEVELT RD		CHICAGO	IL	
60624	1016675787	110059729940	DOLLAR GENERAL STORE 12061	4046 W ROOSEVELT RD		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S108046263		HOWARD, A B	4125 W ROOSEVELT RD		CHICAGO	IL	
60624	U004014229	2042923	HOWARD'S ROOFING CO.	4125 W. ROOSEVELT ROAD		CHICAGO	IL	UST
60624	S107435786		HOWARD, A.B.	4125 WEST ROOSEVELT ROAD		CHICAGO	IL	LUST
60624	S113270515		LAKESIDE BANK TRUST 102783	4156 W ROOSEVELT RD		CHICAGO	IL	
60624	S109143359		LAKESIDE BANK TRUST 102783	4156 WEST ROOSEVELT ROAD		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	1020092913		SPOTLITE CLEANERS	4207-09 W ROOSEVELT		CHICAGO	IL	
60624	1008133706	110018303879	UNITED BAPTIST CHURCH	4220 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	S111898363		UNITED BAPTIST CHURCH	4220 W ROOSEVELT RD		CHICAGO	IL	
60624	U003193657	2035658	UNITED BAPTIST CHURCH	4220 W. ROOSEVELT ROAD		CHICAGO	IL	UST
60624	S104521549		UNITED BAPTIST CHURCH	4220 WEST ROOSEVELT ROAD		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60624	1005635983	110001228314	CASTLE BAKING CO	4224 W ROOSEVELT RD		CHICAGO	IL	
60624	S113270526		WINDY CITY TIRE SHOP	4315 W ROOSEVELT RD		CHICAGO	IL	
60624	1009185471		B & D SPARKLE CLEANERS	4325 W ROOSEVELT RD		CHICAGO	IL	
60624	1008150542	110018473622	IEPA OER	4350 W ROOSEVELT		CHICAGO	IL	FINDS
60624	S111886745		IEPA OER	4350 W ROOSEVELT		CHICAGO	IL	
60624	S110151088		BELLWOOD INDUSTRIAL, INC.	4351 WEST ROOSEVELT RD.		CHICAGO	IL	TIER 2
60624	S111749830		BELLWOOD INDUSTRIAL	4351-4359 W ROOSEVELT RD		CHICAGO	IL	
60624	1004479844	110001820771	RONCO GLASS & MIRROR CO INC	4358 W ROOSEVELT RD		CHICAGO	IL	AIRS, FINDS
60624	1016164665		GERIT DRUM RING/CHARTER STEEL	4401 W ROOSEVELT RD		CHICAGO	IL	
60624	1004693056	110005862691	IDEAL GERIT DRUM RING MFG INC	4401 W ROOSEVELT RD		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S113270463		IDEAL GERIT DRUM RING MFG INC	4401 W ROOSEVELT RD		CHICAGO	IL	
60624	S111925678		RAYBONS AUTOMOTIVE	4402 W ROOSEVELT RD		CHICAGO	IL	
60624	U001965181	2032941	RAYBON MINI MART	4402 W ROOSEVELT RD		CHICAGO	IL	UST
60624	1008134497	110018311833	RAYBONS AUTOMOTIVE	4402 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	S110062710		RAYBON, LEE	4402 WEST ROOSEVELT ROAD		CHICAGO	IL	LUST
60624	S113270488		SHAMROCK RECYCLING	4422 W ROOSEVELT		CHICAGO	IL	
60624	S113270500		MILLER DISPOSAL INC-FORMERLY	4430 S ROOSEVELT		CHICAGO	IL	
60624	1009456402	110024853434	MILLER DISPOSAL INC-FORMERLY	4430 S ROOSEVELT		CHICAGO	IL	FINDS
60624	1000226054	110005836435	ALLIED PALLET	4500 W ROOSEVELT RD		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1008114852	110018114583	AUTO INC	4500 W ROOSEVELT RD		CHICAGO	IL	FINDS
60624	S113269710		AUTO INC	4500 W ROOSEVELT RD		CHICAGO	IL	
60624	S113269689		HARMONS MOTOR SERVICE	4506 W ROOSEVELT		CHICAGO	IL	
60624	1020298218		PHILLIPS FRANK	4526 W ROOSEVELT		CHICAGO	IL	
60624	U003865051	2041212	GARDNER ASPHALT	4734 W ROOSEVELT RD		CHICAGO	IL	UST
60624	S105537764		C.J. BUILDING, INC.	4734 WEST ROOSEVELT RD.		CHICAGO	IL	LUST
60624	S113270460		KRISJOHN CONSTRUCTION	ROOSEVELT & KILDARE		CHICAGO	IL	
60624	1017739213	110063670647	14 -26 S PULASKI	14 -26 S PULASKI	**	CHICAGO	IL	FINDS
60624	1009647749		GEORGE WESTINGHOUSE VOCATIONAL I	S.KEELER AVE AT 126 SOUTH OF W.TAYL	**	CHICAGO	IL	DOT OPS
60624	S109528272		GEORGE WESTINGHOUSE VOCATIONAL I	401 NORTH SAWYER AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S113269740		SAMUEL FB MORSE SCHOOL	620 N SAWYER		CHICAGO	IL	
60624	1008129243	110018259061	SAMUEL FB MORSE SCHOOL	620 N SAWYER		CHICAGO	IL	FINDS
60624	1004696879	110003047444	MORSE SAMUEL SCHOOL	620 N SAWYER AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S113270505		CHICAGO, CITY OF	320 S SPAULDING		CHICAGO	IL	
60624	1010317479	ILR000146118	CHICAGO, CITY OF	320 S SPAULDING		CHICAGO	IL	RCRAInfo-SQG
60624	1005636018	110001342985	BABY VALET INC	423 N SPAULDING		CHICAGO	IL	AIRS, FINDS
60624	1000271612	110009370858	WESKO PLATING INC	423 N SPAULDING		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1008120090	110018167142	GATTO INDUSTRIAL PLATERS INC	423 N SPAULDING AVE		CHICAGO	IL	FINDS
60624	U004014242	2042952	CHICAGO PUBLIC SCHOOL	423 N. SPAULDING		CHICAGO	IL	UST
60624	S104530555		CHICAGO PUBLIC SCHOOLS	423 NORTH SPAULDING AVENUE		CHICAGO	IL	LUST
60624	S113266275		MARTIN YALE INDUSTRIES	500 N SPAULDING		CHICAGO	IL	
60624	1000412087	110005833526	MARTIN YALE INDUSTRIES	500 N SPAULDING AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60624	1011853083	110037152531	519-21 N SPAULDING	519-21 N SPAULDING		CHICAGO	IL	FINDS
60624	S111913690		CHICAGO, CITY OF ABANDONMENT	535 N SPAULDING		CHICAGO	IL	
60624	1006807542	110014459362	CHICAGO, CITY OF ABANDONMENT	535 N SPAULDING		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1010448604	110031464653	734 S SPRINGFIELD	734 S SPRINGFIELD		CHICAGO	IL	FINDS
60624	U001629915	2032550	GATEWAY RESIDENTIAL SITE	3828 W TAYLOR ST		CHICAGO	IL	UST
60624	S113270458		C&S RECYCLING INC	4009 W TAYLOR		CHICAGO	IL	
60624	1008124112	110018207563	C&S RECYCLING INC	4009 W TAYLOR		CHICAGO	IL	FINDS
60624	S113269690		K-TOWN SCRAP	4131 W TAYLOR		CHICAGO	IL	
60624	S113270490		PUBLIC STREET	4200 W TAYLOR ST		CHICAGO	IL	
60624	S113269646		VACANT LOT	4220-4246 W TAYLOR		CHICAGO	IL	
60624	S111888741		IEPA OER	4243 W TAYLOR ST		CHICAGO	IL	
60624	1008150564	110018473846	IEPA OER	4243 W TAYLOR ST		CHICAGO	IL	FINDS
60624	S113269750		VACANT LOT	4253 W TAYLOR ST		CHICAGO	IL	
60624	1004693104	110005868347	SUN CHEMICAL IN PLANT AT CRANE	555 N TRIPP AVE		CHICAGO	IL	RCRA-CESQG, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60624	1012117743	110039019996	CARAUSTAR INDUSTRIES INC	555 N TRIPP AVE		CHICAGO	IL	FINDS
60624	1011916339	110037357099	CARAUSTAR CHICAGO CARTON	555 N TRIPP AVE		CHICAGO	IL	ICIS, FINDS
60624	S110151566		CHICAGO CARTON	555 NORTH TRIPP AVE		CHICAGO	IL	TIER 2
60624	1008134396	110018310825	SUN CHEMICAL-INPLANT AT CRANE	555 TRIPP ST-B		CHICAGO	IL	FINDS
60624	S113269687		SUN CHEMICAL-INPLANT AT CRANE	555 TRIPP ST-B		CHICAGO	IL	
60624	S117527434		VACANT LOT	777 S TRIPP AVE		CHICAGO	IL	
60624	S111903578		WHITEWAY SIGN CO	401 N TRUMBULL		CHICAGO	IL	
60624	U000866030	2020195	ARROW SIGN CO./ A DIVISION OF WHITE	401 N TRUMBULL AVE		CHICAGO	IL	UST
60624	S107740191	11248	RML SPECIALTY HOSPITAL, CHICAGO	3435 W VAN BUREN		CHICAGO	IL	AIRS, TIER 2
60624	1000239570	110001293190	RML SPECIALTY HOSPITAL	3435 W VAN BUREN		CHICAGO	IL	RCRA-CESQG, FINDS
60624	S110360198		BETHANY HOSPITAL	3435 W VAN BUREN		CHICAGO	IL	TIER 2
60624	U003152168	2035489	RML SPECIALITY HOSPITAL	3435 W VAN BUREN STREET		CHICAGO	IL	UST
60624	1017801994	110063972367	3301 -07 W MADISON	3301 -07 W MADISON		CHICAGO	IL	FINDS
60624	1017802061	110063973204	3315 -19 W MADISON	3315 -19 W MADISON		CHICAGO	IL	FINDS
60624	1017802396	110063976924	3321 -25 W MADISON	3321 -25 W MADISON		CHICAGO	IL	FINDS
60624	1017802394	110063976906	3331 -37 W MADISON	3331 -37 W MADISON		CHICAGO	IL	FINDS
60624	1017802395	110063976915	3341 -47 W MADISON	3341 -47 W MADISON		CHICAGO	IL	FINDS
60624	1016441060	110055962365	4001 -03 W MONROE	4001 -03 W MONROE		CHICAGO	IL	FINDS
60624	S113269120		CHICAGO, CITY OF FIRE DEPT	4005 W W END		CHICAGO	IL	
60624	1008127473	110018241286	CHICAGO, CITY OF FIRE DEPT	4005 W W END		CHICAGO	IL	FINDS
60624	1016881331	110059868629	4347 -49 W VAN BUREN	4347 -49 W VAN BUREN		CHICAGO	IL	FINDS
60624	1015928345	110046090289	3201 W WALNUT	3201 W WALNUT		CHICAGO	IL	FINDS
60624	U001473641	2032366	VACANT	1701-05 W WARREN		CHICAGO	IL	UST
60624	S113270502		VACANT LOT	3301 W WASHINGTON		CHICAGO	IL	
60624	1001206591		BETHANY BRETHERN-GARFIELD PARK C	3821 WEST WASHINGTON BLVD.		CHICAGO	IL	MLTS
60624	1005636006	110001228136	CHA-PARKVIEW APARTMENTS	3916 W WASHINGTON		CHICAGO	IL	FINDS
60624	S118420092		PARKVIEW/FANNIE-EMMANUEL APARTME	3916 WEST WASHINGTON BOULEVARD		CHICAGO	IL	SRP
60624	1020732857		GAS PLUS INC	3940 W WASHINGTON BLV		CHICAGO	IL	
60624	1000614495	110005903576	GAS PLUS CAR WASH	3940 W WASHINGTON BLVD		CHICAGO	IL	RCRAInfo-SQG, FINDS, UST
60624	S110613511		GAS PLUS CORP	3940 W WASHINGTON BLVD		CHICAGO	IL	
60624	S110613434		GAS PLUS CAR WASH	3940 WEST WASHINGTON BOULEVARD		CHICAGO	IL	LUST TRUST, LUST
60624	1021086461		RUB-A-DUB CAR BATH INC	3950 W WASHINGTON		CHICAGO	IL	
60624	S113269142		VACANT LOT	4015 W WASHINGTON		CHICAGO	IL	
60624	1021428230		CHAPPELL EZ GO #33 LTD	4049 W WASHINGTON		CHICAGO	IL	
60624	S104872097		BULK PETROLEUM	4049 W WASHINGTON BLVD	60, SSE, 1/2 - 1	CHICAGO	IL	SHWS, LUST
60624	U000173423	2017202	PHILLIPS 66	4049 W WASHINGTON ST.		CHICAGO	IL	UST
60624	1014706085	110040713868	BULK PETROLEUM - OFF THE STREET CL	4049 WEST WASHINGTON BLVD		CHICAGO	IL	FINDS
60624	S110335766		BULK PETROLEUM	4049-4059 WEST WASHINGTON BOULEVA		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	S118887495		LEGAL PREP CHARTER ACADEMY	4319 W WASHINGTON		CHICAGO	IL	
60624	1019323297	ILR000192906	LEGAL PREP CHARTER ACADEMY	4319 W WASHINGTON BLVD		CHICAGO	IL	RCRA-CESQG
60624	1004479142	110011860664	ST MEL SCH	4319 W WASHINGTON BLVD		CHICAGO	IL	FINDS
60624	1018394939	110069513789	LEGAL PREP CHARTER ACADEMY	4319 W WASHINGTON BLVD		CHICAGO	IL	FINDS
60624	U003907931	2041572	ACT CHARTER	4319 W WASHINGTON ST		CHICAGO	IL	UST
60624	1008134483	110018311691	BETHEL PACE CTR	4353 W WASHINGTON		CHICAGO	IL	FINDS
60624	U003668119	2036980	BETHEL NEW LIFE	4353 W WASHINGTON		CHICAGO	IL	UST
60624	S111886202		BETHEL PACE CTR	4353 W WASHINGTON		CHICAGO	IL	
60624	S104524295		BETHEL PACE CTR.	4353 WEST WASHINGTON		CHICAGO	IL	LUST
60624	S105051733		LAYMON MEDICAR, INC.	4659-4661 WEST WASHINGTON STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60624	1017794027	110063749092	CHICAGO, CITY OF 2FM- W END AVE	4001 W WEST END AVE		CHICAGO	IL	FINDS
60624	S117496875		CHICAGO, CITY OF 2FM- W END AVE	4001 W WEST END AVE		CHICAGO	IL	
60624	1001195959	110005954431	CHICAGO FIRE DEPT	4005 W WEST END		CHICAGO	IL	RCRA-NonGen, FINDS
60624	S105225770		CHICAGO, CITY OF	4005 WEST WEST END		CHICAGO	IL	LUST
60624	U003668118	2036979	BETHEL NEWLIFE CORP	4300 W WEST END		CHICAGO	IL	UST
60624	U003971823	2023064	BP GAS STATION	101 N. WESTERN AVE.		CHICAGO	IL	LUST, UST
60624	1000166368	110064142725	CHICAGO ROLLER SKATE CO	4450 WESTLAKE ST	**	CHICAGO	IL	RCRA-NonGen, FINDS
60624	S113269112		EDWARD C DELANO SCHOOL	3937 W WILCOX		CHICAGO	IL	
60624	1001123575	110005951835	DELANO	3937 W WILCOX		CHICAGO	IL	RCRAInfo-SQG, FINDS
60624	1014886643	110043821335	4003 W WILCOX	4003 W WILCOX		CHICAGO	IL	FINDS
60624	S113269105		HELEN M HEFFERAN SCHOOL	4409 W WILCOX		CHICAGO	IL	
60624	1000986863	IL0001015882	HEFFERAN HELEN M SCHOOL	4409 W WILCOX		CHICAGO	IL	RCRA-CESQG
60624	1008307886	110036602067	HEFFERAN ELEM SCHOOL	4409 W WILCOX ST		CHICAGO	IL	FINDS
60624	1021407836		RAYBONS STANDARD SERVICE	4402 WROOSEVELT	**	CHICAGO	IL	
60644	1014940715				**	CHICAGO	IL	DOT OPS
60644	1014938770				**		IL	DOT OPS
60644	1014940754				**	CHICAGO	IL	DOT OPS
60644	1014940753				**	CHICAGO	IL	DOT OPS
60644	1014940757				**	CHICAGO	IL	DOT OPS
60644	U000865378	2016877	JACQUES MARILYN VACONT PROPERTY	3732 W 111TH ST		CHICAGO	IL	UST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	S113318918		WAVETECH POWERSPORTS	833 W 143RD ST UNIT 2		PLAINFIELD	IL	
60644	1000378124	110009370536	OUR HOUR MARTINZING	6825 W 159TH ST		TINLEY PARK	IL	AIRS, RCRA-NonGen, FINDS
60644	U001142547	2012553	HARRINGTON & KING PERF CO INC	5655 & 5658 W FILLMORE ST		CHICAGO	IL	UST
60644	S107740188	3743	BEST DRUM CO	4640 W 5TH AVE		CHICAGO	IL	AIRS
60644	1000391839	110001343136	BEST DRUM COMPANY	4640 W 5TH AVENUE		CHICAGO	IL	RCRA-NonGen, FINDS
60644	1008139443	110018361565	USEPA DAYTON TIRE & RUBBER	4650 W 5TH AVE		CHICAGO	IL	FINDS
60644	S113265954		USEPA DAYTON TIRE & RUBBER	4650 W 5TH AVE		CHICAGO	IL	
60644	S113269568		HARRISON SHEET STEEL SITE	4718 W 5TH AVE		CHICAGO	IL	
60644	1000986806	ILR000003376	HARRISON SHEET STEEL SITE	4718 W 5TH AVE		CHICAGO	IL	RCRA-NonGen
60644	1000984200	IL0001048834	HARRISON SHEET STEEL CO.	4718 W 5TH AVENUE		CHICAGO	IL	CERCLIS
60644	1016186283	110002455619	HARRISON SHEET STEEL SITE	4718 WEST 5TH AVENUE		CHICAGO	IL	FINDS
60644	S113269510		SM & F	4749 W 5TH AVE		CHICAGO	IL	
60644	1008123894	110018205379	EAGLE CONSTRUCTION	79TH & CICERO		CHICAGO	IL	FINDS
60644	S108649951		A & R MANAGEMENT	79TH & CICERO		CHICAGO	IL	LUST
60644	S113269527		EAGLE CONSTRUCTION	79TH & CICERO	**	CHICAGO	IL	
60644	1016782043	110058224746	MOORE PARK	5085 W ADAMS		CHICAGO	IL	FINDS
60644	U004224669		MOORE PARK	5085 W. ADAMS STREET		CHICAGO	IL	UST
60644	1008124010	110018206546	IEPA	4600 W ARLINGTON		CHICAGO	IL	FINDS
60644	S113269537		IEPA	4600 W ARLINGTON	**	CHICAGO	IL	
60644	1004475156	110011822769	SGM PEST CONTROL CO	5811 SOUTH ARTESIAN		CHICAGO	IL	FINDS
60644	1004479952	110001824189	E & R PROTECTIVE COATINGS CO.	4741 W. ARTHINGTON ST.		CHICAGO	IL	FINDS
60644	1008134299	110018309837	DUROCHER ENTERPRISES	4825 ARTHINGTON		CHICAGO	IL	FINDS, LUST
60644	U001142408	2027911	DUROCHER ENT INC	4825 W ARTHINGTON		CHICAGO	IL	UST
60644	1000334605	110005814324	MIDWEST METAL FINISHING CO INC	4949 W ARTHINGTON		CHICAGO	IL	RCRA-NonGen, FINDS
60644	S113266041		MIDWEST METAL FINISHING CO INC	4949 W ARTHINGTON ST		CHICAGO	IL	
60644	S118661274		BEME INTERNATIONAL	4949 W ARTHINGTON-B		CHICAGO	IL	
60644	1017802009	110063972553	BEME INTERNATIONAL	4949 W ARTHINGTON-B		CHICAGO	IL	FINDS
60644	1016227407	110007554306	CHICAGO TRANSIT AUTHORITY CTA	ASHLAND/LAKE ST STA	**	CHICAGO	IL	FINDS
60644	1001086674	ILR000013912	CHICAGO TRANSIT AUTHORITY CTA	ASHLAND/LAKE ST STA		CHICAGO	IL	RCRAInfo-SQG
60644	1008134314	110018309980	KOSHIYAMA COMPANY	11 S AUSTIN		CHICAGO	IL	FINDS
60644	S113269557		KOSHIYAMA COMPANY	11 S AUSTIN		CHICAGO	IL	
60644	U004226074		APARTMENT BUILDING	1131 S. AUSTIN BLVD.		CHICAGO	IL	UST
60644	1017786449	ILR000188177	CHICAGO, CITY OF	200 BLK N LAVERGNE AVE	**	CHICAGO	IL	RCRA-CESQG
60644	1017802095	110063973614	CHICAGO, CITY OF	200 BLK OF LAVERGNE AVE	**	CHICAGO	IL	FINDS
60644	1018098238		CHICAGO, CITY OF	200 BLK OF LAVERGNE AVE	**	CHICAGO	IL	
60644	S118661275		CHICAGO, CITY OF	200 BLK OF LAVERGNE AVE	**	CHICAGO	IL	
60644	1017807590	110064218387	EDWARD DUKE ELLINGTON SCHOOL	224 N CENTER AVE	**	CHICAGO	IL	FINDS
60644	S113269583		EDWARD DUKE ELLINGTON SCHOOL	224 N CENTER AVE	**	CHICAGO	IL	
60644	U003667868	2036695	CENTRAL AVE PUMPING STATION	1015 S CENTRAL PARK		CHICAGO	IL	UST
60644	1010015118	110028286888	ROCKNE STADIUM	1117 S CENTRAL		CHICAGO	IL	FINDS
60644	1011264061	110034192512	CIRCLE ROCK PREP SCHOOL	118 N CENTRAL		CHICAGO	IL	FINDS
60644	S120932719		CIRCLE URBAN MINISTRIES	118 N CENTRAL		CHICAGO	IL	
60644	U004257482		CIRCLE URBAN MINISTRIES	118 N. CENTRAL AVE.		CHICAGO	IL	UST
60644	S119030183		CIRCLE URBAN MINISTRIES	118 NORTH CENTRAL AVENUE		CHICAGO	IL	LUST
60644	1001123590	110005951951	ELLINGTON SCHOOL PROPERTY	224 N CENTRAL AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS, UST SRP
60644	S106121947		EDWARD DUKE ELLINGTON SCHOOL	224 NORTH CENTRAL AVENUE		CHICAGO	IL	
60644	1021648626		ROSE AVE FOODS	304 N CENTRAL AVE		CHICAGO	IL	
60644	S113269669		CENTRAL APARTMENTS	3334-3376 N CENTRAL		CHICAGO	IL	
60644	1008123899	110018205422	CHICAGO PARK DIST	500 S CENTRAL AVE		CHICAGO	IL	FINDS
60644	S113269529		CHICAGO PARK DIST	500 S CENTRAL AVE		CHICAGO	IL	
60644	1003870318	ILD980998397	CHICAGO PARK DIST COLUMBUS PARK	500 SO CENTRAL AVE		CHICAGO	IL	CERCLIS-NFRAP
60644	U003152272		YMCA AUSTIN FAC	501 N CENTRAL AVE		CHICAGO	IL	UST
60644	S111876073		EQUIVA SERVICES LLC	527 S CENTRAL		CHICAGO	IL	
60644	1008134269	110018309542	EQUIVA SERVICES LLC	527 S CENTRAL		CHICAGO	IL	FINDS
60644	1021086180		ALS SHELL SERVICE	527 S CENTRAL AVE		CHICAGO	IL	
60644	U000792165	2021040	SHELL SER STATION	527 S CENTRAL HARRISON		CHICAGO	IL	UST
60644	S104527117		SHELL OIL CO.	527 SOUTH CENTRAL		CHICAGO	IL	LUST
60644	1004479179	110011459527	PLATO SCHOOL	601 S CENTRAL AVE		CHICAGO	IL	FINDS
60644	U003668305	2037443	LORETTO HOSPITAL	645 S CENTRAL		CHICAGO	IL	UST
60644	1004476390	110001288516	LORETTO HOSPITAL	645 S CENTRAL		CHICAGO	IL	RCRA-CESQG, FINDS
60644	S107743707	3425	LORETTO HOSPITAL	645 S CENTRAL AVE		CHICAGO	IL	AIRS
60644	1000608010		LORETTO HOSPITAL	645 SOUTH CENTRAL AVE.		CHICAGO	IL	LUST
60644	1006020600		LORETTO HOSPITAL	645 SOUTH CENTRAL AVENUE		CHICAGO	IL	MLTS
60644	1016082461	110000435636	ANDERSON-SHUMAKER CO	824 S. CENTRAL AVE.		CHICAGO	IL	FINDS
60644	S113269503		ADOLPH PLATING INDUSTRY	832 S CENTRAL AVE		CHICAGO	IL	
60644	1000118491	110005814253	A P I INDUSTRIES	832 S CENTRAL AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60644	1008120674	110018173019	ADOLPH PLATING INDUSTRY	832 S CENTRAL AVE		CHICAGO	IL	FINDS
60644	1010681350	110033154609	COMED-MANHOLE	CENTRAL & CHICAGO AVE		CHICAGO	IL	FINDS
60644	S113269673		COMED-MANHOLE	CENTRAL & CHICAGO AVE		CHICAGO	IL	
60644	S113269632		ALDI FOOD INC	CENTRAL & FILLMORE SW COR	**	CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	1016227408	110007554315	CHICAGO TRANSIT AUTHORITY	CENTRAL & LAKE ST STA	**	CHICAGO	IL	FINDS
60644	1001086675	ILR000013920	CHICAGO TRANSIT AUTHORITY CTA	CENTRAL & LAKE ST STA		CHICAGO	IL	RCRA-NonGen
60644	S113269574		CHICAGO TRANSIT AUTHORITY	CENTRAL & LAKE ST STATION	**	CHICAGO	IL	
60644	S113269652		SBC	CENTRAL & WASHINGTON AVES	**	CHICAGO	IL	
60644	1018654689		NORGE VILLAGE CLEANING	409 N CENTRL AVE		CHICAGO	IL	
60644	S113269650		VACANT LOT	4802 W CHICAGO AVE		CHICAGO	IL	
60644	1014702482	110043642984	PROGRESSIVEWAY MISSIONS CHURCH	5017 W CHICAGO AVE		CHICAGO	IL	FINDS
60644	1009075332		SMILEY DON & CO INC	5435 W CHICAGO AVE		CHICAGO	IL	
60644	S113269564		SUPERIOR AUTOMOTIVE REPAIR CTR	5449-53 W CHICAGO AVE		CHICAGO	IL	
60644	1008124337	110018209847	SUPERIOR AUTOMOTIVE REPAIR CTR	5449-53 W CHICAGO AVE		CHICAGO	IL	FINDS
60644	1020220462		T & G INC	818 S CICERO AVE	**	CHICAGO	IL	
60644	S116159235		VACANT LOT	1027-1031 S CICERO AVE		CHICAGO	IL	
60644	1107806007	110064099657	VACANT LOT	1027-1031 S CICERO AVE		CHICAGO	IL	FINDS
60644	U001965112	2033220	CSX TRANSPORTATION	1111 S CICERO AVE		CHICAGO	IL	UST
60644	U004226079		COMMERCIAL BUILDING	114-124 S. CICERO AVENUE	**	CHICAGO	IL	UST
60644	1005636020	110001343127	CICERO JOINT VENTURE	1142 S. CICERO AVENUE		CHICAGO	IL	FINDS
60644	1008147481	110018442979	SPEEDWAY-FORMERLY	119 S CICERO		CHICAGO	IL	FINDS
60644	S111905333		SPEEDWAY-FORMERLY	119 S CICERO		CHICAGO	IL	
60644	1014704325	110043420893	FORMER SPEEDWAY 8314	119 S CICERO AVE		CHICAGO	IL	FINDS
60644	U000865510	2017661	BP	119 S CICERO AVE		CHICAGO	IL	UST
60644	1004695984	ILR000034959	FORMER SPEEDWAY 8314	119 S CICERO AVE		CHICAGO	IL	RCRA-NonGen
60644	S104529937		SPEEDWAY SUPERAMERICA	119 SOUTH CICERO		CHICAGO	IL	LUST
60644	S117534054		GURVIS, STEVE	120 S CICERO AVE		CHICAGO	IL	
60644	1017412604	110063269476	GURVIS, STEVE	120 S CICERO AVE		CHICAGO	IL	FINDS
60644	S117449766		GURVIS, STEVE	120 SOUTH CICERO AVENUE		CHICAGO	IL	LUST
60644	S113269507		CICERO CLEANERS	158 N CICERO		CHICAGO	IL	
60644	1008134401	110018310870	IEPA	16 S CICERO AVE		CHICAGO	IL	FINDS
60644	S113269692		IEPA	16 S CICERO AVE		CHICAGO	IL	
60644	1009188584		MR LEE FABRIC GUARD CLEANERS	206 S CICERO AVE		CHICAGO	IL	
60644	S111875313		ARCO PETROLEUM PRODUCTS CO	252 S CICERO		CHICAGO	IL	
60644	1008123889	110018205324	ARCO PETROLEUM PRODUCTS CO	252 S CICERO		CHICAGO	IL	FINDS
60644	S104527309		ARCO PETROLEUM PROD.	252 SOUTH CICERO AVE.		CHICAGO	IL	LUST
60644	1009072487		JACKSON CITGO	300 S CICERO AVE		CHICAGO	IL	
60644	U000174419	2021045	CITGO WAY	300 S. CICERO AVENUE		CHICAGO	IL	UST
60644	1020817009		VOLK CHARLES SERVICE STATION	301 N CICERO		CHICAGO	IL	
60644	S113269609		VACANT LOT	315 S CICERO		CHICAGO	IL	
60644	1021032912		CICERO & GLADYS	325 S CICERO		CHICAGO	IL	
60644	1016406310	110055411246	WILSON PLATING CO	375 N CICERO AVE		CHICAGO	IL	FINDS
60644	1004478851	110011838477	ATTENTION CTR ALTERNATIVE SCHOOL	4 N CICERO AVE		CHICAGO	IL	FINDS
60644	1023451681	110068287277	BRACH'S CONFECTIONS INC	401 CICERO AVE N		CHICAGO	IL	FINDS
60644	S117496955		AMERICAN DEMOLITION CORP	401 N CICERO AVE		CHICAGO	IL	AIRES
60644	1000169388	110059727489	BRACH & BROCK CONFECTIONS INC	401 N CICERO AVE		CHICAGO	IL	AIRES, RCRA-NonGen, FINDS
60644	S109685145		BRACH & BROCK CONFECTIONS, INC.	401 NORTH CICERO AVENUE		CHICAGO	IL	SRP
60644	1015860454	110045524143	406 N CICERO	406 N CICERO		CHICAGO	IL	FINDS
60644	1009185585		58 MINUTE CLEANER	409 S CICERO AVE		CHICAGO	IL	
60644	1005905055	110012574758	CHICAGO, CITY OF ABANDONMENT	556 N CICERO AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60644	S111911946		CHICAGO, CITY OF ABANDONMENT	556 N CICERO AVE		CHICAGO	IL	
60644	S113269672		CMC AUTO GROUP	609 N CICERO AVE		CHICAGO	IL	
60644	1007448557	ILR000129080	CHICAGO, CITY OF ABANDONMENT	610 N CICERO		CHICAGO	IL	RCRAInfo-SQG
60644	1007692542	110018387422	CHICAGO, CITY OF ABANDONMENT	610 N CICERO AVE		CHICAGO	IL	FINDS
60644	S108046538		CHICAGO, CITY OF ABANDONMENT	610 N CICERO AVE		CHICAGO	IL	
60644	S113269658		TIANGUIS AUTO SALES INC	610 S CICERO AVE		CHICAGO	IL	
60644	S118661276		XCLUSIVE AUTOMOTIVE LLC	625 N CICERO		CHICAGO	IL	
60644	1017786485	110064384296	XCLUSIVE AUTOMOTIVE LLC	625 N CICERO		CHICAGO	IL	RCRA-NonGen, FINDS
60644	U004051831	2043169	FORMER AUTO REPAIR SHOP	632 N. CICERO AVENUE		CHICAGO	IL	UST
60644	S111918726		DAOUD, AHMED	632-634 N CICERO	**	CHICAGO	IL	
60644	S107739327		DAOUD, AHMED	632-634 NORTH CICERO		CHICAGO	IL	LUST
60644	S113269670		HOREB AUTO BODY	700 N CICERO AVE		CHICAGO	IL	
60644	S113269677		PRO WHEELS	717 N CICERO		CHICAGO	IL	
60644	1019931728		ARTISTIC CLEANER	739 CICERO	**	CHICAGO	IL	
60644	S113269546		PRESSTEC INDUSTRIES INC	739 S CICERO		CHICAGO	IL	
60644	1000612148	110005889565	PRESSTEC INDUSTRIES INC	739 S CICERO		CHICAGO	IL	RCRA-NonGen, FINDS
60644	1019931729		ARTISTIC CLEANER	739 S CICERO AVE		CHICAGO	IL	
60644	S111906882		EBONY AFFAIR BEAUTY SUPPLY	740 N CICERO		CHICAGO	IL	
60644	U003762826	2039994	EBONY AFFAIR	740 N CICERO AVE		CHICAGO	IL	UST
60644	S104530579		EBONY AFFAIR	740 NORTH CICERO AVE.		CHICAGO	IL	LUST
60644	1021681133		C & S SERVICE STATION	743 N CICERO AVE		CHICAGO	IL	
60644	S111920459		AMZ ENTERPRISES	749 S CICERO		CHICAGO	IL	
60644	U004068189	2043462	AMZ CITGO	749 SOUTH CICERO		CHICAGO	IL	LUST, UST
60644	S113269533		MAGIKIST MONARCH	750 S CICERO		CHICAGO	IL	
60644	1000253016	110005822351	MAGIKIST MONARCH	750 S CICERO		CHICAGO	IL	RCRAInfo-SQG, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	1015831151	110046381526	VACANT LOT	751 N CICERO		CHICAGO	IL	FINDS
60644	S113708626		VACANT LOT	751 N CICERO		CHICAGO	IL	
60644	S113269545		SCOTTSDALE SHOPPING CTR	7901 S CICERO AVE		CHICAGO	IL	
60644	S110613605		GAS PLUS	818 S CICERO AVE		CHICAGO	IL	
60644	S110613450		GAS PLUS	818 SOUTH CICERO AVENUE		CHICAGO	IL	LUST
60644	1020675452		MILLERS CAR WASH INC	818-20 S CICERO		CHICAGO	IL	
60644	S111748449		SKW INDUSTRIES LLC	900 S CICERO AVE		CHICAGO	IL	AIRS
60644	1014702446		SKW INDUSTRIES LLC	900 S CICERO AVE		CHICAGO	IL	
60644	1018156020	110066954424	PROGRESSIVE COATING	900 S CICERO AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60644	1016357370	110043175792	SKW INDUSTRIES LLC	900 SOUTH CICERO AVENUE		CHICAGO	IL	FINDS
60644	1018290211		RELIABLE ANODIZING CORP	927 S CICERO		CHICAGO	IL	ICIS
60644	S110859686		RELIABLE PLATING & ANODIZING	927 S CICERO AVE		CHICAGO	IL	
60644	S110155653		RELIABLE PLATING & ANODIZING	927 SOUTH CICERO AVENUE		CHICAGO	IL	TIER 2
60644	S113269675		BLACK DIAMOND PIPE & TUBE	CICERO & LAKE		CHICAGO	IL	
60644	1001087314	ILR000020461	CHICAGO TRANSIT AUTHORITY	CICERO & LAKE STS STA		CHICAGO	IL	RCRAInfo-SQG
60644	1016227455	110007555038	CHICAGO TRANSIT AUTHORITY	CICERO & LAKE STS STA	**	CHICAGO	IL	FINDS
60644	1009410166	110024925090	COMED	CICERO AVE & HARRISON ST		CHICAGO	IL	FINDS
60644	S113269664		COMED	CICERO AVE & HARRISON ST	**	CHICAGO	IL	
60644	1009398703	ILR000141424	COMED	CICERO AVE & HARRISON ST		CHICAGO	IL	RCRA-NonGen
60644	S113269620		PUBLIC STREET	4600 W CONGRESS PKWY		CHICAGO	IL	
60644	1004696822	ILR000058842	LELAND GEORGE ELEMENTARY	5221 W CONGRESS PKWY		CHICAGO	IL	RCRA-CESQG
60644	1011305838	110036581678	LELAND ELEM SCHOOL	5221 W CONGRESS PY		CHICAGO	IL	FINDS
60644	S113269585		GEORGE LELAND SCHOOL	5221 W CONGRESS PY		CHICAGO	IL	
60644	1001123489	110005951194	ARMSTRONG	5345 W CONGRESS PKWY		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269590		ARMSTRONG SCHOOL	5345 W CONGRESS PKWY		CHICAGO	IL	
60644	1010361675	110031016424	ARMSTRONG SCHOOL	5557 W CONGRESS PKWY		CHICAGO	IL	FINDS
60644	1017739302	110063671539	BANK	5645 W CORCORAN PL		CHICAGO	IL	FINDS
60644	S113269538		ROLLING CLEAN CAR WASH	5817 W CORCORAN		CHICAGO	IL	
60644	1000325143	110005864476	ROLLING CLEAN CAR WASH	5817 W CORCORAN		CHICAGO	IL	RCRA-NonGen, FINDS
60644	U003769793	2040459	VACANT LOT	SOUTHWEST CORNER OF CENTRAL & FIL	**	CHICAGO	IL	UST
60644	S111890459		PROSPERITY TRUCKING CO	4600 W ERIE		CHICAGO	IL	
60644	U001965179	2033178	PROSPERITY TRUCKING	4600 W ERIE		CHICAGO	IL	UST
60644	1008123917	110018205609	PROSPERITY TRUCKING CO	4600 W ERIE		CHICAGO	IL	FINDS
60644	S104523277		PROSPERITY TRUCKING	4600 WEST ERIE	37, West, 1/4 - 1/2	CHICAGO	IL	LUST
60644	S113269575		TABITHA COMMUNITY SVCS	4654 W ERIE		CHICAGO	IL	
60644	1001086831	110005940241	TABITHA COMMUNITY SERVICES	4654 W ERIE		CHICAGO	IL	RCRA-NonGen, FINDS
60644	U003042171	2034666	TABITHA COMMUNITY SERVICES	4654 W ERIE		CHICAGO	IL	UST
60644	1001076620	110005936112	NASH SCHOOL	4837 W ERIE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269569		HENRY H NASH SCHOOL	4837 W ERIE ST		CHICAGO	IL	
60644	1017386664	110062848646	4901 W FERDINAND	4901 W FERDINAND		CHICAGO	IL	FINDS
60644	S113269607		VACANT LOT	5610 W FILLMORE		CHICAGO	IL	
60644	1000362181	110005814155	HARRINGTON KING PERFORATING	5655 W FILLMORE AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113266112		HARRINGTON & KING PERFORATING	5655 W FILLMORE AVE		CHICAGO	IL	
60644	S117514215		LASARTHE PARTNERS LLC	5758 W FILLMORE ST		CHICAGO	IL	
60644	1023676284	ILR000194688	LASARTHE PARTNERS LLC	5758 W FILLMORE ST		CHICAGO	IL	RCRAInfo-SQG
60644	1023709761		LASARTHE PARTNERS LLC	5758 W FILLMORE ST		CHICAGO	IL	
60644	S113269668		CHICAGO, CITY OF ABANDONMENT	4600 W FLOURNOY ST		CHICAGO	IL	
60644	1010354737	110031015158	CHICAGO, CITY OF ABANDONMENT	4600 W FLOURNOY ST		CHICAGO	IL	FINDS
60644	1010563458	ILR000148692	CHICAGO, CITY OF ABANDONMENT	4600 W FLOURNOY ST		CHICAGO	IL	RCRAInfo-SQG
60644	S113269641		JU JO REALTY INC	4842-4922 W FLOURNOY ST		CHICAGO	IL	
60644	S105736080		JUJO REALTY, INC.	4842-4922 WEST FLOURNOY STREET		CHICAGO	IL	SRP
60644	U000791560	2030856	HOLLANDER HOME FASHIONS CORP	4900 W FLOURNOY ST		CHICAGO	IL	UST
60644	1000281783	110005859348	WILLETT NATIONALEASE CO	5000 W FLOURNOY ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S109366409		WILLETT NATIONALEASE CO	5000 W FLOURNOY ST		CHICAGO	IL	
60644	U004128137		WILLET NATIONALEASE	5000 WEST FLOURNOY		CHICAGO	IL	LUST, UST
60644	U000173674	2012028	IDOT EISENHOWER MAINT YARD	5201 W FLOURNOY		CHICAGO	IL	UST
60644	S111884217		IDOT EISENHOWER HEADQUARTERS	5201 W FLOURNOY		CHICAGO	IL	
60644	1008137351	110018340507	IDOT EISENHOWER HEADQUARTERS	5201 W FLOURNOY		CHICAGO	IL	FINDS
60644	S104524894		ILLINOIS DEPT. OF TRANSPORTATION	5201 WEST FLOURNOY		CHICAGO	IL	LUST
60644	U001143011	2009214	ROADWAY SIGNAL/LIGHTING MAINT	5320 W FLOURNOY		CHICAGO	IL	UST
60644	1009796848	110027229176	IL BELL TELEPHONE CO DBA AT&T ILLINC	5055 W FULTON		CHICAGO	IL	FINDS
60644	U001142597	2007792	IL BELL TELEPHONE CO	5055 W FULTON		CHICAGO	IL	UST
60644	1000104565	ILD980684542	IL BELL TEL DBA AT&T	5055 W FULTON ST		CHICAGO	IL	RCRA-NonGen
60644	S104526540		ILLINOIS BELL TELEPHONE	5055 WEST FULTON		CHICAGO	IL	LUST
60644	1009186531		SUNSHINE CLEANERS	5156 W FULTON		CHICAGO	IL	
60644	S116677457		CEDRIC WHEELER TIRE TRANSPORTE	5930 W FULTON		CHICAGO	IL	
60644	1016793281	110058396775	CEDRIC WHEELER TIRE TRANSPORTE	5930 W FULTON		CHICAGO	IL	FINDS
60644	S113266175		AMERICAN POUCH FOODS	4603 W GLADYS		CHICAGO	IL	
60644	1000444310	ILD984807669	AMERICAN POUCH	4603 W. GLADYS		CHICAGO	IL	CERCLIS
60644	1016279609	110009336101	AMERICAN POUCH FOODS	4603 W. GLADYS		CHICAGO	IL	FINDS
60644	S110825001		HOUSING OPPORTUNITY MEANS III	4623 W GLADYS		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	U004179099		CONSTRUCTION SITE	4623 W. GLADYS AVENUE		CHICAGO	IL	UST
60644	S110828580		HOUSING OPPORTUNITIES MEAN EMPOV	4623 WEST GLADYS AVENUE		CHICAGO	IL	Inst Control, SRP, LUST
60644	1021205674		REEDS SHELL STATION	5240 W GLADYS AVE		CHICAGO	IL	
60644	1021764590		GRAND GAS MART INC	GRAND WEST MOTEL	**	CHICAGO	IL	
60644	1020219373		GRAND GAS MART INC	WEST GRAND	**	CHICAGO	IL	
60644	S110156818		MIDWEST LTD PARTNERSHIP	6 N HAMLIN		CHICAGO	IL	TIER 2
60644	1008123919	110018205627	MIDWEST LTD PARTNERSHIP	6 N HAMLIN		CHICAGO	IL	FINDS
60644	U001965098	2033174	BLACKSTONE MANUFACTURING	4630 W HARRISON		CHICAGO	IL	UST
60644	S113269504		BLACKSTONE MFG CO INC	4630 W HARRISON ST		CHICAGO	IL	
60644	1000128679	ILD039641998	BMC PRODUCTS INC	4630 W HARRISON ST		CHICAGO	IL	RCRA-NonGen
60644	1000173634	ILD005119458	BLACKSTONE MFG CO INC	4630 W HARRISON ST		CHICAGO	IL	RCRAInfo-SQG
60644	1016056020	110002125913	BLACKSTONE MANUFACTURING CO INC	4630 W. HARRISON ST.		CHICAGO	IL	FINDS
60644	1017402897	110063027807	QUICK WAY TIRE SERVICE	4657 W HARRISON ST		CHICAGO	IL	FINDS
60644	S117503547		QUICK WAY TIRE SERVICE	4657 W HARRISON ST		CHICAGO	IL	
60644	1020277603		DENNIS & ESSIE AUTO GARAG	4700 W HARRISON ST		CHICAGO	IL	
60644	1014887026	110043966474	MAACO COLLISION CENTER	4722 W HARRISON ST		CHICAGO	IL	FINDS
60644	U004196125		HARRISON STREET, INC.	4751 W. HARRISON		CHICAGO	IL	UST
60644	1008122157	110018187950	FLOOD BROTHERS DISPOSAL	4827 W HARRISON		CHICAGO	IL	FINDS
60644	U000865182	2001455	FLOOD BROTHERS DISPOSAL	4827 W HARRISON		CHICAGO	IL	UST
60644	S113265892		NORTHWEST DISPOSAL	4827 W HARRISON ST		CHICAGO	IL	
60644	U003888404	2041457	TAMELING DISPOSAL	4835 W HARRISON		CHICAGO	IL	UST
60644	S113269643		GROENBOOM, ROGER	4835 W HARRISON		CHICAGO	IL	
60644	1008122406	110018190447	FLOOD BROTHERS	4921 W HARRISON		CHICAGO	IL	FINDS
60644	S109699969		FLOOD BROTHERS	4921 W HARRISON		CHICAGO	IL	
60644	U003853380	2041018	FLOOD BROTHERS DISPOSAL RECYCLIN	4921 W. HARRISON STREET		CHICAGO	IL	UST
60644	S109699762		FLOOD BROTHERS DISPOSAL	4921 WEST HARRISON STREET		CHICAGO	IL	LUST
60644	U003715154	2039366	CHICAGO BOARD OF EDUCATION WAR	5045 W HARRISON ST		CHICAGO	IL	UST
60644	1017371362	110060381251	BUILD INC	5100 W HARRISON ST		CHICAGO	IL	FINDS
60644	S117322726		BUILD INC	5100 W HARRISON ST		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60644	U004224663		BUILD, INC.	5100 W. HARRISON STREET		CHICAGO	IL	UST
60644	S113269581		MICHELE CLARK SCHOOL	5101 W HARRISON ST		CHICAGO	IL	
60644	1001116792	ILR000028175	CLARK MICHELLE SCHOOL	5101 W HARRISON ST		CHICAGO	IL	RCRAInfo-SQG
60644	1008148092	110018449053	MICHELE CLARK SCHOOL	5101 W HARRISON ST		CHICAGO	IL	FINDS
60644	1009188585		NEIGHBORHOOD VARIETY SHOP	5200 W HARRISON		CHICAGO	IL	
60644	U000174271	2006796	ROADWAY SIGNAL/LIGHTING MAINT	5321 W HARRISON		CHICAGO	IL	UST
60644	1004479176	110011838734	CAM ACADEMY	5400 W HARRISON ST		CHICAGO	IL	FINDS
60644	S113265888		MEADE ELECTRIC	5401 W HARRISON ST		CHICAGO	IL	
60644	1000986649	110005931055	MEADE ELECTRIC	5401 W HARRISON ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	U001143010	2014046	MEADE ELECTRIC COMPANY, INC.	5401 W. HARRISON ST.		CHICAGO	IL	UST
60644	S113269604		VACANT LOT	5437 W HARRISON		CHICAGO	IL	
60644	U000865429	2003056	KOOY MOTOR SERV INC	5447 W HARRISON ST		CHICAGO	IL	UST
60644	1008123908	110018205510	KOOY, LARRY	5447 W HARRISON ST		CHICAGO	IL	FINDS
60644	S111886281		KOOY, LARRY	5447 W HARRISON ST		CHICAGO	IL	
60644	S104524269		KOOY, LARRY	5447 WEST HARRISON ST.		CHICAGO	IL	LUST
60644	1020898082		ALBERTI JEROME	5501 W HARRISON		CHICAGO	IL	
60644	1020048464		NEW ERA CLEANERS	5506 W HARRISON		CHICAGO	IL	
60644	U004224672		LORETTO HOSPITAL	5540 W. HARRISON STREET		CHICAGO	IL	UST
60644	1018484550		NEW ERA CLEANERS	5554 W HARRISON		CHICAGO	IL	
60644	S113269639		U-PAC-MORE LEASING	4921 W HARRISON-B		CHICAGO	IL	
60644	1017412727	110063270721	4620 W HURON	4620 W HURON		CHICAGO	IL	FINDS
60644	1004479177	110011811218	COMM CHRISTIAN SCHOOL OF AUSTIN	5443 W HURON		CHICAGO	IL	FINDS
60644	S113269671		CHICAGO JESUIT ACADEMY	5058 W JACKSON BLVD		CHICAGO	IL	
60644	U004183505		CHICAGO JESUIT ACADEMY	5058 W. JACKSON BLVD.		CHICAGO	IL	UST
60644	1010015082	110028286192	CHICAGO JESUIT ACADEMY	5074 W JACKSON BLVD		CHICAGO	IL	FINDS
60644	U003668388	2038219	JACKSON SQUARE NURSING & REHAB CI	5130 W JACKSON BLVD		CHICAGO	IL	UST
60644	1000615049	110005907368	AMOCO OIL CO, ACA MGMT SVC	5201 W JACKSON		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S111887884		AMOCO OIL CO, ACA MGMT SVC	5201 W JACKSON BLVD		CHICAGO	IL	
60644	U001141922	2023003	5201 JACKSON, INC.	5201 W. JACKSON		CHICAGO	IL	UST
60644	S104524356		AMOCO OIL CO. #15043	5201 WEST JACKSON		CHICAGO	IL	LUST
60644	1015946986	110054140096	COLUMBUS PARK GOLF COURSE	5701 W JACKSON BLVD		CHICAGO	IL	FINDS
60644	1016141444	ILR000176701	COLUMBUS PARK REFECTORY	5701 W JACKSON BLVD		CHICAGO	IL	RCRA-CESQG
60644	S113402844		COLUMBUS PARK REFECTORY	5701 W JACKSON BLVD		CHICAGO	IL	NPDES
60644	S107743225	16036	JONAS ENTERPRISES INC	21 N KILPATRICK		CHICAGO	IL	AIRS
60644	1000157005	110000435627	JONAS ENTERPRISES INC	21 N KILPATRICK AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS, TRIS
60644	S110153888		JONAS ENTERPRISES, INC.	21 NORTH KILPATRICK		CHICAGO	IL	TIER 2
60644	1000287201	ILD005474572	QUALITY PLATING CO INC	323 N KILPATRICK AVE		CHICAGO	IL	CERCLIS, RCRA-NonGen, PRP
60644	1008124313	3878	QUALITY PLATING CO	323 N KILPATRICK AVE		CHICAGO	IL	AIRS
60644	1016052680	110001319396	QUALITY PLATING CO.	323 NORTH KILPATRICK AVE.		CHICAGO	IL	ICIS, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	1016872985	110059729904	415 S KILPATRICK	415 S KILPATRICK		CHICAGO	IL	FINDS
60644	1000359834	110001812405	AMERICAN FLANGE AND MFG CO INC	825 S KILPATRICK AVE		CHICAGO	IL	AIRS, RCRA-NonGen, FINDS
60644	1022830626		832 S. KILPATRICK	832 S. KILPATRICK		CHICAGO	IL	US BROWNFIELDS
60644	1023543925	110070004559	832 S. KILPATRICK	832 S. KILPATRICK		CHICAGO	IL	FINDS
60644	1010557554	110032924110	COMED-MANHOLE	KILPATRICK & KINZIE		CHICAGO	IL	FINDS
60644	S113269476		COMED-MANHOLE	KILPATRICK & KINZIE		CHICAGO	IL	
60644	1010563617	ILR000150268	COMED	KILPATRICK & KINZIE		CHICAGO	IL	RCRAInfo-SQG
60644	1004476632		JACOB SUCHARD BRANCH	4656 W KINZIE		CHICAGO	IL	FTTS
60644	1016299030	110011885326	JACOB SUCHARD BRANCH	4656 W KINZIE		CHICAGO	IL	FINDS
60644	U001142410	2013563	EJ BRACH & SONS	4656 W KINZIE ST		CHICAGO	IL	UST
60644	9185158			4656 WEST KINZIE		CHICAGO	IL	ERNS
60644	S113269520		PUBLIC WAY	4700 W KINZIE		CHICAGO	IL	
60644	S113269681		VACANT LOT	4836-4842 S KINZIE		CHICAGO	IL	
60644	S113265959		USEPA MCC CONSTRUCTION	2100 S KOSTNER		CHICAGO	IL	
60644	95293853			201 NORTH LACROSSE	**	CHICAGO	IL	ERNS
60644	S113269678		VACANT LOT	4520 W LAKE ST		CHICAGO	IL	
60644	S111889627		STEWART BUS CO	4611 W LAKE		CHICAGO	IL	
60644	1001487526	110003051232	STEWART BUS CO	4611 W LAKE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	U000865905	2008460	VACANT BUILDING	4611 W LAKE ST		CHICAGO	IL	UST
60644	S105815566		RELIABLE BUS CO. (STEWART BUS CO.)	4611 WEST LAKE ST.		CHICAGO	IL	LUST
60644	U001143188	2027291	STROBECKER CORP	4646 LAKE ST		CHICAGO	IL	UST
60644	1005636373	110001226735	STROMBECKER CORP	4646 W. LAKE ST.		CHICAGO	IL	FINDS
60644	1000453271	110005877408	GENERAL TRUCK REPAIR	4749 W LAKE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269543		GENERAL TRUCK RPR	4749 W LAKE ST		CHICAGO	IL	
60644	1008119183	110018158036	CHICAGO TRANSIT AUTHORITY CTA	4800 W LAKE ST		CHICAGO	IL	FINDS
60644	S113269576		CHICAGO TRANSIT AUTHORITY CTA	4800 W LAKE ST		CHICAGO	IL	
60644	S113269683		GONZALEZ TIRE SHOP	4815 W LAKE ST		CHICAGO	IL	
60644	S111920211		GARVIN INDUSTRIES	4939 W LAKE ST		CHICAGO	IL	
60644	U004060408	2043344	MAINTENANCE GARAGE	4939 W. LAKE STREET		CHICAGO	IL	UST
60644	S108187443		ZEBRA INDUSTRIES	4939 WEST LAKE STREET		CHICAGO	IL	LUST
60644	1020937883		FLASH AUTO PARTS	5050 W LAKE ST		CHICAGO	IL	
60644	S113269517		GREEN ROUND EPS INC	5103 W LAKE ST		CHICAGO	IL	
60644	1000978994	110005806342	GREEN ROUND E P S INC	5103 W LAKE ST		CHICAGO	IL	RCRA-NonGen, FINDS
60644	S113269624		VACANT LOT	5105-25 W LAKE ST		CHICAGO	IL	
60644	S113269577		S&S NEW MAGIC TOUCH A-BODY	5124 W LAKE ST		CHICAGO	IL	
60644	1004695601	110005943792	S&S NEW MAGIC TOUCH AUTOBODY	5124 W LAKE ST		CHICAGO	IL	RCRA-CESQG, FINDS
60644	S111909055		CERTIFIED ALIGNMENT	5223 W LAKE ST		CHICAGO	IL	
60644	U003769757	2040382	CERTIFIED ALIGNMENT	5223 W. LAKE STREET		CHICAGO	IL	UST
60644	S104967901		CERTIFIED ALIGNMENT	5223 WEST LAKE ST.		CHICAGO	IL	LUST
60644	S109953784		PCC COMMUNITY WELLNESS CTR	5425 W LAKE ST		CHICAGO	IL	
60644	U004138006		CONSTRUCTION SITE	5425 WEST LAKE AVE.		CHICAGO	IL	UST
60644	S109366559		PCC COMMUNITY WELLNESS CENTER	5425 WEST LAKE STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60644	1009095776		PALLS STANDARD SERVICE	5467-75 W LAKE ST		CHICAGO	IL	
60644	1018843893		B & T CLEANERS	5509 W LAKE		CHICAGO	IL	
60644	S111914487		LANOWSKI, DRONISLAW	5520 W LAKE ST		CHICAGO	IL	
60644	U003914165	2041762	EMPTY BLUIDING	5520 W. LAKE STREET		CHICAGO	IL	UST
60644	S105958683		LANOWSKI, DRONISLAW	5520 WEST LAKE ST.		CHICAGO	IL	LUST
60644	1018898436		NORGE VILLAGE CLEANERS	5526 W LAKE ST	**	CHICAGO	IL	
60644	1009188206		BALO JOHNS CLEANERS	5609 W LAKE ST		CHICAGO	IL	
60644	1004692890	110005841189	BALO JOHN CLEANERS	5609 W LAKE ST		CHICAGO	IL	RCRA-CESQG, FINDS
60644	U001142261	2030918	AUSTON TOWN HALL	5610 W LAKE		CHICAGO	IL	UST
60644	1004697398	110003056763	AUSTIN TOWN HALL PARK	5610 W LAKE ST		CHICAGO	IL	RCRA-CESQG, FINDS
60644	S113269547		AUSTIN TOWN HALL PARK	5610 W LAKE ST	**	CHICAGO	IL	
60644	1008150810	110018476308	PROCUNIER SAFETY CHUCK	5815 W LAKE ST		CHICAGO	IL	FINDS
60644	S113266242		PROCUNIER SAFETY CHUCK	5815 W LAKE ST		CHICAGO	IL	
60644	1005635850	110001228804	PETERSEN ICE CREAM CO	5835 W LAKE ST		CHICAGO	IL	AIRS, FINDS
60644	1009188253		LAKE & MAYFIELD CLEANERS	5870 W LAKE ST		CHICAGO	IL	
60644	1004478865	110011703647	MARS HILL SCH	5916 W LAKE ST		CHICAGO	IL	FINDS
60644	1009187586		L & L DRY CLEANERS & LAUNDRY	5936 W LAKE ST		CHICAGO	IL	
60644	U001142267	2030892	AUSTON PARK	5951 W LAKE		CHICAGO	IL	UST
60644	1008134324	110018310086	AUSTIN	5951 W LAKE		CHICAGO	IL	FINDS
60644	S113269558		AUSTIN	5951 W LAKE		CHICAGO	IL	
60644	1000114445	110001823876	ACE FOUNDRY CO	353 N LAMON AVE		CHICAGO	IL	AIRS, RCRA-NonGen, FINDS, LUST
60644	U003668022	2036868	ACE FOUNDRY CO	353-363 N LAMON		CHICAGO	IL	UST
60644	S105743925		TWO RIVER ROAD LLC	720 NORTH LARABEE STREET		CHICAGO	IL	LUST
60644	1016701878	110056414651	FAMILY DOLLAR INC 5002	100 S LARAMIE AVE		CHICAGO	IL	FINDS
60644	S116677455		FAMILY DOLLAR INC 5002	100 S LARAMIE AVE		CHICAGO	IL	
60644	1008119355	110018159758	GRANE TRANSPORTATION	1001 S LARAMIE		CHICAGO	IL	FINDS
60644	S108045244		GRANE TRANSPORTATION	1001 S LARAMIE		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	1000311803	110005819114	GRANE TRUCKING CO	1001 S LARAMIE AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	1005932945		TONY SACCO PIGMENTS & SOLVENTS	1001 S LARAMIE AVE		CHICAGO	IL	TSCA
60644	U003971767	2011338	GRANE TRANSPORTATION LINES, LTD.	1001 S. LARAMIE AVENUE		CHICAGO	IL	UST
60644	S106132013		GRANE TRANSPORTATION	1001 SOUTH LARAMIE AVENUE		CHICAGO	IL	LUST
60644	1018156095	110067043407	COMED	1010 S LARAMIE		CHICAGO	IL	RCRA-NonGen, FINDS
60644	S111877402		TSS30 COLUMBUS PARK SUBSTATION	1010 S LARAMIE STREET		CHICAGO	IL	TIER 2
60644	S110156713		TSS30 COLUMBUS PARK SUBSTATION	1010 S LARAMIE STREET		CHICAGO	IL	TIER 2
60644	1001967989	110003056148	SOLVAN PERFORMANCE CHEMICAL	1011 S LARAMIE AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269623		SOLVAY PERFORMANCE CHEMICAL	1011 S LARAMIE AVE		CHICAGO	IL	
60644	S113269647		FIRST STUDENT	1011 S LARAMIE AVE-B		CHICAGO	IL	
60644	1020098831		SUNSHINE CLEANERS	301 N LARAMIE AVE		CHICAGO	IL	
60644	U003298509	2036362	AUSTIN STATION	324 S LARAMIE		CHICAGO	IL	UST
60644	1014703184	110041357475	333 N LARAMIE	333 N LARAMIE		CHICAGO	IL	FINDS
60644	1018686208		WESTCHESTER CLEANERS	364 N LARAMIE		CHICAGO	IL	
60644	1017794186	110063750926	BY THE HAND CLUB FOR KIDS	416 N LARAMIE AVE		CHICAGO	IL	FINDS
60644	U004227545		BY THE HAND CLUB FOR KIDS - ME/AUST	416 N. LARAMIE		CHICAGO	IL	UST
60644	S117724634		BY-THE-HAND CLUB FOR KIDS	416 NORTH LARAMIE AVENUE		CHICAGO	IL	LUST
60644	1015799472	110046375347	417 N LARAMIE	417 N LARAMIE		CHICAGO	IL	FINDS
60644	1015799471	110046375338	419 N LARAMIE	419 N LARAMIE		CHICAGO	IL	FINDS
60644	1021494256		C & W AUTO REBUILDERS	420 N LARAMIE AVE		CHICAGO	IL	
60644	1015799470	110046375329	421 N LARAMIE	421 N LARAMIE		CHICAGO	IL	FINDS
60644	1009075479		STAN WILLIAMS LAR HAR SVC STN	521 S LARAMIE		CHICAGO	IL	
60644	1009186599		J CLEANERS	563 N LARAMIE AVE		CHICAGO	IL	
60644	S113269642		TWO RIVER ROAD LLC	720 N LARAMIE		CHICAGO	IL	
60644	S113269680		CHICAGO DOT	720-1100 S LARAMIE		CHICAGO	IL	
60644	1020559595		BILLS TEXACO	735 S LARAMIE		CHICAGO	IL	
60644	1011852596	110037147655	KFC RESTAURANT	762 N LARAMIE AVE		CHICAGO	IL	FINDS
60644	1010563401	ILR000148130	COMED	1001 S LARAMIE-B		CHICAGO	IL	RCRA-NonGen
60644	S113269666		COMED	1001 S LARAMIE-B		CHICAGO	IL	
60644	1007217931	110016734649	FIRST STUDENT	1011 S LARAMIE-B		CHICAGO	IL	FINDS
60644	1007092929	ILR000125021	FIRST STUDENT	1011 S LARAMIE-B		CHICAGO	IL	RCRA-CESQG
60644	S113269635		K HARRIS TRUCKING	731 N LATROBE		CHICAGO	IL	
60644	S110859806		COMED MANHOLE	N LATROBE & W MADISON	**	CHICAGO	IL	
60644	1011995682	110038218899	COMED MANHOLE	N LATROBE & W MADISON		CHICAGO	IL	FINDS
60644	1012178646	ILR000157214	COMED MANHOLE	N LATROBE & W MADISON		CHICAGO	IL	RCRA-NonGen
60644	1021407864		BILLS TEXACO	735 S LAURENT	**	CHICAGO	IL	
60644	1004696905	110003047774	SPENCER MATH & SCIENCE	214 N LAVERGNE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60644	U003715136	2039305	SPENCER MATH & SCIENCE	214 N LAVERGNE AVE		CHICAGO	IL	UST
60644	S113269682		EL NDO YUMURI TIRE	355 N LAVERGNE		CHICAGO	IL	
60644	1010445724	110031464378	EL NDO YUMURI TIRE	355 N LAVERGNE		CHICAGO	IL	FINDS
60644	U004060444	2043402	ADDISON PIPE AND TUBE	355 N. LAVERGNE AVE.		CHICAGO	IL	UST
60644	S113269578		HORATIO MAY COMM ACAD	512 S LAVERGNE		CHICAGO	IL	
60644	1001112175	110005944504	HORATIO MAY ACADEMY	512 S LAVERGNE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	1018681775		JOHNSON SARINAS	508 N LAWLER AVE		CHICAGO	IL	
60644	1016440647	110055957727	ST MARTIN DE PORRES	116 N LECLAIRE		CHICAGO	IL	FINDS
60644	1018633053		HOWARD & SONS CLEANING	427 N LECLAIRE AVE		CHICAGO	IL	
60644	S113269548		JAKACKI BAG & BARREL	4607 W LEXINGTON		CHICAGO	IL	
60644	1016406011	110055407974	J&S BUILDING LLC	5055 W LEXINGTON ST		CHICAGO	IL	FINDS
60644	S116159236		J&S BUILDING LLC	5055 W LEXINGTON ST		CHICAGO	IL	
60644	1004479951	110001802880	SECRETARY OF STATE - DRIVER FACILIT	5301 W LEXINGTON		CHICAGO	IL	AIRS, FINDS
60644	S104524701		ILLINOIS MOTOR VEHICLE FACILITY	5301 WEST LEXINGTON		CHICAGO	IL	LUST
60644	1008134304	110018309882	CHICAGO, CITY OF, LEXINGTON PUMPINC	5555 W LEXINGTON		CHICAGO	IL	AIRS, FINDS
60644	1010317242	ILR000143602	CHICAGO, CITY OF LEXINGTON PUMP ST.	5555 W LEXINGTON ST		CHICAGO	IL	RCRA-CESQG
60644	U004149062		LEXINGTON PUMPING STATION	5555 W. LEXINGTON STREET		CHICAGO	IL	UST
60644	1000986470	ILD984870071	HOWE JULIA WARD SCHOOL	702 N LOREL AVE		CHICAGO	IL	RCRA-CESQG
60644	S107743257	3220	JULIA WARD HOME SCHOOL	720 N LOREL		CHICAGO	IL	AIRS
60644	1008307895	110036509604	HOWE ELEM SCHOOL	720 N LOREL AV		CHICAGO	IL	FINDS
60644	S113269539		CHICAGO TRANSIT AUTHORITY	352 N LOTUS AVE		CHICAGO	IL	
60644	1008134283	110018309677	CHICAGO TRANSIT AUTHORITY	352 N LOTUS AVE		CHICAGO	IL	FINDS
60644	1008124003	110018206476	LAIDLAW TRANSIT INC	4510 W MADISON		CHICAGO	IL	FINDS
60644	S111905171		LAIDLAW TRANSIT INC	4510 W MADISON		CHICAGO	IL	
60644	S104528065		LAIDLAW TRANSIT, INC.	4510 WEST MADISON		CHICAGO	IL	LUST
60644	1011854148	110037163333	WESTSIDE LEARNING CENTER	4624 W MADISON		CHICAGO	IL	FINDS
60644	1011852976	110037151462	4659 W MADISON AVE	4659 W MADISON AVE		CHICAGO	IL	FINDS
60644	1009074064		M-K STANDARD SERVICE	4700 W MADISON		CHICAGO	IL	
60644	1016872862	110059727997	4718 W MADISON	4718 W MADISON		CHICAGO	IL	FINDS
60644	1009680649	110027903115	CHICAGO, CITY OF ABANDONMENT	4729 W MADISON		CHICAGO	IL	FINDS
60644	S113269665		CHICAGO, CITY OF ABANDONMENT	4729 W MADISON		CHICAGO	IL	
60644	U1010317253	ILR000143727	CHICAGO, CITY OF ABANDONMENT	4729 W MADISON		CHICAGO	IL	RCRA-CESQG
60644	U003838669	2040843	GAS PLUS MOBIL	4804 W MADISON		CHICAGO	IL	UST
60644	S118419145		4900 W MADISON ST	4900 W MADISON ST		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	S111908496		WESTSIDE PLANNING & DEVELOPMEN	4940 W MADISON AVE		CHICAGO	IL	
60644	S104792934		WESTSIDE PLANNING & DEVELOPMENT	4940 WEST MADISON AVE.		CHICAGO	IL	LUST
60644	1000309400	110001337615	M K CLEANERS INC	4948 W MADISON		CHICAGO	IL	AIRS, RCRAInfo-SQG, FINDS
60644	S109092695		M&K CLEANERS, INC.	4948 WEST MADISON STREET		CHICAGO	IL	DRYCLEANERS, SRP
60644	1008123943	110018205878	ADVANCE AUTO 6944	5001 W MADISON AVE		CHICAGO	IL	FINDS
60644	S113269592		ADVANCE AUTO 6944	5001 W MADISON AVE		CHICAGO	IL	
60644	S104491611		HOLSTEIN PROPERTY	5001 WEST MADISON AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60644	1016440224	110055953268	MCDONALDS	5015 W MADISON		CHICAGO	IL	FINDS
60644	S118838353		DCY310-AUSTIN SUBSTATION	5049 W. MADISON		CHICAGO	IL	TIER 2
60644	1021527051		RYANS GAS FOR LESS	5107 W MADISON ST		CHICAGO	IL	
60644	S108046427		EASYWAY OIL INC	5107 W MADISON ST		CHICAGO	IL	
60644	U003971873	2034040	3 TEAM GROUP, INC.	5107 W. MADISON STREET		CHICAGO	IL	UST
60644	S106655924		EASYWAY OIL, INC.	5107 WEST MADISON STREET		CHICAGO	IL	LUST
60644	1004479180	110011832357	AUSTIN DEVELOPMENTAL CTR	5151 W MADISON ST		CHICAGO	IL	FINDS
60644	1019921258		SPOTLESS CLEANERS	5152 W MADISON		CHICAGO	IL	
60644	1008134264	110018309481	EQUIVA SERVICES LLC	5200 W MADISON		CHICAGO	IL	FINDS
60644	S112364302		EQUIVA SERVICES LLC	5200 W MADISON		CHICAGO	IL	
60644	U001143111	2021031	ENTY DUANE SHELL SER STN	5200 W MADISON LARAMIE		CHICAGO	IL	UST
60644	S104527429		SHELL OIL CO.	5200 WEST MADISON		CHICAGO	IL	LUST
60644	1009075863		JOHNS ARCO	5201 W MADISON		CHICAGO	IL	
60644	U001141956	2020352	AMOCO SS#18893 FAC#11759	5201 W MADISON 18615		CHICAGO	IL	UST
60644	S113269588		FIRSTAR DEVELOPMENT CORP	5201 W MADISON ST		CHICAGO	IL	
60644	1008123924	110018205681	FIRSTAR DEVELOPMENT CORP	5201 W MADISON ST		CHICAGO	IL	FINDS
60644	S104491610		ATLANTIC RICHFIELD	5201 WEST MADISON STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60644	1018548314		ROBINSON CLEANING CORP	5327 W MADISON		CHICAGO	IL	
60644	1020076026		ROBINSON CLEANING CORP	5357 W MADISON		CHICAGO	IL	
60644	1000195951	110005870094	ROSE CLEANERS	5405 W MADISON ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	1009186946		ROSE CLEANER	5405 W MADISON ST		CHICAGO	IL	
60644	1020751675		SCHLACHTER RONALD	5430 W MADISON		CHICAGO	IL	
60644	1020121178		WILLIAMS CUT RATE LIQUORS	5439 W MADISON ST		CHICAGO	IL	
60644	S113269644		AUTOZONE 2587	5440 W MADISON		CHICAGO	IL	
60644	1009185610		IRA THE TAYLOR	5449 W MADISON		CHICAGO	IL	
60644	1021710489		CENTRAL SUPER SERVICE STATION	5467 W MADISON		CHICAGO	IL	
60644	S107745603	3478	ROBERT EMMET SCHOOL	5500 W MADISON		CHICAGO	IL	AIRS
60644	1001116613	ILR000026377	EMMET ROBERT SCHOOL	5500 W MADISON ST		CHICAGO	IL	RCRAInfo-SQG
60644	1001816885	110003053052	CENTRAL CLEANERS	5602 W MADISON		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269616		CENTRAL CLEANERS	5602 W MADISON		CHICAGO	IL	
60644	S108968258		CENTRAL CLEANERS	5602 WEST MADISON AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60644	1009184626		PAULS CLEANING CENTER	5626 W MADISON		CHICAGO	IL	
60644	1019943579		BRITE CLEANERS	5633 W MADISON ST		CHICAGO	IL	
60644	1009185025		BRITE CLEANERS	5635 W MADISON		CHICAGO	IL	
60644	U003987963	2042619	CONSTRUCTION SITE - POLICE DISTRICT	5663-81 W. MADISON AVENUE		CHICAGO	IL	UST
60644	1001076676	110005936540	KINGS CLEANERS	5664 W MADISON		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	1007153993	110016690357	KINGS CLEANERS	5668 W MADISON		CHICAGO	IL	AIRS, FINDS
60644	S113269570		KINGS CLEANERS	5668 W MADISON		CHICAGO	IL	
60644	1009457284	110024845970	CHICAGO, CITY OF POLICE 15TH D	5701 W MADISON ST		CHICAGO	IL	FINDS
60644	S113269648		CHICAGO, CITY OF POLICE 15TH D	5701 W MADISON ST		CHICAGO	IL	
60644	S113269549		AMOCO 15937	5725 W MADISON & MENARD	**	CHICAGO	IL	
60644	1000862633	110007552353	AMOCO 15937	5725 W MADISON AND MENARD		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	1010038509	110028261734	PUBLIC BLDG COMMISSION CHG	5727 W MADISON		CHICAGO	IL	FINDS
60644	S111887272		PUBLIC BLDG COMMISSION CHG	5727 W MADISON		CHICAGO	IL	
60644	S104524006		PUBLIC BUILDING COMMISSION OF CHIC.	5727 WEST MADISON		CHICAGO	IL	LUST
60644	1020121179		WILLIAMS CUT RATE LIQUORS	5736 W MADISON		CHICAGO	IL	
60644	S113269565		ONE STOP TIRE SHOP INC	5829 W MADISON		CHICAGO	IL	
60644	1008134339	110018310237	ONE STOP TIRE SHOP INC	5829 W MADISON		CHICAGO	IL	FINDS
60644	1009186603		T & K CLEANERS	5851 W MADISON ST		CHICAGO	IL	
60644	1011915652	110037357277	A A RAYNOR & SONS	5911 W MADISON		CHICAGO	IL	FINDS
60644	1008134205	110018308883	BIG O MOVERS & STORAGE INC	5951 W MADISON ST		CHICAGO	IL	FINDS
60644	S111879356		BIG O MOVERS & STORAGE INC	5951 W MADISON ST		CHICAGO	IL	
60644	U004128343		BIG O MOVERS	5951 WEST MADISON		CHICAGO	IL	LUST, UST
60644	1018561656		SMART CLEANERS	5957 W MADISON ST		CHICAGO	IL	
60644	U000864608	2023060	AMOCO SS #16502 FAC #10540	MADISON & KILPATRICK		CHICAGO	IL	UST
60644	1012178644	ILR000157198	COMED MANHOLE	MADISON & PARKSIDE		CHICAGO	IL	RCRA-NonGen
60644	S110859807		COMED MANHOLE	MADISON & PARKSIDE	**	CHICAGO	IL	
60644	1011995556	110038218915	COMED MANHOLE	MADISON & PARKSIDE		CHICAGO	IL	FINDS
60644	1010040639	110028092908	10 SOUTH MASON LLC	10 SOUTH MASON		CHICAGO	IL	ICIS, FINDS
60644	1007448578	ILR000129296	PCC COMMUNITY WELLNESS CTR	355 N MASON		CHICAGO	IL	RCRAInfo-SQG

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	S113269655		PCC COMMUNITY WELLNESS CTR	355 N MASON		CHICAGO	IL	
60644	1007692506	110018383738	PCC COMMUNITY WELLNESS CTR	355 N MASON		CHICAGO	IL	FINDS
60644	2000531970			1108 SOUTH MAYFIELD		CHICAGO	IL	ERNS
60644	97402814			125 SOUTH MAYFIELD	**	CHICAGO	IL	ERNS
60644	1018887852		GENERAL ELECTRIC CO	1013 S MENARD		CHICAGO	IL	
60644	1019998637		GREENS CLEANERS	125 S MENARD AVE		CHICAGO	IL	
60644	S110828736		EVOLUTION INTERIORS 905 WAREHOUSE	905 S MENARD AVENUE		CHICAGO	IL	TIER 2
60644	1004479178	110011861887	LEARNING NETWORK	5911 W MIDWAY PARK		CHICAGO	IL	FINDS
60644	1007284194		LEARNING NETWORK CENTER	5911 W MIDWAY PKWY		CHICAGO	IL	FTTS
60644	1001116790	ILR000028159	CLARK GEORGE ROGERS SCHOOL	1045 S MONITOR		CHICAGO	IL	RCRAInfo-SQG
60644	S113269580		GEORGE ROGERS CLARK SCHOOL	1045 S MONITOR		CHICAGO	IL	
60644	1016090470	110005948653	GEORGE ROGERS CLARK SCHOOL	1045 S MONITOR AVE		CHICAGO	IL	FINDS
60644	1017371675	110060384454	408 -20 N LARAMIE	408 -20 N LARAMIE	**	CHICAGO	IL	FINDS
60644	1000437011	ILD047584198	COLOVOS COMPANY	4444 WEST OHIO STREET	G, SSW, 1/8 - 1/4	CHICAGO	IL	CORRACTS, Inst Control, CERCLIS-NFRAP, ENG CONTROLS, SRP, RCRAlInfo-SQG, LUST
60644	1000109181	110009387591	FMC CORP BEVERAGE EQUIPMENT DIV	4601 W OHIO ST		CHICAGO	IL	
60644	S113266050		FMC CORP	4601 W OHIO ST		CHICAGO	IL	
60644	S113269625		ROME METAL MFG INC	4612 OHIO ST		CHICAGO	IL	
60644	1004697385	110003056380	ROME METAL MANUFACTURING	4612 W OHIO ST		CHICAGO	IL	RCRA-CESQG, FINDS
60644	1014705332	110042256616	PROGRESSIVE TRUE VINE CHURCH	5035 W OHIO		CHICAGO	IL	FINDS
60644	1015830953	110046379156	5317-5319 W OHIO	5317-5319 W OHIO		CHICAGO	IL	FINDS
60644	U003853376	2041013	AUSTIN BAPIST CHURCH	5460 W OHIO		CHICAGO	IL	UST
60644	1001123574	110005951826	OSCAR DEPRIEST SCHOOL	139 S PARKSIDE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269584		OSCAR DEPRIEST SCHOOL	139 S PARKSIDE		CHICAGO	IL	
60644	S113269586		FRANCIS SCOTT KEY SCHOOL	517 N PARKSIDE		CHICAGO	IL	
60644	1004696740	110003045847	FRANCIS SCOTT KEY SCHOOL	517 N PARKSIDE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60644	1014704079	110042177364	115 N PINE	115 N PINE		CHICAGO	IL	FINDS
60644	1001123492	ILR000031922	AUSTIN COMMUNITY ACADEMY	231 N PINE		CHICAGO	IL	RCRA-NonGen
60644	1009409220	110024917161	AUSTIN POLYTECHNICAL ACADEMY	231 N PINE		CHICAGO	IL	FINDS
60644	S113269582		AUSTIN COMMUNITY	231 N PINE		CHICAGO	IL	
60644	S113269633		USED & WASTE TIRE	335 N PINE AVE		CHICAGO	IL	
60644	1008123953	110018205976	USED & WASTE TIRE	335 N PINE AVE		CHICAGO	IL	FINDS
60644	1000906968	110001292949	NATIONAL BAKING CO	5001 W POLK ST		CHICAGO	IL	AIRS, RCRA-NonGen, FINDS
60644	U001142866	2013483	NATL BAKING CO	5001 W POLK ST		CHICAGO	IL	UST
60644	S104523116		NATIONAL BAKING CO.	5001 WEST POLK ST.		CHICAGO	IL	LUST
60644	1016730689	110057353064	ALPHA BAKING CO INC	5001 WEST POLK STREET		CHICAGO	IL	ICIS, FINDS
60644	S104521992		COMPASS GROUP	5048 POLK ST		CHICAGO	IL	LUST
60644	1008134359	110018310442	COMPASS GROUP	5048 POLK ST		CHICAGO	IL	FINDS
60644	1000301863	ILD113643100	COMMONWEALTH EDISON CO CENTRAL	5059 W POLK		CHICAGO	IL	RCRAInfo-SQG, LUST
60644	S107740990	11195	COM ED - CHICAGO CENTRAL DIV HQ	5059 W POLK ST		CHICAGO	IL	AIRS
60644	U000865063	2022652	COMMONWEALTH EDISON CO	5059 W POLK ST		CHICAGO	IL	UST
60644	1016054942	110001824072	COM ED - CHICAGO CENTRAL DIV HQ	5059 W POLK ST		CHICAGO	IL	FINDS
60644	1008135649	110018323410	SA HEALY	5263 POLK ST		CHICAGO	IL	FINDS
60644	S113270469		SA HEALY	5263 POLK ST		CHICAGO	IL	
60644	1004477986	110007266948	DIAMOND UNLIMITED INC	POLK & LARAMIE		CHICAGO	IL	AIRS, FINDS
60644	1009075336		DONS SHELL SERVICE	425 S PULASKI		CHICAGO	IL	
60644	1008111516	110018081092	ALDI FOODS CENTRAL	NW QUADRANT ROOSEVELT&CTL	**	CHICAGO	IL	FINDS
60644	S113269631		ALDI FOODS CENTRAL	NW QUADRANT ROOSEVELT&CTL	**	CHICAGO	IL	
60644	1007692499	110018383168	LAVERGNE COURT APARTMENTS	4940 W QUINCY ST		CHICAGO	IL	FINDS
60644	1007570012	ILR000131128	LAVERGNE COURT APARTMENTS	4940 W QUINCY ST		CHICAGO	IL	RCRA-CESQG
60644	S113269656		LAVERGNE COURT APARTMENTS	4940 W QUINCY ST		CHICAGO	IL	
60644	S113269651		XK TRUCKING INC	5412 W QUINCY ST		CHICAGO	IL	
60644	S113269679		CHICAGO, CITY OF	5615 W RACE ST		CHICAGO	IL	
60644	S113269663		CHICAGO DEPT OF TRANSPORTATION	5800 W RAILROAD AVE		CHICAGO	IL	
60644	1000881346	ILD082076969	CHICAGO STUDIO CITY	5700 W ROOSEVELT RD		CHICAGO	IL	CORRACTS, CERCLIS-NFRAP, RCRA-NonGen
60644	1000417775	ILD068469386	DANA CORP VICTOR PRODUCTS DIV CHC	5750 W ROOSEVELT RD		CHICAGO	IL	CORRACTS, CERCLIS-NFRAP, RCRA-NonGen, RAATS
60644	S110152816		GATTO INDUSTRIAL PLATERS INC.	4620 WEST ROOSEVELT ROAD		CHICAGO	IL	TIER 2
60644	1016086463	110009368497	PARCO PRODUCTS INC	4710 W ROOSEVELT RD		CHICAGO	IL	FINDS
60644	1017427538	60650GRDNR47	GAC CHICAGO INC	4718 W ROOSEVELT RD		CHICAGO	IL	TRIS
60644	1000861010	IL0000018952	TRIANGLE DECORATING CO	4800 ROOSEVELT RD		CHICAGO	IL	RCRA-NonGen
60644	S107740842	3068	HARBORTOWN DIVISION IBR CORP	4800 W ROOSEVELT RD		CHICAGO	IL	AIRS
60644	1008151563	110018483906	TRIANGLE DECORATING	4800 W ROOSEVELT RD		CHICAGO	IL	AIRS, FINDS
60644	1000823575	ILD984870410	HARBORTOWN DIVISION	4800 W ROOSEVELT RD		CHICAGO	IL	RCRAInfo-SQG
60644	1016077913	110000431364	HARBORTOWN DIVISION, IBR CORP	4800 W. ROOSEVELT RD.		CHICAGO	IL	ICIS, FINDS
60644	S113269674		BUSINESS ESSENTIALS SVC TEAM LLC	5000 W ROOSEVELT ST 100-C		CHICAGO	IL	
60644	1016277724	110009283382	ALDENS INCORPORATED CHIPS	5000 WEST ROOSEVELT ROAD		CHICAGO	IL	FINDS
60644	1000208358	ILD980905277	ALDENS INCORPORATED CHIPS	5000 WEST ROOSEVELT ROAD		CHICAGO	IL	CERCLIS
60644	S111748438		PACKAGING CORP OF AMERICA	5200 W ROOSEVELT AVE		CHICAGO	IL	AIRS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	1012312328	110009364320	PACKAGING CORP OF AMERICA	5200 W ROOSEVELT RD		CHICAGO	IL	ICIS, FINDS
60644	1000861003	IL0000018564	PACKAGING CORP OF CHICAGO	5200 W ROOSEVELT RD		CHICAGO	IL	RCRA-CESQG
60644	S117508585		PACKAGING CORPORATION OF AMERICA	5200 W ROOSEVELT RD.		CHICAGO	IL	TIER 2
60644	S110360454		PACKAGING CORPORATION OF CHICAGO	5200 WEST ROOSEVELT		CHICAGO	IL	TIER 2
60644	1017412789	110063271374	ROLA INC	5230 W ROOSEVELT RD		CHICAGO	IL	FINDS
60644	S117534019		ROLA INC	5230 W ROOSEVELT RD		CHICAGO	IL	
60644	S117449757		ROLA INC	5230 WEST ROOSEVELT ROAD		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60644	S111909573		WEST ROOSEVELT DEVELOPMENT	5300 W ROOSEVELT		CHICAGO	IL	
60644	S104968046		WEST ROOSEVELT DEVELOPMENT	5300 WEST ROOSEVELT ST.		CHICAGO	IL	LUST
60644	1000162261	110009365971	SUNBEAM CORP	5400 W ROOSEVELT RD		CHICAGO	IL	RCRA-NonGen, FINDS
60644	S113269622		SWABY MFG CO	5414 W ROOSEVELT RD		CHICAGO	IL	
60644	1004697348	110003055700	SWABY MFG CO	5414 W ROOSEVELT RD		CHICAGO	IL	RCRA-CESQG, FINDS
60644	1014390002	110009375568	SHETLAND PROPERTIES	5420 W ROOSEVELT RD		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S108046461		SHETLAND PROPERTIES	5420 W ROOSEVELT RD		CHICAGO	IL	
60644	1014705275	110041634648	SHETLAND PROPERTIES	5420 W ROOSEVELT RD		CHICAGO	IL	FINDS
60644	S107744454	16060	MORSE CALIPERS INC	5450 W ROOSEVELT RD		CHICAGO	IL	AIRS
60644	1001213752	ILR000045351	MORSE CALIPER CORP	5450 W ROOSEVELT RD		CHICAGO	IL	RCRAInfo-SQG
60644	1016061547	110001339230	MORSE CALIPERS INC	5450 W. ROOSEVELT RD.		CHICAGO	IL	FINDS
60644	S117511550		LBP 5490 LOCATION	5490 W. ROOSEVELT ROAD		CHICAGO	IL	TIER 2
60644	S113269637		CHICAGOLAND TRUCKIN INC	5494 W ROOSEVELT RD		CHICAGO	IL	
60644	S113270482		CENVELT CORP	5600 W ROOSEVELT		CHICAGO	IL	
60644	1008137522	110018342239	CENVELT CORP	5600 W ROOSEVELT		CHICAGO	IL	FINDS
60644	S116385801		WEST ROOSEVELT ROAD CORPORATION	5630-5636 WEST ROOSEVELT ROAD		CHICAGO	IL	SRP
60644	1016702012	110056416249	FAMILY DOLLAR INC 6538	5660 W ROOSEVELT RD		CHICAGO	IL	FINDS
60644	S116677456		FAMILY DOLLAR INC 6538	5660 W ROOSEVELT RD		CHICAGO	IL	
60644	1016088030	110009371376	CHICAGO STUDIO CITY	5700 W ROOSEVELT RD		CHICAGO	IL	FINDS
60644	1005522758	110001340040	AMERICAN CRUSHING CO.	5700 W. ROOSEVELT RD.		CHICAGO	IL	FINDS
60644	1000984199	IL0001039056	WEST ROOSEVELT DRUM SITE	5728-32 W. ROOSEVELT ROAD		CHICAGO	IL	CERCLIS-NFRAP
60644	1016277603	110009279930	WEST ROOSEVELT DRUM SITE	5728-32 W. ROOSEVELT ROAD		CHICAGO	IL	ICIS, FINDS
60644	S108187522		HARTGROVE HOSPITAL	5730 ROOSEVELT ROAD		CHICAGO	IL	SRP
60644	S104491634		VICTOR PRODUCTS	5750 WEST ROOSEVELT ROAD		CHICAGO	IL	Inst Control, SRP
60644	1008122509	110018191516	WINDY CITY RECYCLING	ROOSEVELT RD & CENTRAL AVE NW COF		CHICAGO	IL	AIRS, FINDS
60644	1016227855	110007561263	ALDI FOODS CENTRAL	ROOSEVELT RD/CENTRAL	**	CHICAGO	IL	FINDS
60644	1004698239	ILR000104802	ALDI FOODS CENTRAL	ROOSEVELT RD/CENTRAL		CHICAGO	IL	RCRA-NonGen
60644	1017386628	110062848263	238 -46 S CICERO	238 -46 S CICERO	**	CHICAGO	IL	FINDS
60644	1015860355	110045522993	8657 S SAGINAW	8657 S SAGINAW		CHICAGO	IL	FINDS
60644	1008134254	110018309383	IEPA	4608 SUPERIOR		CHICAGO	IL	FINDS
60644	S112362252		IEPA	4608 SUPERIOR		CHICAGO	IL	
60644	S113269555		CHICAGO, CITY OF	4612 W SUPERIOR(ALONG RR		CHICAGO	IL	
60644	1008134309	110018309944	CHICAGO, CITY OF	4612 W SUPERIOR(ALONG RR		CHICAGO	IL	FINDS
60644	S113269688		WEST TRUCKING	4101 W TAYLOR		CHICAGO	IL	
60644	1000824194	110005917231	PARAMOUNT PICTURES UNTOUCHABLES	5560 W TAYLOR		CHICAGO	IL	RCRAInfo-SQG, FINDS
60644	S113269513		PARAMOUNT PICTURES-UNTOUCHABLES	5560 W TAYLOR	**	CHICAGO	IL	
60644	U001473592	2022083	CORBITT MFG	5600 W TAYLOR ST		CHICAGO	IL	UST
60644	S110151476		CENTRAL & TAYLOR	5600 W. TAYLOR		CICERO	IL	TIER 2
60644	S110360222		CENTRAL & TAYLOR (ID:185484)	5600 W. TAYLOR		CHICAGO	IL	TIER 2
60644	1008119945	110018165661	WOODRIDGE PRODUCTION INC - THE BE.	5660 W TAYLOR		CHICAGO	IL	FINDS
60644	U000865217	2022082	CHICAGO CITY STUDIO	5660 W TAYLOR ST		CHICAGO	IL	UST
60644	S113269553		WOODRIDGE PRODUCTION INC - THE BE.	5660 W TAYLOR ST STAGE 3		CHICAGO	IL	
60644	1000213465	ILD005255096	WOODRIDGE PRODUCTIONS INC-BEAST	5660 W TAYLOR ST STAGE 3		CHICAGO	IL	CORRACTS, RCRA-NonGen
60644	1008134232	110018309169	BETH ANNE FOUNDATION	4950 W THOMAS		CHICAGO	IL	FINDS
60644	S104524289		BETH ANNE FOUNDATION	4950 WEST THOMAS		CHICAGO	IL	LUST
60644	1023649334	110070059637	CHICAGO METROPOLITAN AREA	UNKNOWN	**	CHICAGO, IL	IL	FINDS
60644	S113269516		BELDEN MFG CO	4601 W VAN BUREN		CHICAGO	IL	
60644	S113265965		BELDEN MFG CO	4601 W VAN BUREN		CHICAGO	IL	
60644	1001077057	110018267702	BELDEN MFG CO	4601 W VAN BUREN		CHICAGO	IL	RCRA-NonGen, FINDS
60644	S101744587	0316250025	BELDEN MANUFACTURING	4601 WEST VAN BUREN STREET		CHICAGO	IL	SRP
60644	1012220459	110040530994	CHICAGO, CITY OF (SPILL)	4620 W VAN BUREN		CHICAGO	IL	FINDS
60644	S113269676		CHICAGO, CITY OF (SPILL)	4620 W VAN BUREN		CHICAGO	IL	
60644	1012219464	110040517447	CHICAGO DEPT OF ENVIRONMENT	4620 W VAN BUREN		CHICAGO	IL	FINDS
60644	1014389845	ILR000160978	CHICAGO DEPT OF ENVIRONMENT	4620 W VAN BUREN		CHICAGO	IL	RCRAInfo-SQG
60644	1010362491	110031016923	LAKE & WALLER LLC	420 N WALLER AVE		CHICAGO	IL	FINDS
60644	S113269667		LAKE & WALLER LLC	420 N WALLER AVE		CHICAGO	IL	
60644	S108891240		LAKE & WALLER LLC	420 NORTH WALLER AVENUE		CHICAGO	IL	ENG CONTROLS, SRP
60644	S113269662		VACANT LOT	445 N WALLER AVE		CHICAGO	IL	
60644	1017478950		DOUGLASS F JUNIOR HIGH ACADEMY	543 N WALLER AV		CHICAGO	IL	
60644	1001116626	ILR000026518	DOUGLASS MIDDLE SCH	543 N WALLER ST		CHICAGO	IL	RCRAInfo-SQG
60644	S113269579		DOUGLASS MIDDLE SCHOOL	543 N WALLER ST		CHICAGO	IL	
60644	1008134358	110018310424	GUYON ASSOC LTD PARTNERSHIP	4000 W WASHINGTON		CHICAGO	IL	FINDS
60644	S113269572		GUYON ASSOC LTD PARTNERSHIP	4000 W WASHINGTON		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60644	U004196126		R & D BUS	4610 W. WASHINGTON		CHICAGO	IL	UST
60644	1017793798	110063746326	4651 W WASHINGTON	4651 W WASHINGTON		CHICAGO	IL	FINDS
60644	S113269684		R&D BUS CO	4654 WASHINGTON BLVD		CHICAGO	IL	
60644	A100411387		R & D BUS COMPANY-TANK#2-12,000	4654 WEST WASHINGTON		CHICAGO	IL	AST
60644	A100411386		R & D BUS COMPANY-TANK#1-1,000	4654 WEST WASHINGTON		CHICAGO	IL	AST
60644	1009075836		BOBS SINCLAIR SERVICE STATION	4661 W WASHINGTON		CHICAGO	IL	
60644	1020508127		ACTION L8B TOWING	4667 W WASHINGTON BLVD		CHICAGO	IL	
60644	1014886638	110043821282	4701 W WASHINGTON	4701 W WASHINGTON		CHICAGO	IL	FINDS
60644	S113269661		CHICAGO, CITY OF	4701 W WASHINGTON BLVD		CHICAGO	IL	
60644	S113269649		VACANT LOT	4801-4815 W WASHINGTON BLVD		CHICAGO	IL	
60644	1007570013	ILR000131136	WASHINGTON COURT APARTMENTS	5430 W WASHINGTON		CHICAGO	IL	RCRA-CESQG
60644	1007692500	110018383257	WASHINGTON COURT APARTMENTS	5430 W WASHINGTON BLVD		CHICAGO	IL	FINDS
60644	S113269657		WASHINGTON COURT APARTMENTS	5430 W WASHINGTON BLVD		CHICAGO	IL	
60644	U003763031	2040358	5501 W WASHINGTON BUILDING	5501 W WASHINGTON ST		CHICAGO	IL	UST
60644	1011982489	110037885241	ROCK OF OUR SALVATION CHURCH	5618 W WASHINGTON BLVD		CHICAGO	IL	FINDS
60644	1018878854		LUCKETT WENDELL	4742 W WEST END AVE		CHICAGO	IL	
60644	S113269660		VACANT LOT	4600 W WILCOX	**	CHICAGO	IL	
60651	S108111032		CHICAGO AVE/HOMAN AVE		**	CHICAGO	IL	SWF/LF
60651	1014940771				**	CHICAGO	IL	DOT OPS
60651	1014940802				**	CHICAGO	IL	DOT OPS
60651	1018529142		COMMUNITY TAILOR & CLEANERS	5010 WEST 16TH ST		CHICAGO	IL	
60651	1017797668	110063906313	IDOT 82622 FAP 307-K-5 CONSTRUCTION	RTE 307-E OF AUSTIN-RTE 50, RTE 64-N A	**	CHICAGO	IL	FINDS
60651	1022154760		PAULS SHELL SERVICE	4002-8	**	CHICAGO	IL	
60651	S104525231		NORTHWESTERN SALT COMPANY	4343 WEST 5TH AVENUE		CHICAGO	IL	SRP, LUST
60651	U003668738	2038930	2040155	3434 NORTH ASHLAND AVENUE		CHICAGO	IL	LUST, UST
60651	1000442257	ILD005122163	PLAYSKOOL INC	4501 W AUGUSTA BLVD	L, NNW, 1/4 - 1/2	CHICAGO	IL	CORRACTS, CERCLIS-NFRAP, RCRA-NonGen
60651	1009075385		A&G AUTO SPECIALIST	3301 W AUGUSTA BLVD		CHICAGO	IL	
60651	1009646231			4414 W AUGUSTA BLVD		CHICAGO	IL	DOT OPS
60651	U000791569	2013650	HUDSON SCREW MACHINE PRODUCTS	4500 W AUGUSTA BLVD		CHICAGO	IL	UST
60651	1004478585	110009379047	HUDSON SCREW MACHINE PRODUCTS C	4500 W AUGUSTA BLVD		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S111885916		SHARPER FINISH	4500 W AUGUSTA BLVD		CHICAGO	IL	
60651	1001653027		HUDSON SCREW MACHINE PROD.	4500 WEST AUGUSTA BLVD.	L, NNW, 1/4 - 1/2	CHICAGO	IL	LUST
60651	1016103704	110001810229	PLAYSKOOL INC	4501 W AUGUSTA		CHICAGO	IL	FINDS
60651	S113266801		PLAYSKOOL INC	4501 W AUGUSTA BLVD		CHICAGO	IL	
60651	S113708620		WALNUT STREET PROPERTIES	4501 W AUGUSTA BLVD-B		CHICAGO	IL	
60651	1015830974	110046379361	WALNUT STREET PROPERTIES	4501 W AUGUSTA BLVD-B		CHICAGO	IL	FINDS
60651	S104523629		PLAYSKOOL, INC.-NORTH PARCEL	4501 WEST AUGUSTA BOULEVARD	L, NNW, 1/4 - 1/2	CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60651	1009072688		ABM SERVICE CENTER	4540 W AUGUSTA BLVD		CHICAGO	IL	
60651	1008134394	110018310790	WHOLESALE OIL CO	4540 W AUGUSTA BLVD		CHICAGO	IL	FINDS
60651	U003152229	2021487	WHOLESALE OIL CO	4540 W AUGUSTA BLVD		CHICAGO	IL	UST
60651	S104530097		WHOLESALE OIL CO.	4540 WEST AUGUSTA BLVD.	N, NNW, 1/4 - 1/2	CHICAGO	IL	LUST
60651	1008137761	110018344629	SCENTEX INC	4545 AUGUSTA BLVD		CHICAGO	IL	FINDS
60651	S113269108		SCENTEX INC	4545 AUGUSTA BLVD		CHICAGO	IL	
60651	1004694114	ILD984888495	SCENTEX INC	4545 W AUGUSTA		CHICAGO	IL	RCRA-CESQG
60651	U000792073	2030163	SCENTEX INC	4545 W AUGUSTA BLVD		CHICAGO	IL	UST
60651	S104524870		SCENTEX INC.	4545 WEST AUGUSTA BLVD.	44, NNW, 1/4 - 1/2	CHICAGO	IL	LUST
60651	S113269619		WHOLESALE OIL CO	4560 W AUGUSTA BLVD		CHICAGO	IL	
60651	1008134388	110018310745	WHOLESALE OIL CO	4560 W AUGUSTA BLVD		CHICAGO	IL	FINDS
60651	U001143319	2021492	WHOLESALE OIL CO.	4560 W. AUGUSTA BLVD.		CHICAGO	IL	UST
60651	S104530096		WHOLESALE OIL CO.	4560 WEST AUGUSTA BLVD.	N, NNW, 1/4 - 1/2	CHICAGO	IL	LUST
60651	S112363326		A E STALEY - INDUSTRIAL PRODUCTS DIV	4614 W AUGUSTA BLVD		CHICAGO	IL	
60651	1004479974	110001824090	A E STALEY - INDUSTRIAL PRODUCTS DIV	4614 W AUGUSTA BLVD		CHICAGO	IL	AIRS, FINDS
60651	S104527792		AE STALEY	4616 WEST AUGUSTA BLVD.	53, NNW, 1/2 - 1	CHICAGO	IL	LUST
60651	1000438977	110005816153	FLEX-O-GLASS INC	4647 W AUGUSTA BLVD		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S113269072		FLEX-O-GLASS INC	4647 W AUGUSTA BLVD		CHICAGO	IL	
60651	1008123949	110018205930	TREATMENT PRODUCTS LTD	4701 W AUGUSTA BLVD		CHICAGO	IL	FINDS
60651	1008880482	ILR000138099	TREATMENT PRODUCTS LTD	4701 W AUGUSTA BLVD		CHICAGO	IL	RCRA-CESQG
60651	S113269611		TREATMENT PRODUCTS LTD	4701 W AUGUSTA BLVD		CHICAGO	IL	
60651	1023390841	110067091630	NEUMATTER METHODS LLC	4701 W. AUGUSTA BLVD.		CHICAGO	IL	FINDS
60651	S113269518		CRUMB RUBBER INC	4722 W AUGUSTA BLVD		CHICAGO	IL	
60651	1008134217	110018309016	CRUMB RUBBER INC	4722 W AUGUSTA BLVD		CHICAGO	IL	FINDS
60651	1012178666	ILR000157412	COMED MANHOLE	5011 W AUGUSTA		CHICAGO	IL	RCRA-NonGen
60651	S110859297		COMED MANHOLE	5011 W AUGUSTA		CHICAGO	IL	
60651	S113269396		ABANDON HOUSE	5439 W AUGUSTA		CHICAGO	IL	
60651	U003907967	2041640	NEW HOPE INSP BPTIST CHUCH	5801 W AUGUSTA BLVD		CHICAGO	IL	UST
60651	S113269515		HENRY'S AUTO REPAIR	5845 W AUGUSTA BLVD		CHICAGO	IL	
60651	1020818858		DUFFY'S PURE OIL STATION	5847 N AUGUSTA BLVD		CHICAGO	IL	
60651	1008122666	110018193079	APARTMENT BUILDING	1022-1024 N AUSTIN BLVD		CHICAGO	IL	FINDS
60651	S113269519		APARTMENT BUILDING	1022-1024 N AUSTIN BLVD	**	CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	1008134342	110018310264	EQ SVC	102224 N AUSTIN		CHICAGO	IL	FINDS
60651	S113269567		EQ SVC	102224 N AUSTIN	**	CHICAGO	IL	
60651	1020035540		MARSHALLS DRY CLEANING	1151 N AUSTIN BLVD		CHICAGO	IL	
60651	1019932806		AUSTIN TAILOR SHOP	1207 AUSTIN		CHICAGO	IL	
60651	S113269522		MDS ENGINEERS & CONSULTANTS PC	1533 N AUSTIN BLVD		CHICAGO	IL	
60651	1018574504		TIP TOP CLEANERS	1555 AUSTIN AV		CHICAGO	IL	
60651	1014704487	110042177783	1908 W BELMONT	1908 W BELMONT		CHICAGO	IL	FINDS
60651	U003152228	2021469	CITGO	4357 W. BELMONT		CHICAGO	IL	UST
60651	1004475852	110010593768	JAN SMOLEN	PO BOX 417368	**	CHICAGO	IL	ICIS, FINDS
60651	S113269171		CHICAGO, CITY OF-FORMERLY	1135 N CENTRAL AVE-SPILL		CHICAGO	IL	
60651	U001143318	2021475	POWER KING SERVICE STATION	1155 N CENTRAL		CHICAGO	IL	UST
60651	1009073006		TONYS AUTO CLINIC	1155 N CENTRAL AVE		CHICAGO	IL	
60651	1004698124	110003062364	SHELL SERVICE STATION	1201 N CENTRAL		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S111909208		SHELL OIL CO	1201 N CENTRAL		CHICAGO	IL	
60651	1009074239		THOMAS JOSEPH & CHANDY JOSEPH	1201 N CENTRAL AVE		CHICAGO	IL	
60651	S104792675		EQUIVA SERVICES LLC	1201 NORTH CENTRAL AVE.		CHICAGO	IL	LUST
60651	U000792119	2021027	SUPER FUEL	1201 NORTH CENTRAL DIVISION		CHICAGO	IL	UST
60651	1021080668		THOMAS JOSEPH & CHANDY JOSEPH	1203 N CENTRAL AVE		CHICAGO	IL	
60651	1000143172	110005827454	SPRA-RITE INC	1240 N CENTRAL PARK		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269076		SPRA-RITE INC	1240 N CENTRAL PARK	**	CHICAGO	IL	
60651	1010418871	110032948309	NORA TIRE RECYCLING & DISPOSAL	1241 N CENTRAL		CHICAGO	IL	FINDS
60651	S113269062		NORA TIRE RECYCLING & DISPOSAL	1241 N CENTRAL		CHICAGO	IL	
60651	1000359856	110005859856	AMERICAN FOTOKEMI INC	1250 N CENTRAL PARK AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	1008117649	110018142650	ELITE FABRICATIONS INC	1250 N CENTRAL PARK AVE		CHICAGO	IL	FINDS
60651	S111905611		ELITE FABRICATIONS INC	1250 N CENTRAL PARK AVE		CHICAGO	IL	
60651	U003668741	2038934	ELITE FABRICATION, INC.	1250 NORTH CENTRAL PARK		CHICAGO	IL	LUST, UST
60651	1022076369		GEORGE & NICKS SERVICE STATION	1551 N CENTRAL AVE		CHICAGO	IL	
60651	S111921480		MILLER JR, LEO J	2933 N CENTRAL AVE		CHICAGO	IL	
60651	S108891444		MILLER, LEO J. JR.	2933 NORTH CENTRAL AVENUE		CHICAGO	IL	LUST
60651	1010038901	110028269763	ADVANCE AUTO PARTS 6532	2946 N CENTRAL AVE		CHICAGO	IL	FINDS
60651	S113269153		ADVANCE AUTO PARTS 6532	2946 N CENTRAL AVE		CHICAGO	IL	
60651	1010317055	ILR000141838	CHICAGO TRANSIT AUTHORITY	300-302 W CHICAGO AVE		CHICAGO	IL	RCRA-NonGen
60651	S113269161		CHICAGO TRANSIT AUTHORITY	300-302 W CHICAGO AVE	**	CHICAGO	IL	
60651	S111920681		MIDWEST FENCE	3319 W CHICAGO		CHICAGO	IL	
60651	S108255681		MIDWEST FENCE	3319 WEST CHICAGO AVENUE		CHICAGO	IL	SRP, LUST
60651	1018886719		CHICAGO CLEANERS	3335 W CHICAGO AVE		CHICAGO	IL	
60651	S120826169		RESILIENT CORRIDOR-SITE 2	3342-3344 WEST CHICAGO AVENUE		CHICAGO	IL	SRP
60651	S113269531		ROJAS AUTO REBUILDERS	3347 W CHICAGO AVE		CHICAGO	IL	
60651	1000614203	110005901480	ROJAS AUTO BODY	3347 W CHICAGO AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1008150853	110018476736	ROJAS AUTO REBUILDERS	3347 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	1019941537		BON-RICS ELITE CLEANERS	3455 W CHICAGO		CHICAGO	IL	
60651	1020039963		MI CLEANERS	3500 W CHICAGO AVE		CHICAGO	IL	
60651	S113269174		VACANT LOT	3516-3520 W CHICAGO		CHICAGO	IL	
60651	S111889065		AMOCO 15944	3601 W CHICAGO		CHICAGO	IL	
60651	1009074368		YORKS ARCO	3601 W CHICAGO		CHICAGO	IL	
60651	1000862311	110005927952	AMOCO 15944	3601 W CHICAGO AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S104523582		AMOCO OIL CO. #15944	3601 WEST CHICAGO AVE.		CHICAGO	IL	LUST
60651	S113269534		STAR CLEANERS	3638 W CHICAGO AVE		CHICAGO	IL	
60651	1000351022	110005864564	STAR CLEANERS	3638 W CHICAGO AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S108536298	3716-5887-01	STAR CLEANERS	3638 WEST CHICAGO AVENUE		CHICAGO	IL	SRP
60651	1020094630		STARS CLEANERS	3640 CHICAGO AVE		CHICAGO	IL	
60651	1020160407		CUBS PARK SERVICE STATION	3650 W CHICAGO AVE		CHICAGO	IL	
60651	S113269136		VACANT LOT	3744 W CHICAGO		CHICAGO	IL	
60651	1009072067		C & R SHELL AUTO CARE SERVICE	3759 W CHICAGO AVE		CHICAGO	IL	
60651	S120826168		RESILIENT CORRIDOR-SITE 1B	3802-04 WEST CHICAGO AVENUE		CHICAGO	IL	SRP
60651	S117495160		RESILIENT CORRIDOR-SITE 1A	3812 WEST CHICAGO AVENUE		CHICAGO	IL	SRP
60651	1020018436		KELLYS CLEANERS	3821 W CHICAGO AVE		CHICAGO	IL	
60651	S113269743		VACANT LOT	3903 W CHICAGO AVE		CHICAGO	IL	
60651	1017816305	110064440083	3920 W CHICAGO	3920 W CHICAGO		CHICAGO	IL	FINDS
60651	1019991647		FREEMANS CLEANERS	3921 W CHICAGO AVE		CHICAGO	IL	
60651	1019970173		DE ROSA & SONS	3925 W CHICAGO		CHICAGO	IL	
60651	1021085012		MR KWICK CAR WASH	3938 W CHICAGO AVE		CHICAGO	IL	
60651	1020809259		PAULS SHELL SERVICE	4000 W CHICAGO AVE		CHICAGO	IL	
60651	S113269095		SHELL OIL CO	4002 W CHICAGO & PULASKI	**	CHICAGO	IL	
60651	1008129412	110018260754	SHELL OIL CO	4002 W CHICAGO & PULASKI		CHICAGO	IL	FINDS
60651	1001087177	110005942659	SHELL	4002 W CHICAGO AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	U001143114	2021037	AT THE CORNER PHILLIPS 66	4002 WEST CHICAGO AVENUE		CHICAGO	IL	UST
60651	1004479188	110011838814	CARC/SOL SCHOOL	4014 W CHICAGO		CHICAGO	IL	FINDS
60651	1015850464	110055069205	CHICAGO REAL ESTATE RESOURCES	4014 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S113807992		CHICAGO REAL ESTATE RESOURCES	4014 W CHICAGO AVE		CHICAGO	IL	
60651	U004194505		ALL THINGS POSSIBLE DAY CARE	4014 W. CHICAGO AVE.		CHICAGO	IL	UST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	S113427576		CHICAGO REAL ESTATE RESOURCES	4014 WEST CHICAGO AVENUE	55, East, 1/2 - 1	CHICAGO	IL	LUST
60651	S113269541		CLAYSON LORENZ CO	4048 W CHICAGO AVE		CHICAGO	IL	
60651	1008134285	110018309702	CLAYSON LORENZ CO	4048 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S113266015		PMR CORP	4105 W CHICAGO AVE		CHICAGO	IL	
60651	1000109144	110005812120	PMR CORP/SIMMONS REFING CO	4105 W CHICAGO AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	U001142573	2030106	HOSPITAL LAUDRY SER	4141 W CHICAGO AVE		CHICAGO	IL	UST
60651	S111888083		HOSPITAL LAUNDRY SERVICE	4141 W CHICAGO AVE		CHICAGO	IL	
60651	S104523834		HOSPITAL LAUNDRY SERVICES	4141 WEST CHICAGO AVE.	35, East, 1/4 - 1/2	CHICAGO	IL	LUST
60651	1004473297	110001380265	HOSPITAL LAUNDRY SERVICE	4141 WEST CHICAGO AVENUE		CHICAGO	IL	FINDS
60651	1004478885	110011514959	WESTSIDE PREP SCHOOL	4146 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	U003987960	2042615	FORMER SWISS VALLEY DAIRY	4155 W. CHICAGO AVENUE	K, ENE, 1/4 - 1/2	CHICAGO	IL	UST
60651	1004478547	110018248840	COUNTRY'S DELIGHT DAIRY	4201 W CHICAGO		CHICAGO	IL	FINDS
60651	S107741178	2904	PS COYOTE INC	4201 W CHICAGO		CHICAGO	IL	AIRS
60651	U001142103	2010448	COUNTRY DELIGHT	4201 W CHICAGO AVE	K, ENE, 1/8 - 1/4	CHICAGO	IL	UST
60651	1008123721	110018203638	CERTIFIED GROCERS	4206 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S111881789		CERTIFIED GROCERS	4206 W CHICAGO AVE		CHICAGO	IL	
60651	S104525568		CERTIFIED GROCERS	4206 WEST CHICAGO AVE.	K, ENE, 1/4 - 1/2	CHICAGO	IL	LUST
60651	U003715237	2039526	BECKER'S DAIRY	4224 W CHICAGO AVE		CHICAGO	IL	UST
60651	S104529972		L. PRITIKIN & BECKER	4224 WEST CHICAGO	38, East, 1/4 - 1/2	CHICAGO	IL	LUST
60651	S113266330		F&B MFG CO	4248 W CHICAGO AVE		CHICAGO	IL	
60651	1000103708	110005843427	F&B MFG CO	4248 W CHICAGO AVE	19, ENE, 1/8 - 1/4	CHICAGO	IL	RCRA-NonGen, FINDS
60651	1000823882	110005915180	MOORE SUPPLY CO	4318 W CHICAGO AVE	B, NE, 1/8 - 1/4	CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	U001142848	2031171	MOORE SUPPLY CO	4318 W CHICAGO AVE	B, NE, 1/8 - 1/4	CHICAGO	IL	UST
60651	U003668496	2038571	FLORENCE MACARONI INC	4334 W CHICAGO AVE	A, NNE, 1/8 - 1/4	CHICAGO	IL	UST
60651	S111903012		FLORENCE MACARONI CO	4346 W CHICAGO		CHICAGO	IL	
60651	S104529194		FLORENCE MACARONI CO.	4346 WEST CHICAGO	A, NNE, 0 - 1/8	CHICAGO	IL	LUST
60651	1008134833	110018315205	CTA CHICAGO & PULASKI BUS GARAGE	4401 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S111886289		CTA CHICAGO & PULASKI BUS GARAGE	4401 W CHICAGO AVE		CHICAGO	IL	
60651	1000824678	110005920600	CHICAGO TRANSIT AUTHORITY	4401 WEST CHICAGO AVE.	2, North, 0 - 1/8	CHICAGO	IL	RCRA-NonGen, FINDS, LUST
60651	U004191082		MACHINE SHOP	4416 W. CHICAGO AVENUE	5, NNW, 1/8 - 1/4	CHICAGO	IL	UST
60651	S113269521		ELECTRONIC RECOVERY	4444 W CHICAGO AVE		CHICAGO	IL	
60651	1004692256	110005795194	FEDERAL ARMORED EXPRESS	4500 W CHICAGO AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	U001629861	2032579	DUNBAR ARMORED	4500 W. CHICAGO AVE.	I, NW, 1/8 - 1/4	CHICAGO	IL	UST
60651	S107740733	13602	CHICAGO RECYCLING ASSOC LTD PART	4501 W CHICAGO AVE	I, NW, 1/8 - 1/4	CHICAGO	IL	AIRS
60651	1004474543	110001363658	CHICAGO RECYCLING ASSOC. LTD. PART	4501 WEST CHICAGO AVENUE		CHICAGO	IL	FINDS
60651	S110152699		FREEDMAN SEATING CO.	4544 W. CHICAGO AVE.		CHICAGO	IL	TIER 2
60651	1012087361	110038507292	4600 W CHICAGO AVE	4600 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S113269180		4600 W CHICAGO AVE	4600 W CHICAGO AVE		CHICAGO	IL	
60651	1020788198		GOMEZ TRANSMISSIONS	4600 W CHICAGO AVE		CHICAGO	IL	
60651	1015942701	110054927781	GOMEZ RECYCLING	4600 W CHICAGO AVENUE		CHICAGO	IL	FINDS
60651	S113269603		ADVANCE EQUIPMENT MFG CO	4615 W CHICAGO AVE		CHICAGO	IL	
60651	1004696330	110005960068	ADVANCE EQUIPMENT MFG CO	4615 W CHICAGO AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1008340624	60651CHRMM46	CHROMIUM INDUSTRIES INC	4645 W CHICAGO AVE		CHICAGO	IL	AIRS, TIER 2, TRIS
60651	U001142294	2020012	CHROMIUM INDUSTRIES LLC	4645 W CHICAGO AVE		CHICAGO	IL	AIRS, UST
60651	1000334784	ILD045683471	CHROMIUM INDUSTRIES LLC	4645 W CHICAGO AVE		CHICAGO	IL	RCRAInfo-LQG
60651	1016082472	110000435930	CHROMIUM INDUSTRIES LLC	4645 W. CHICAGO AVE.		CHICAGO	IL	FINDS
60651	S110151620		CHROMIUM INDUSTRIES INC.	4645 W. CHICAGO AVENUE		CHICAGO	IL	TIER 2
60651	1021434510		O J UNION 76 SERVICE CENTER	4701 W CHICAGO AVE		CHICAGO	IL	
60651	U001142741	2008736	CHICAGO & KILPATRICK	4701 W CHICAGO AVE		CHICAGO	IL	UST
60651	S113269071		CARL GOLDBERG MODELS INC	4734 W CHICAGO AVE		CHICAGO	IL	
60651	1000185039	110005812095	CARL GOLDBERG MODELS INC	4734 W CHICAGO AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	1008134376	110018310629	CHICAGO, CITY OF	4830 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S111902251		CHICAGO, CITY OF	4830 W CHICAGO AVE		CHICAGO	IL	
60651	U000173357	2018786	DEPT STREETS & SANITATION	4830 W CHICAGO AVE		CHICAGO	IL	UST
60651	S105225832		CHICAGO, CITY OF	4830 WEST CHICAGO AVE.		CHICAGO	IL	LUST
60651	S113269149		WEST CHICAGO BRANCH LIBRARY	4856 W CHICAGO AVE		CHICAGO	IL	
60651	S113269172		CHICAGO, CITY OF GENERAL SVCS	4900 W CHICAGO AVE		CHICAGO	IL	
60651	1008150496	110018473169	IEPA OER	5035 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S111881480		IEPA OER	5035 W CHICAGO AVE		CHICAGO	IL	
60651	1018485990		CHICAGO CLEANERS	5054 W CHICAGO AV		CHICAGO	IL	
60651	1021745924		JOHNS STANDARD SERVICE	5056 W CHICAGO AVE 2		CHICAGO	IL	
60651	S113269601		ANTHONY CLEANERS	5136 W CHICAGO		CHICAGO	IL	
60651	1004697262	110003054202	ANTHONY'S CLEANERS	5136 W CHICAGO		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1018728928		MR ANTHONY CLEANERS	5136 W CHICAGO AVE		CHICAGO	IL	
60651	S111009294		MR ANTHONY'S CLEANERS	5136 WEST CHICAGO		CHICAGO	IL	
60651	1000979063	110005806832	SHELL OIL CO	5150 W CHICAGO		CHICAGO	IL	DRYCLEANERS
60651	1008122991	110018196307	EQUIVA SERVICES LLC	5150 W CHICAGO & LARAMIE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S113269554		EQUIVA SERVICES LLC	5150 W CHICAGO & LARAMIE	**	CHICAGO	IL	FINDS
60651	U000865807	2021035	CITGO GAS STATION	5150 WEST CHICAGO AVENUE		CHICAGO	IL	LUST, UST
60651	1011853034	110037152041	MCDONALDS RESTAURANT	5153 W CHICAGO AVE		CHICAGO	IL	FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	1018659956		KINGS CLEANERS	5256 W CHICAGO AVE		CHICAGO	IL	
60651	1015818114	110054635980	NEW MOMS	5317 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S113708621		NEW MOMS	5317 W CHICAGO AVE		CHICAGO	IL	
60651	S111902626		CHICAGO DEPT OF ENV	5327 W CHICAGO AVE		CHICAGO	IL	
60651	1008134378	110018310656	CHICAGO DEPT OF ENV	5327 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S105225842		CHICAGO DEPARTMENT OF ENVIRONMEI	5327 WEST CHICAGO AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60651	S111904874		TONYS GAS	5335 W CHICAGO AVE		CHICAGO	IL	
60651	1008134381	110018310674	TONYS GAS	5335 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	U002222598	2034137	LOREL AVENUE FOOD MART, INC. (VALEF	5335 W. CHICAGO AVENUE		CHICAGO	IL	LUST, UST
60651	S110151562		CHICAGO AVE	5336 W. CHICAGO AVE		CHICAGO	IL	TIER 2
60651	S110151475		CENTRAL & AUGUSTA	5336 W. CHICAGO AVE.		CHICAGO	IL	TIER 2
60651	S113269536		ACEC CORP	5352 W CHICAGO AVE		CHICAGO	IL	
60651	1008123900	110018205431	ACEC CORP	5352 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S104528068		AUSTIN CARRIER CTR.	5352 WEST CHICAGO AVE.		CHICAGO	IL	LUST
60651	1001218640	110005959203	ALLIANCE FRANCAIS DE CHICAGO	54 W CHICAGO AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S113269598		ALLIANCE FRANCAISE DE CHICAGO	54 W CHICAGO AVE		CHICAGO	IL	
60651	1016702017	110056416301	FAMILY DOLLAR INC 2458	5410 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S116677448		FAMILY DOLLAR INC 2458	5410 W CHICAGO AVE		CHICAGO	IL	
60651	1020131463		D & B SERVICE STATION	5431 W CHICAGO AVE		CHICAGO	IL	
60651	1004696257	110005958160	WALGREENS #0230	5518 W CHICAGO		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269595		WALGREENS 0230	5518 W CHICAGO		CHICAGO	IL	
60651	1020008548		IDEEL CLEANERS	5605 W CHICAGO AVE		CHICAGO	IL	
60651	1020526764		OATIS GEORGE	5625 W CHICAGO		CHICAGO	IL	
60651	S113269525		RJ ROOFING	5910 W CHICAGO AVE		CHICAGO	IL	
60651	1008134223	110018309070	RJ ROOFING	5910 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	S113269634		DOUBLE DOOR DRY CLEANERS	5925 W CHICAGO AVE		CHICAGO	IL	
60651	1009186425		DOUBLE DOOR DRY CLEANER INC	5925 W CHICAGO AVE		CHICAGO	IL	
60651	1004698692	110012270540	DOUBLE DOOR DRY CLEANERS	5925 W CHICAGO AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269606		VACANT LOT	5928 W CHICAGO		CHICAGO	IL	
60651	1019994611		GENERAL CONTINENTAL CLEANERS	5952 W CHICAGO AVE		CHICAGO	IL	
60651	S116677451	110059728718	SALVATION ARMY	825 N CHRISTIANA AVE		CHICAGO	IL	FINDS
60651	1016872926		SALVATION ARMY	825 N CHRISTIANA AVE		CHICAGO	IL	UST
60651	U004223332		SALVATION ARMY STORE	825 N. CHRISTIANA AVE.		CHICAGO	IL	LUST
60651	S116758479		SALVATION ARMY - FREEDOM CENTER	825 NORTH CHRISTIANA AVENUE		CHICAGO	IL	SRP
60651	S120826167		SALVATION ARMY ASSESSMENT CTR	924 N CHRISTIANA AVE		CHICAGO	IL	LUST TRUST, LUST, UST
60651	U000790871	2022945	SANTHOM, INC.	1001 N. CICERO AVE.		CHICAGO	IL	AIRS, ICIS, FINDS
60651	1004477855	110001812389	INTERNATIONAL FREEZER CORP-FREEZ	1013 N CICERO AVE		CHICAGO	IL	FINDS
60651	1014702675	110043543644	DYNACRON	1017 N CICERO AVE		CHICAGO	IL	
60651	S113269177		DYNACRON	1017 N CICERO AVE		CHICAGO	IL	
60651	1014472076	ILR000165456	DYNACRON	1017 N CICERO AVE		CHICAGO	IL	RCRA-CESQG
60651	S113266095		NATIONAL CAN CORP	1031 N CICERO AVE		CHICAGO	IL	
60651	1000260242	110005834357	NATIONAL CAN CORP	1031 N CICERO AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	U001142867	2013664	CICERO AVENUE PROPERTIES I, LP	1031 NORTH CICERO AVENUE		CHICAGO	IL	UST
60651	S109528236		NATIONAL CAN CORPORATION	1031 NORTH CICERO AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, UST
60651	U001142458	2020154	FLEX-O-GLASS	1100 N. CICERO AVE.		CHICAGO	IL	
60651	S111888570		SHELL OIL CO	1150 N CICERO AVE		CHICAGO	IL	
60651	1015742531	ILR000103622	SHELL OIL PRODUCTS US	1150 N CICERO AVE		CHICAGO	IL	RCRA-NonGen
60651	1016094333	110003062373	SHELL OIL CO	1150 N CICERO AVE		CHICAGO	IL	FINDS
60651	1020645944		MARATHON DIVISON CICERO	1150 N CICERO AVE		CHICAGO	IL	
60651	U001143087	2021025	MOBIL	1150 NORTH CICERO		CHICAGO	IL	LUST, UST
60651	1004696648	110009385842	ERICKSON COSMETICS	1155 N CICERO		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1008120825	110018174526	CHICAGO COSMETICS LLC	1155 N CICERO AVE		CHICAGO	IL	FINDS
60651	S107743597	3303	CHICAGO COSMETICS LLC	1155 N CICERO AVE		CHICAGO	IL	AIRS
60651	U004022812	2043047	WAREHOUSE	1155 N. CICERO AVENUE		CHICAGO	IL	UST
60651	S104523060		LEAF INC.	1155 NORTH CICERO AVE.		CHICAGO	IL	LUST
60651	1009460449	110024850026	LA BENDICION	1200 N CICERO		CHICAGO	IL	FINDS
60651	S113269654		LA BENDICION	1200 N CICERO		CHICAGO	IL	
60651	1008151401	110018482257	ANCHOR BOARD UP	1310 N CICERO		CHICAGO	IL	FINDS
60651	1000356531	110005864788	IMPRESSIONS HANDPRINTERS	1310 N CICERO		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269074		ANCHOR BOARD UP	1310 N CICERO		CHICAGO	IL	
60651	S105155410		ANCHOR BOARD-UP COMPANY	1310 NORTH CICERO AVE.		CHICAGO	IL	LUST
60651	S113269151		RESIDENTIAL BUILDING	1348 N CICERO		CHICAGO	IL	
60651	U004196113		TRUST 5025683, LLC, SERIES 1400 N. CICI	1400 N. CICERO AVE.		CHICAGO	IL	UST
60651	S110151694		COCA-COLA BOTTLING COMPANY OF CH	1401 CICERO		CHICAGO	IL	TIER 2
60651	1000207656	ILD005146592	UNILEVER HOME & PERSONAL CARE	1401 N CICERO		CHICAGO	IL	RCRA-NonGen
60651	1018155973	ILR000189423	MLRP MERLIN LLC	1401 N CICERO		CHICAGO	IL	RCRAInfo-SQG
60651	1011840692		UNILEVER CHICAGO CONSOLIDATED DIS	1401 N CICERO AVENUE		CHICAGO	IL	RMP
60651	1008124261	110018209071	MIDWEST COCA-COLA BOTTLING COMPA	1401 N. CICERO		CHICAGO	IL	AIRS, TIER 2, FINDS
60651	S118838447		GREAT LAKES COCA-COLA - CHICAGO	1401 N. CICERO		CHICAGO	IL	TIER 2

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	S111922572		PALM REALTY	1434 N CICERO AVE		CHICAGO	IL	
60651	S108891456		PALM REALTY	1434 NORTH CICERO AVENUE		CHICAGO	IL	LUST
60651	U000173737	2010599	INSTANTWHIP-CHICAGO INC	1535 N CICERO AVE		CHICAGO	IL	UST
60651	U020559588		REEDS SHELL STATION	801 N CICERO AVE		CHICAGO	IL	
60651	U001142785	2021028	CHICAGO AVENUE MARATHON	801 N. CICERO AVE.		CHICAGO	IL	UST
60651	S104529894		MARTIN OIL	801 NORTH CICERO AVE.		CHICAGO	IL	LUST
60651	1014704329	110043420937	FORMER SPEEDWAY 8337	801-805 N CICERO AVE		CHICAGO	IL	FINDS
60651	S111909088		SPEEDWAY-FORMERLY	801-805 N CICERO AVE		CHICAGO	IL	
60651	1008147520	110018443344	SPEEDWAY-FORMERLY	801-805 N CICERO AVE		CHICAGO	IL	FINDS
60651	1004696000	ILR000035113	FORMER SPEEDWAY 8337	801-805 N CICERO AVE		CHICAGO	IL	RCRA-NonGen
60651	S104522001		SPEEDWAY SUPERAMERICA	801-805 NORTH CICERO AVE.		CHICAGO	IL	LUST
60651	S111910077		CHICAGO VENTURE	821 N CICERO AVE		CHICAGO	IL	
60651	S105060091		CHICAGO VENTURE	821 NORTH CICERO AVE.		CHICAGO	IL	LUST
60651	1020847506		MACS TEXACO SERVICE STATION	831 N CICERO AVE		CHICAGO	IL	
60651	1001213565	110005958268	RR ROOFING & CONSTRUCTION	834 N CICERO		CHICAGO	IL	RCRA-NonGen, FINDS
60651	U003667739	2036534	SHOP	834 N CICERO AVE		CHICAGO	IL	UST
60651	S111899406		RR ROOFING & CONSTRUCTION CO	834 N CICERO AVE		CHICAGO	IL	
60651	1020298074		NINE SISTERS LAUNDERETTE CLRS	900 N CICERO		CHICAGO	IL	
60651	S111879239		JUAREZ AUTO SALES & REPAIRS	900 N CICERO AVE		CHICAGO	IL	
60651	1000462983	110005884034	JUAREZ AUTO SALES & REPAIRS	900 N CICERO AVE		CHICAGO	IL	RCRA-CESQG, FINDS, LUST
60651	U004118755		INDUSTRIAL BUILDING	933 N. CICERO AVENUE		CHICAGO	IL	UST
60651	S111906631		CHICAGO PUBLIC SCHOOLS	938-956 N CICERO AVE		CHICAGO	IL	
60651	U003762816	2039979	FORMER BELKE MANUFACTURING	944-48 N CICERO NEW MCNAIR SCHOOL :		CHICAGO	IL	UST
60651	S113269627		MCNAIR SCHOOL	944-958 N CICERO AVE		CHICAGO	IL	
60651	S104492244		MCNAIR SCHOOL	944-958 NORTH CICERO AVENUE		CHICAGO	IL	SRP
60651	1017816626	110064443614	MLRP MELIN LLC	1401 N CICERO-B		CHICAGO	IL	FINDS
60651	1018112559		MLRP MELIN LLC	1401 N CICERO-B		CHICAGO	IL	
60651	S118661266		MLRP MERLIN LLC	1401 N CICERO-B		CHICAGO	IL	
60651	1000109177	110005869364	MAR COR INDUSTRIES INC	4501 W CORTEZ		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S113269059		MAR-COR INDUSTRIES INC	4501 W CORTEZ ST		CHICAGO	IL	
60651	S113268775		4600 W CORTLAND DUMP	4600 W CORTLAND		CHICAGO	IL	
60651	S113269101		ANIXTER CENTER	3207-3209 W CRYSTAL		CHICAGO	IL	
60651	1008133650	110018303316	ANIXTER CENTER	3207-3209 W CRYSTAL		CHICAGO	IL	FINDS
60651	S111914620		CHICAGO, CITY OF ABANDONMENT	5318 W CRYSTAL		CHICAGO	IL	
60651	1006930440	ILR000123075	CHICAGO, CITY OF ABANDONMENT	5318 W CRYSTAL		CHICAGO	IL	RCRAInfo-SQG
60651	1004473296	110001292529	RAINBOW LAUNDRY & DRY CLEANERS	4307 W DIV ST		CHICAGO	IL	AIRS, FINDS
60651	1010152807	110030120562	PARTY HOUSE CATERING	6112 W DIVERSEY		CHICAGO	IL	FINDS
60651	1001232079	110003046597	DIVISION AUTO REPAIR	3353 W DIVISION ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S111903064		DIVISION AUTO REPAIR	3353 W DIVISION ST		CHICAGO	IL	
60651	U003668493	2038568	DIVISION AUTO	3353 WEST DIVISION		CHICAGO	IL	LUST, UST
60651	U001142065	2025444	BURKE DISPLAY MANUFACTURING	3401 W DIVISION ST		CHICAGO	IL	UST
60651	S111878200		BURKE COMMUNICATION INDUSTRIES	3401 W DIVISION ST		CHICAGO	IL	
60651	1001651226		BURKE COMMUNICATIONS	3401 WEST DIVISION		CHICAGO	IL	LUST
60651	S113807986		NEW LIFE CONVENANT CHURCH	3410 W DIVISION		CHICAGO	IL	
60651	1015850430	110055068741	NEW LIFE CONVENANT CHURCH	3410 W DIVISION		CHICAGO	IL	FINDS
60651	U004194492		OLD FORMER FURNITURE WAREHOUSE	3410 W. DIVISION		CHICAGO	IL	UST
60651	S113427575		NEW LIFE CONVENANT CHURCH	3410 WEST DIVISION		CHICAGO	IL	LUST
60651	1019959107		CNB DRY CLEANERS	3728 W DIVISION ST		CHICAGO	IL	
60651	1009072372		DIVISION HAML I SERVICE STN	3800 W DIVISION		CHICAGO	IL	
60651	U001143311	2021478	HAMLIN-DIVISION	3800 W DIVISION ST		CHICAGO	IL	UST
60651	S113269125		VACANT LOT	3813-25 W DIVISION		CHICAGO	IL	
60651	U003888415	2041482	MIDTOWN FOODS	3855 W DIVISION THRID PARTY REMOVAL		CHICAGO	IL	UST
60651	S105815873		MIDTOWN FOOD	3855 WEST DIVISION		CHICAGO	IL	LUST
60651	S104524345		AMOCO OIL CO. #5072	3954 DIVISION		CHICAGO	IL	LUST
60651	1016227266	110007551309	AMOCO 5072	3954 W DIVISION & PULASKI		CHICAGO	IL	FINDS
60651	S113269085		AMOCO 5072	3954 W DIVISION & PULASKI	**	CHICAGO	IL	
60651	U001141889	2022954	BP	3954 W. DIVISION STREET		CHICAGO	IL	UST
60651	1008134240	110018309249	IEPA	4026 W DIVISION		CHICAGO	IL	FINDS
60651	S112360754		IEPA	4026 W DIVISION		CHICAGO	IL	
60651	1020124085		YOUNG KIM	4058 W DIVISION		CHICAGO	IL	
60651	S113269098		HELANDER METAL SPINNING CO	4108 W DIVISION		CHICAGO	IL	
60651	1000862240	110005927453	HELANDER METAL SPINNING CO	4108 W DIVISION		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	U001386513	2032244	HELANDER METHL SPINNING	4108 W DIVISION ST		CHICAGO	IL	UST
60651	U003668553	2038662	STANDARD LUMBER COMPANY	4112 W DIVISION		CHICAGO	IL	UST
60651	1008150840	110018476601	BIG CITY LAUNDRY	4224 W DIVISION ST		CHICAGO	IL	FINDS
60651	S113266320		BIG CITY LAUNDRY	4224 W DIVISION ST		CHICAGO	IL	
60651	S114005170		BIG CITY LAUNDRY	4224 WEST DIVISION STREET		CHICAGO	IL	SRP
60651	1021667841		TRANSMISSION	4235 W DIVISION ST		CHICAGO	IL	
60651	1020096201		STONE M & SONS INC	4305-07 W DIVISION		CHICAGO	IL	
60651	1006870817	110014340793	FAN BAG CO	4307 WEST DIVISION STREET		CHICAGO	IL	FINDS
60651	1018889841		JOES CLEANERS	4313 W DIVISION ST		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	1018762797		JOES CLEANERS	4314 W DIVISION ST		CHICAGO	IL	
60651	1018834182		RAINBOW LAUNDRY & DRY CLRS*	4325 W DIVISION		CHICAGO	IL	
60651	1008150734	110018475540	CORTINA TOOL	4333 W DIVISION		CHICAGO	IL	FINDS
60651	S113266152		CORTINA TOOL	4333 W DIVISION		CHICAGO	IL	
60651	U001965205	2033001	WHOLESALE OIL CO	4340 W DIVISION ST		CHICAGO	IL	UST
60651	1000887169	110005799788	WHOLESALE OIL CO	4340 W DIVISION ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1016792227	110058385368	O & G SPRING	4405 W DIVISION		CHICAGO	IL	FINDS
60651	96336692			44528 WEST DIVISION	**	CHICAGO	IL	ERNS
60651	U001142274	2030416	FANTUS PAPER PRODUCTS	4459 W DIVISION		CHICAGO	IL	UST
60651	S111891599		O&G SPRING & WIRE	4500 W DIVISION ST		CHICAGO	IL	
60651	1000347152	110064441509	O AND G SPRING AND WIRE	4500 W DIVISION ST		CHICAGO	IL	ICIS, RCRAInfo-SQG, FINDS
60651	S104523030		GRAPHIC CONVERTING	4500 WEST DIVISION		CHICAGO	IL	LUST
60651	S110157314		WILKENS-ANDERSON CO.	4525 W. DIVISION ST.		CHICAGO	IL	TIER 2
60651	1001479601	2513	ALLIED METAL CO	4528 W DIVISION ST		CHICAGO	IL	AIRS, LUST
60651	1000248909	ILD002993442	ALLIED METAL CO PLANT #3	4528 W DIVISION ST		CHICAGO	IL	RCRA-NonGen, UST
60651	1016948112		ALLIED METAL CO	4528 W. DIVISION ST.		CHICAGO	IL	TSCA
60651	S110150602		ALLIED METAL COMPANY	4528 W. DIVISION STREET		CHICAGO	IL	AIRS, TIER 2
60651	1000175105	110000435949	ALLIED METAL COMPANY	4528 WEST DIVISION STREET	58, NNW, 1/2 - 1	CHICAGO	IL	CORRACTS, CERCLIS-NFRAP, ICIS, RCRA-NonGen, FINDS, TRIS
60651	1000213520	110003064111	GENERAL IRON INDUSTRIES INC	4600 W DIVISION		CHICAGO	IL	RCRA-NonGen, FINDS
60651	1005635828	110001365077	EARTH, INC.	4615 WEST DIVISION		CHICAGO	IL	FINDS
60651	1004472724	110001356577	ROBINSON BUS SERVICE INC	4617 W DIVISION		CHICAGO	IL	AIRS, RCRA-CESQG, FINDS
60651	U001143013	2012972	WINDY CITY METAL RECYCLING & RESOL	4617 W. DIVISION STREET		CHICAGO	IL	UST
60651	S105059742		ROBINSON BUS LINES	4617 WEST DIVISION STREET		CHICAGO	IL	LUST
60651	S119030242		HELENE CURTIS	4700 WEST DIVISION		CHICAGO	IL	LUST
60651	U003668123	2036984	LEAF CONFECTIONERY	4701 W DIVISION		CHICAGO	IL	UST
60651	1008120455	110018170806	GENERAL ENGINEERING WORKS	4701 W DIVISION ST		CHICAGO	IL	FINDS
60651	S113266010		GENERAL ENGINEERING WORKS	4701 W DIVISION ST		CHICAGO	IL	
60651	S113708619		RIBBON WEBBING CORP	4711 W DIVISION ST		CHICAGO	IL	
60651	1011428201	110035833195	RIBBON WEBBING CORP	4711 W DIVISION ST		CHICAGO	IL	FINDS
60651	S112087639		RIBBON WEBBING CORPORATION	4711 WEST DIVISION STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60651	1004693119	110005871299	ERICKSON CO CICERO THE	4737 W DIVISION		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269061		ERICKSON CO CICERO THE	4737 W DIVISION ST		CHICAGO	IL	
60651	1009074311		CICERO & DIVISION SERVICE STN	4800 W DIVISION		CHICAGO	IL	
60651	U003152226	2021465	CICERO-DIVISION	4800 W DIVISION ST		CHICAGO	IL	UST
60651	S113269159		LYNGE, STELLA	4818 W DIVISION		CHICAGO	IL	
60651	1009217011	ILR000139964	LYNGE, STELLA	4818 W DIVISION		CHICAGO	IL	RCRAInfo-SQG
60651	S113269077		NEW VISION COLLISION	4825 W DIVISION ST		CHICAGO	IL	
60651	1000220340	110005875400	NEW VISION COLLISION	4825 W DIVISION ST		CHICAGO	IL	RCRA-CESQG, FINDS
60651	U003193638	2035794	RENES AUTO CLASSIC INC	4825 WEST DIVISION		CHICAGO	IL	UST
60651	1008150806	110018476264	VAN BERGEN & GREENER INC	4834 W DIVISION ST		CHICAGO	IL	FINDS
60651	S113266237		VAN BERGEN & GREENER INC	4834 W DIVISION ST		CHICAGO	IL	
60651	1004472538	110011828139	KIT PKAK, INC.	4834 W. DIVISION ST		CHICAGO	IL	FINDS
60651	1000860929	110005794195	CONSTRUCTION SUPPLY	4851 W DIVISION		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S111889055		CONSTRUCTION SUPPLY	4851 W DIVISION		CHICAGO	IL	
60651	U001629830	2032766	CONSTRUCTION SUPPLY	4851 WEST DIVISION		CHICAGO	IL	LUST, UST
60651	1004698549	110012270283	FEDERICOS BODY SHOP	4857 W DIVISION		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S104524857		TOP VALUE MUFFLER & BRAKES	4857 WEST DIVISION		CHICAGO	IL	LUST
60651	S111900098		GLOBAL GAS FOR LESS	5035 W DIVISION		CHICAGO	IL	
60651	1004694967	110005932232	GLOBAL GAS FOR LESS	5035 W DIVISION		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1018670100		KINGS CLEANERS	5035 W DIVISION ST		CHICAGO	IL	
60651	U003971812	2021821	AMSTAR	5035 W. DIVISION STREET		CHICAGO	IL	UST
60651	S111914658		MENDEZ, JOSE	5056 W DIVISION ST		CHICAGO	IL	
60651	1009076085		GEM AUTO REPAIR & ALARM CENTER	5056 W DIVISION ST		CHICAGO	IL	
60651	U003914180	2041800	JOSE MENDEZ	5056 W. DIVISION STREET		CHICAGO	IL	UST
60651	S105958710		MENDEZ, JOSE	5056 WEST DIVISION ST.		CHICAGO	IL	LUST
60651	1004478868	110011851941	NORTHWEST INST CONTEMP ACADEMY	5108 W DIVISION		CHICAGO	IL	FINDS
60651	1019968339		DIVISION CLEANERS	5135 W DIVISION ST		CHICAGO	IL	
60651	1009071563		F & K STANDARD SERVICE	5151 WEST DIVISION		CHICAGO	IL	
60651	1019973710		DIVISION CLEANERS	5200 W DIVISION ST		CHICAGO	IL	
60651	1008134280	110018309659	NATIONAL BANK OF GREECE	5201 W DIVISION ST		CHICAGO	IL	FINDS
60651	S111876028		NATIONAL BANK OF GREECE	5201 W DIVISION ST		CHICAGO	IL	
60651	U003929767	2041930	LARAMIE MARATHON, INC.	5201 W. DIVISION AVENUE		CHICAGO	IL	UST
60651	S104527127		AMBAR CONSTRUCTION CO. INC.	5201 WEST DIVISION		CHICAGO	IL	LUST
60651	S113269299		MANNION PLUMBING INC	5409 W DIVISION ST		CHICAGO	IL	
60651	S113269096		CONSUMERS ROOFING	5419 W DIVISION ST		CHICAGO	IL	
60651	1008123732	110018203754	CONSUMERS ROOFING	5419 W DIVISION ST		CHICAGO	IL	FINDS
60651	S107743308	3719	KASH 'N' KARRY DRY CLEANERS	5460 W DIVISION		CHICAGO	IL	AIRS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	1000237473	ILD033796798	KASH AND KARRY CLEANERS	5460 W DIVISION ST		CHICAGO	IL	RCRAInfo-SQG
60651	1017432664		KASH 'N' KARRY DRY CLEANERS	5460 WEST DIVISION		CHICAGO	IL	
60651	1009075086		MINUTILLO TONY	5501 W DIVISION ST		CHICAGO	IL	
60651	S113269160		CAIRO SONS ROOFING	5522 W DIVISION		CHICAGO	IL	
60651	1010731305	110033600887	CAIRO SONS ROOFING	5522 W DIVISION		CHICAGO	IL	FINDS
60651	U000173109	2017841	CAIRO & SONS ROOFING CO	5522 W DIVISION ST		CHICAGO	IL	UST
60651	1019951547		CENTRAL & DIVISION CLEANERS	5604 W DIVISION ST		CHICAGO	IL	
60651	A100407595		AT&T MOBILITY-TANK#1-173	5725 WEST DIVISION STREET		CHICAGO	IL	AST
60651	1020939616		F & K STANDARD SERVICE	5751 W DIVISION		CHICAGO	IL	
60651	1000210311	110005850757	SUPER DRY CLEANERS	5757 W DIVISION		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269506		SUPER DRY CLEANERS	5757 W DIVISION		CHICAGO	IL	
60651	S106779141		SUPER ONE HOUR CLEANERS	5757 WEST DIVISION STREET		CHICAGO	IL	Inst Control, SRP
60651	1021246288		EMILS MOBILE SERVICE	5900 W DIVISION		CHICAGO	IL	
60651	1021309630		VIDALS TRANSMISSION	5901 W DIVISION ST		CHICAGO	IL	
60651	1015937034	110046094276	YOUTH OUTREACH SERV	5910 W DIVISION		CHICAGO	IL	FINDS
60651	1018528453		AUSTIN CLEANERS	5934-45 W DIVISION		CHICAGO	IL	
60651	1016227039	110007546959	CHICAGO CITY OF DEPT OF TRANS	DIVISION ELSTON BRIDGE		CHICAGO	IL	FINDS
60651	1008133597	110018302790	IEPA OER	4824 W DIVISION-ALLEY		CHICAGO	IL	FINDS
60651	S113269067		IEPA OER	4824 W DIVISION-ALLEY		CHICAGO	IL	
60651	1020644528		BILTOMRE SERVICE STATION	2057-59 W DIVISN ST	**	CHICAGO	IL	
60651	S113269636		CHICAGO GRANITE & MARBLE	4435 W DIVISION		CHICAGO	IL	
60651	1000213457	ILD005128962	GENERAL ENGINEERING WORKS	4701 W DIVISION ST		CHICAGO	IL	RCRAInfo-SQG
60651	U001141898	2020341	AMOCO SS #15944 FACILITY#11688	3601 W EST CHICAGO 18074		CHICAGO	IL	UST
60651	S113269117		MUNOZ MARIN PRIMARY CTR	3320 W EVERGREEN		CHICAGO	IL	
60651	1004696864	110003047319	MUNOZ MARIN PRIMARY CTR	3320 W EVERGREEN AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269164		CODEX LOGISTICS	3940 W FERDINAND		CHICAGO	IL	
60651	S110359906		CITY OF CHICAGO	4233 W FERDINAND		CHICAGO	IL	AIRS
60651	S113269106		CIRCLE AUTOMOTIVE	4536 W GLADYS		CHICAGO	IL	
60651	S113269128		HENEHGAN WRECKING CO	3200 W GRAND		CHICAGO	IL	
60651	1016406485	110055413093	GATEWAY BUILDING PRODUCTS	3233 W GRAND AVE		CHICAGO	IL	FINDS
60651	1000608750	110009370796	ELEVATOR INDUSTRIES OF ILLINOIS	3260 W GRAND AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	1006017004	110001227912	SCENTEX INC	3260 W GRAND AVE		CHICAGO	IL	AIRS, FINDS
60651	U001143047	2022003	ELEVATOR INDUSTRIES OF ILLINOIS	3260 W GRAND AVE		CHICAGO	IL	UST
60651	S108480021		MILHALACK, DAVE	3300 W GRAND AVE		CHICAGO	IL	
60651	1010731289	110033600725	MILHALACK, DAVE	3300 W GRAND AVE		CHICAGO	IL	FINDS
60651	U004014278	2043020	VACANT CAR DEALERSHIP	3300 W. GRAND AVENUE		CHICAGO	IL	UST
60651	U004022835	2043104	MILHALACK, DAVE	3300 WEST GRAND AVENUE		CHICAGO	IL	LUST, UST
60651	1001116412	110005946138	HI TECH SURGEONS AUTO BODY	3320 W GRAND AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S113269630		HI TECH SURGEONS AUTO BODY	3320 W GRAND AVE		CHICAGO	IL	
60651	1000824337	110005918212	KRAUS, NORMAN	3326 W GRAND		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	U000865433	2031452	KRAUS, NORMAN	3326 W GRAND		CHICAGO	IL	UST
60651	U003668102	2036962	KRAUSE NORMAN	3333 W GRAND		CHICAGO	IL	UST
60651	S113269092		GRAND FURNITURE CO	3333 W GRAND		CHICAGO	IL	
60651	1020880401		MASTER TECH AUTO	3348 W GRAND AVE		CHICAGO	IL	
60651	U004226100		INDUSTRIAL/MANUFACTURING BUILDING	3401-3441 W. GRAND AVENUE		CHICAGO	IL	UST
60651	1017387111	110062853201	PAPYRUS PRESS INC	3441 W GRAND AVE		CHICAGO	IL	FINDS
60651	S117533948		PAPYRUS PRESS INC	3441 W GRAND AVE		CHICAGO	IL	
60651	S117449734		PAPYRUS PRESS, INC.	3441 WEST GRAND AVENUE		CHICAGO	IL	LUST
60651	U003104620	2035143	PARKING LOT	3453 W GRAND AVE		CHICAGO	IL	UST
60651	S111896271		PAPYRUS PRESS	3453 W GRAND AVE		CHICAGO	IL	
60651	1001087418	110005944194	PAPYRUS PRESS PARKING LOT	3453 W GRAND AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS, LUST
60651	S118661273		GRAND MOSAIC LLC	3490-3508 W GRAND AVE	**	CHICAGO	IL	
60651	U004228791		COMMERCIAL BUILDING	3490-3508 W. GRAND AVENUE		CHICAGO	IL	UST
60651	S118455669		GRAND MOSAIC, LLC	3490-3508 WEST GRAND AVENUE	**	CHICAGO	IL	LUST
60651	S118559136		GRAND MOSAIC LLC	3490-3508 WEST GRAND AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60651	U003668021	2036867	POLK BROS	3500 W GRAND		CHICAGO	IL	UST
60651	1008134331	110018310157	POLK BROTHERS	3500 W GRAND AVE		CHICAGO	IL	FINDS
60651	1015889366	110045972872	CVS PHARMACY 8733	3552 W GRAND		CHICAGO	IL	FINDS
60651	1014952671	ILR000170415	CVS PHARMACY 8733	3552 W GRAND		CHICAGO	IL	RCRA-NonGen
60651	S113708618		CVS PHARMACY 8733	3552 W GRAND		CHICAGO	IL	
60651	U004068175	2043494	PARKING LOT OF COMMERCIAL STORE	3552 W. GRAND		CHICAGO	IL	UST
60651	S113269110		AUTO ZONE	3577 W GRAND AVE		CHICAGO	IL	
60651	1008116183	110018127944	AUTO ZONE	3577 W GRAND AVE		CHICAGO	IL	FINDS
60651	U004123151		GRAND MOBIL	3601 W. GRAND AVENUE		CHICAGO	IL	UST
60651	S113269154		CASTILLOS AUTO REPAIR	3685 W GRAND AVE		CHICAGO	IL	
60651	1021080357		R&D TRANSMISSIONS	3685 W GRAND AVE		CHICAGO	IL	
60651	S113269088		WEST GRAND AUTO REPAIR	3688 W GRAND AVE		CHICAGO	IL	
60651	1008133630	110018303110	WEST GRAND AUTO REPAIR	3688 W GRAND AVE		CHICAGO	IL	FINDS
60651	1018699378		GRAND-HAMLIN QUICK CLEAN CTR	3742-44 W GRAND AVE		CHICAGO	IL	

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	U003715114	2039260	LAWRENCE GREZIEK	3822 W GRAND AVE		CHICAGO	IL	UST
60651	1008134384	110018310709	OSO TIRE SHOP	3834 W GRAND AVE		CHICAGO	IL	FINDS
60651	S111905502		OSO TIRE SHOP	3834 W GRAND AVE		CHICAGO	IL	
60651	S104529992		GREZLIK, LAWRENCE	3834 WEST GRAND		CHICAGO	IL	LUST
60651	1021424773		ALEJIA FAMILY TOWING	3900 W GRAND AVE		CHICAGO	IL	
60651	1016881041	110059865597	3901 W GRAND 1314 N SPRINGFIELD	3901 W GRAND 1314 N SPRINGFIELD		CHICAGO	IL	FINDS
60651	S113269561		NATIONAL TRANSMISSION	3910 W GRAND AVE		CHICAGO	IL	
60651	1000861254	110005796344	NATIONAL TRANSMISSION	3910 W GRAND AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1000209822	110005828328	NATIONAL TRANSMISSION	3945 W GRAND		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113265859		NATIONAL TRANSMISSION	3945 W GRAND		CHICAGO	IL	
60651	1009074970		NTS INC	3945 W GRAND AVE		CHICAGO	IL	
60651	1008133511	110018301924	SHELL	3965 W GRAND & PULASKI		CHICAGO	IL	FINDS
60651	S113269094		SHELL	3965 W GRAND & PULASKI	**	CHICAGO	IL	
60651	1009072068		TAYLORS SHELL SERVICE	3965 W GRAND AVE		CHICAGO	IL	
60651	1005905028	110012575203	SHELL SVC STATION	3965 W GRAND AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S104528566		SHELL SERVICE STATION, SAP #136930	3965 WEST GRAND AVENUE		CHICAGO	IL	LUST
60651	U003668111	2036972	GENDE UNIVERSAL	4014 W GRAND		CHICAGO	IL	UST
60651	S107742231	13782	GENDEX CORP	4014 W GRAND AVE		CHICAGO	IL	AIRS
60651	1000431455	110009374435	UNIVERSAL X RAY	4014 W GRAND AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	1004474544	110001381923	GENDEX CORPORATION	4014 W GRAND AVENUE		CHICAGO	IL	FINDS
60651	1001648436		GENDX	4014 WEST GRAND AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP, LUST
60651	1016443163	110056034820	SALVATION ARMY	4052 W GRAND		CHICAGO	IL	FINDS
60651	1009186240		RUFFOLO SAMUEL & BARBARA	4101 W GRAND AVE		CHICAGO	IL	
60651	S113269152		MB FINANCIAL	4101 W GRAND AVE		CHICAGO	IL	
60651	S106967076		MB FINANCIAL	4101 WEST GRAND AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60651	S113269532		CAR CARE BODYSHOP INC	4122 W GRAND AVE		CHICAGO	IL	
60651	1004692806	110005826473	CAR CARE BODYSHOP INC	4122 W GRAND AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1000232244	110005843515	KING TRANSMISSION CO	4152 W GRAND AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269530		KING TRANSMISSION CO	4152 W GRAND AVE		CHICAGO	IL	
60651	S113269179		MERCADO TIRE & WHEELS INC	4164 W GRAND AVE		CHICAGO	IL	
60651	1021845687		WINSTON SERVICE	4209 W GRAND		CHICAGO	IL	
60651	S113269093		SCOTT ABO TT MFG	4215 W GRAND AE		CHICAGO	IL	
60651	U002112835	2033763	ROSEMONT LARRY & MICHAELS JOEL	4215 W GRAND AVE		CHICAGO	IL	UST
60651	1000824674	110005920584	SCOTT ABO TT MFG	4215 W GRAND AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	2009906609			4215 WEST GRAND AVE		CHICAGO	IL	ERNS
60651	S113269618		BAHEMA AUTOBODY	4228 W GRAND AVE		CHICAGO	IL	
60651	1004697206	110003053258	RAHEMA AUTO BODY	4228 W GRAND AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1017386688	110062848897	LAKEVIEW BUS LINES INC	4253 W GRAND		CHICAGO	IL	FINDS
60651	S117323796		LAKEVIEW BUS LINES INC	4253 W GRAND		CHICAGO	IL	
60651	U004227533		RIM CITY & VIP AUTO SOUND	4253 W. GRAND AVENUER		CHICAGO	IL	UST
60651	S117449721		LAKEVIEW BUS LINES, INC.	4253 WEST GRAND		CHICAGO	IL	LUST
60651	S113269157		CHICAGO WATER PARTNERS	W GRAND AVE N LONG TO N LAMON AVE	**	CHICAGO	IL	
60651	S113269158		CHICAGO WATER PARTNERS	W GRAND AVE N PULASKI TO N SPAULDII	**	CHICAGO	IL	
60651	S113269079		SUPERIOR TOOL & STAMPING CO	4519 W HADDON		CHICAGO	IL	
60651	S113269087		GRAND AVENUE AUTOBODY	4540 W HADDON		CHICAGO	IL	
60651	1004693800	110005903335	GRAND AVE AUTO BODY	4540 W HADDON		CHICAGO	IL	RCRA-CESQG, FINDS
60651	U003975131	2042322	HURON OF HAMLIN	656 N. HAMLIN		CHICAGO	IL	UST
60651	1011853658	110037158438	YMCA - OUR LADY OF ANGELS	824 N HAMLIN		CHICAGO	IL	FINDS
60651	1020334678		GRAND HARDING SERVICE STATION	1351 N HARDING		CHICAGO	IL	
60651	1021748069		HARLEM IRVING PLAZA MBL SV CTR	4198 N HARLEM	**	CHICAGO	IL	
60651	1021566088		HARLEM IRVING PLZ MOBIL SV CTR	4198 N HARLEM AVE	**	CHICAGO	IL	
60651	1009646466			3224 W HIRSCH STREET		CHICAGO	IL	DOT OPS
60651	1001213550	110005958062	JAMES LOWELL ELEMENTARY SCHOOL	3322 W HIRSCH ST		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269115		JAMES RUSSELL LOWELL SCHOOL	3322 W HIRSCH ST		CHICAGO	IL	
60651	1008126100	110018227523	JAMES RUSSELL LOWELL SCHOOL	3322 W HIRSCH ST		CHICAGO	IL	FINDS
60651	S113269512		MELESIO GARCIA	3835 W HIRSCH		CHICAGO	IL	
60651	S107744688	3353	NOBEL SCHOOL-CHGO BD ED	4127 W HIRSCH ST		CHICAGO	IL	AIRS
60651	1001227896	110010300575	NOBEL SCHOOL-CHGO BD ED	4127 W HIRSCH ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269155		HOMAN AUTO SERVICE	1061 N HOMAN		CHICAGO	IL	
60651	U000864992	2002913	CHICAGO PRESS CORP	1112 N HOMAN AVE		CHICAGO	IL	AIRS, UST
60651	1016111389	110001820389	CHICAGO PRESS CORP	1112 N. HOMAN AVENUE		CHICAGO	IL	FINDS
60651	1007878865	110018310549	SKYLINE DESIGN	1240 N HOMAN AVE		CHICAGO	IL	FINDS
60651	1007879550	ILR000132266	SKYLINE DESIGN	1240 N HOMAN AVE		CHICAGO	IL	RCRAInfo-SQG
60651	U000791630	2026600	C & R BLDG PARTNERSHIP	1240 N HOMAN AVE		CHICAGO	IL	UST
60651	S111900707		SKYLINE DESIGN	1240 N HOMAN AVE		CHICAGO	IL	
60651	S104528549		ISC/NEWCO, INC.	1240 NORTH HOMAN AVE.		CHICAGO	IL	LUST
60651	1009648092			INTERSECTION OF N. HOMAN & W. AUGU		CHICAGO	IL	DOT OPS
60651	S113269594		OUR LADY OF THE ANGLES	3800 W IOWA		CHICAGO	IL	
60651	1001213577	110005958366	OUR LADY OF THE ANGLES	3800 W IOWA		CHICAGO	IL	RCRA-NonGen, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	1015928251	110046088728	OUR LADY OF ANGELS	3801 W IOWA		CHICAGO	IL	FINDS
60651	1014705324	110042256536	OUR LADY OF ANGELS CHURCH	3808 W IOWA		CHICAGO	IL	FINDS
60651	1016287324	110011437212	OUR LADY OF THE ANGELS	3814 W IOWA ST		CHICAGO	IL	FINDS
60651	1005621316		OUR LADY OF THE ANGELS	3814 W IOWA ST		CHICAGO	IL	FTTS
60651	1016440368	110055954739	OUR LADY OF ANGELS	3815 W IOWA		CHICAGO	IL	FINDS
60651	U004142067		OUR LADY OF THE ANGELS CONVENT	3815 W. IOWA STREET		CHICAGO	IL	UST
60651	1011852073	110037141438	4403 W IOWA ST	4403 W IOWA ST		CHICAGO	IL	FINDS
60651	U003929792	2041964	INDUSTRIAL BUILDING	4701 W IOWA		CHICAGO	IL	UST
60651	S116159232		INDUSTRIAL METALS & SCRAP INC	4707 W IOWA ST		CHICAGO	IL	
60651	1016141421	110055409419	INDUSTRIAL METALS & SCRAP INC	4707 W IOWA ST		CHICAGO	IL	RCRA-NonGen, FINDS
60651	1001123542	ILR000032466	BYFORD	5600 W IOWA		CHICAGO	IL	RCRAInfo-SQG
60651	1016052297	110001292841	BYBORD SCHOOL-CHGO BD ED	5600 W IOWA ST		CHICAGO	IL	FINDS
60651	S107740438	3487	BYBORD SCHOOL	5600 W IOWA ST		CHICAGO	IL	AIRS
60651	1021852924		FRIES JOE STANDARD SERVICE	5965 W IOWA		CHICAGO	IL	
60651	1008133730	110018304119	NORA TIRE RECYCLING & DISPOSAL	215 N KARLOV		CHICAGO	IL	FINDS
60651	S113269146		NORA TIRE RECYCLING & DISPOSAL	215 N KARLOV		CHICAGO	IL	
60651	S113269078		GATEWAY SCREW & RIVET INC	1440 N KEATING AVE		CHICAGO	IL	
60651	1008133616	110018302978	GATEWAY SCREW & RIVET INC	1440 N KEATING AVE		CHICAGO	IL	FINDS
60651	1000267641	ILD005163068	ROCK-OLA MFG CORP	800 N KEDZIE AVE		CHICAGO	IL	CORRACTS, CERCLIS-NFRAP, RCRA-NonGen
60651	S111899858		UNIVERSITY HOSPITAL	1116 N KEDZIE AVE		CHICAGO	IL	
60651	U003298535	2036369	UNIVERSITY HOSPITAL	1116 NORTH KEDZIE		CHICAGO	IL	LUST, UST
60651	1001211341		WALTHER MEMORIAL HOSPITAL	1116 NORTH KEDZIE AVENUE		CHICAGO	IL	MLTS
60651	S111888691		MILITARY & NAVAL DEPT CHIC NORTHWE	1551 N KEDZIE AVE		CHICAGO	IL	
60651	U001142613	2008718	NORTHWEST ARMORY	1551 N KEDZIE AVE		CHICAGO	IL	UST
60651	1004479975	110001821100	MILITARY & NAVAL DEPT - CHIC NORTHW	1551 N KEDZIE AVE		CHICAGO	IL	FINDS
60651	S104523684		ILLINOIS DEPT. OF MILITARY AFFAIRS	1551 NORTH KEDZIE AVE.		CHICAGO	IL	LUST
60651	S113265841		ROCK OLA MFG CORP	800 N KEDZIE		CHICAGO	IL	
60651	1016094407	110001800864	ROCK OLA MFG CORP	800 N KEDZIE		CHICAGO	IL	FINDS
60651	U003668353	2038088	MIDWEST FENCE CORPORATION	900 N KEDZIE		CHICAGO	IL	UST
60651	S110360396		MIDWEST FENCE CORPORATION	900 N. KEDZIE AVE		CHICAGO	IL	TIER 2
60651	S113265915		COM ED	901 N KEDZIE		CHICAGO	IL	
60651	1008150491	110018473114	COM ED	901 N KEDZIE		CHICAGO	IL	FINDS
60651	1009189129		ERICA CLEANERS	947 N KEDZIE AVE		CHICAGO	IL	
60651	S107745108	3662	PICCOLO SCHOOL	1040 N KEELER		CHICAGO	IL	AIRS
60651	1001227875	ILR000053116	PICCOLO BRIAN SCHOOL	1040 N KEELER AVE		CHICAGO	IL	RCRAInfo-SQG
60651	S113269162		VACANT LOT	1635 N KENTON		CHICAGO	IL	
60651	U000792290	2013524	GENDEX-UNIVERSAL	1441 N KEYSTONE		CHICAGO	IL	UST
60651	S113269084		WILLETT INC	902 N KILBORN		CHICAGO	IL	
60651	1000231790	110001803692	BORG-ERICKSON CORP	1133 N KILBOURN		CHICAGO	IL	AIRS, RCRAInfo-SQG, FINDS
60651	S113266234		ARGUS MANUFACTURING CO	1134 N KILBOURN AVE		CHICAGO	IL	
60651	1000427506	110005814538	ARGUS MFG CO	1134 N KILBOURN AVE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S104002294		LAIDLAW TRANSIT, INC.	902 KILBOURN ST.	36, NNW, 1/4 - 1/2	CHICAGO	IL	LUST
60651	U001143323	2024868	WILLETT MOTOR COACH CO	902 N KILBOURN		CHICAGO	IL	UST
60651	S113269168		PALMGREN STEEL PRODUCTS INC	914 N KILBOURN		CHICAGO	IL	
60651	1004698072	110002353079	TAG FURNISHINGS GROUP	916 N KILBOURN AVE		CHICAGO	IL	AIRS, RCRAInfo-SQG, FINDS
60651	S111884664		LAIDLAW TRANSIT INC	902 KILBOURNE ST	**	CHICAGO	IL	
60651	1008135892	110018325873	LAIDLAW TRANSIT INC	902 KILBOURNE ST		CHICAGO	IL	FINDS
60651	1000612101	110005889235	WILLET INC	902 N KILBOURNE		CHICAGO	IL	RCRA-NonGen, FINDS
60651	S107745302	14972	PROTEC METAL FINISHING CORP	1428 N KILPATRICK AVE		CHICAGO	IL	AIRS
60651	S110155561		PRO-TEC METAL FINISHING CORPORATIC	1428 N. KILPATRICK AVENUE		CHICAGO	IL	TIER 2
60651	1004697529	110003057986	FULLERTON AUTO BODY	1436 N KILPATRICK AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269628		FULLERTON AUTOBODY	1436 N KILPATRICK AVE		CHICAGO	IL	
60651	S107746060	29906	SKILD PLATING CORP	1516 N KILPATRICK		CHICAGO	IL	AIRS
60651	1000278414	ILD041057902	SKILD PLATING CORP	1516 N KILPATRICK		CHICAGO	IL	RCRAInfo-SQG
60651	S110156080		SKILD PLATING	1516-18 N. KILPATRICK AVENUE		CHICAGO	IL	TIER 2
60651	1000861697	ILD984870451	RIPPEL ARCHITECTURE METALS	1525 N KILPATRICK		CHICAGO	IL	RCRA-NonGen
60651	U001143005	2023946	RIPPEL ARCHITECTURAL METALS INC	1525 N KILPATRICK AVE		CHICAGO	IL	AIRS, UST
60651	S111886475		VAUGHN MFG CO	900 N KILPATRICK		CHICAGO	IL	
60651	1000688718	110005908795	VAUGHN MFG CO	900 N KILPATRICK	O, NW, 1/2 - 1	CHICAGO	IL	RCRA-NonGen, FINDS, LUST
60651	U003972130	2036245	AMCO CORP	901 N KILPATRICK AVE		CHICAGO	IL	UST
60651	1000324839	ILD984774315	INDUSTRIAL METAL ENTERPRISE INC	901 N KILPATRICK AVE	O, NW, 1/4 - 1/2	CHICAGO	IL	RCRA-NonGen, LUST
60651	9046911			901 N. KILPATRICK		CHICAGO	IL	ERNS
60651	1016082474	110000435958	WEST CHICAGO METAL PRODUCTS, INC	901 NORTH KILPATRICK AVENUE		CHICAGO	IL	FINDS
60651	S116549596		MAUSER USA, LLC-CHICAGO FIBER	903 N. KILPATRICK AVE.		CHICAGO	IL	TIER 2
60651	S117509848		CITY OF CHICAGO	5316 18 KING DRIVE		CHICAGO	IL	
60651	S113269082		K-DEL INDUSTRIES	4127 W KINZIE		CHICAGO	IL	
60651	1008133627	110018303085	K-DEL INDUSTRIES	4127 W KINZIE		CHICAGO	IL	FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	S113269566		STEPENWOLF THEATER COMPANY	1010 N KOLMAR		CHICAGO	IL	
60651	1000986728	110005931563	STEPENWOLF THEATRE CO	1010 N KOLMAR		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269069		SPEKO PRODUCTS INC	1014 N KOLMAR		CHICAGO	IL	
60651	1016441660	110055969082	CHICAGO DOT, CITY OF	1020 KOLMAR AVE-B		CHICAGO	IL	FINDS
60651	S116159233		CHICAGO DOT, CITY OF	1020 KOLMAR AVE-B		CHICAGO	IL	
60651	S107746721	3731	TRITON INDUSTRIES	1020 N KOLMAR AVE		CHICAGO	IL	AIRS
60651	1016180398	110001228859	TRITON INDUSTRIES INC	1020 NORTH KOLMAR AVENUE		CHICAGO	IL	FINDS
60651	S111900413		BEARINGS MFG	1033 N KOLMAR		CHICAGO	IL	
60651	1000362182	110005818035	BEARINGS MFG. CO.	1033 NORTH KOLMAR AVE.	52, NNW, 1/4 - 1/2	CHICAGO	IL	RCRAInfo-SQG, FINDS, LUST
60651	S113269544		CLASSIC MIDWEST DIE MOLD	1140 N KOSTNER		CHICAGO	IL	
60651	1008133619	110018303003	IEPA OER	1140 N KOSTNER		CHICAGO	IL	FINDS
60651	S113269080		IEPA OER	1140 N KOSTNER		CHICAGO	IL	
60651	1008134363	110018310488	DELTA DEMOLITION INC	1230 N KOSTNER AVE		CHICAGO	IL	FINDS
60651	U000174117	2014131	DELTA DEMOLITION	1230 N. KOSTNER AVENUE		CHICAGO	IL	UST
60651	S117461796		1230 N KOSTNER, LLC	1230 NORTH KOSTNER AVENUE		CHICAGO	IL	LUST
60651	1000366542	110005830985	HYDROAIRE INC	1238 N KOSTNER		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S109550581		HYDROAIRE INC	1238 N KOSTNER		CHICAGO	IL	
60651	U004128354		HYDROAIRE, INC.	1238 N. KOSTNER		CHICAGO	IL	UST
60651	S109550375		HYDROAIRE, INC.	1238 NORTH KOSTNER AVENUE		CHICAGO	IL	SRP, LUST
60651	1000435276	ILD072330681	STEWART WARNER CORP ELECTRONICS	1300 KOSTNER AVE		CHICAGO	IL	AIRS, TIER 2, RCRAInfo-SQG
60651	1014390060	110001824063	STEWART-WARNER ELECTRONIC DIVISIC	1300 N KOSTNER AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1014704074	110042177319	AGAIN AUTO PARTS LLC	1300 N KOSTNER AVE-B		CHICAGO	IL	FINDS
60651	S113269175		AGAIN AUTO PARTS LLC	1300 N KOSTNER AVE-B		CHICAGO	IL	
60651	U003668800	2039073	CITY BOX COMPANY	1300 N. KOSTNER		CHICAGO	IL	UST
60651	S117462812		ALLIED METAL COMPANY	1300 N. KOSTNER AVENUE		CHICAGO	IL	TIER 2
60651	S104491485		STEWART WARNER CORPORATION	1300 NORTH KOSTNER AVENUE		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60651	S119030359		STEWART WARNER CORP.	1300 NORTH KOSTNER ST.		CHICAGO	IL	LUST
60651	1000199589	ILD064409683	PYLE-NATIONAL CO	1334 N KOSTNER		CHICAGO	IL	Inst Control, ENG CONTROLS, RCRA-NonGen, SRP, LUST
60651	U000864775	2000635	BRINTEC PYLE NATL DIV	1334 N KOSTNER AVE		CHICAGO	IL	UST
60651	S107745339	11236	SINE SYSTEMS PYLE CONNECTORS COR	1334 N KOSTNER AVE		CHICAGO	IL	AIRS
60651	1016096775	110000775108	SINE SYSTEMS PYLE CONNECTORS COR	1334 N. KOSTNER AVENUE		CHICAGO	IL	ICIS, FINDS
60651	S113265999		ZENITH ELECTRONICS - KOSTNER PLANT	1500 N KOSTNER		CHICAGO	IL	
60651	1000264564	ILD005120589	ZENITH RADIO CORP	1500 N KOSTNER		CHICAGO	IL	RCRAInfo-SQG, LUST
60651	U003152294	2023703	ZENITH ELECTRONICS CORP	1500 N KOSTNER AVE		CHICAGO	IL	UST
60651	1016096782	110000776517	ZENITH ELECTRONICS - KOSTNER PLANT	1500 NORTH KOSTNER AVENUE		CHICAGO	IL	FINDS
60651	S113269617		ADVANCE DISPLAY	1657 N KOSTNER		CHICAGO	IL	
60651	1000348306	110005814413	SIMPLOMATIC MFG	816 N KOSTNER	8, North, 1/8 - 1/4	CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113268586		SIMPLOMATIC MFG	816 N KOSTNER		CHICAGO	IL	
60651	S111907481		ST FRANCIS OF ASSISI	932 KOSTNER RD		CHICAGO	IL	
60651	S104564359		ST. FRANCIS OF ASSISI	932 KOSTNER RD.	39, North, 1/4 - 1/2	CHICAGO	IL	LUST
60651	U003762897	2040080	ST FRANCIS OF ASSISI CHURCH	932 N KOSTNER AVE		CHICAGO	IL	UST
60651	1018784639		GABRIEL CLEANERS	3359 W LA MOYNE	**	CHICAGO	IL	
60651	1008133662	110018303432	RC INDUSTRIES	1420 N LAMON		CHICAGO	IL	FINDS
60651	S110828875		R. C. INDUSTRIES, INC.	1420 N. LAMON AVE		CHICAGO	IL	TIER 2
60651	U001142225	2030879	LAFOLLETTE PARK	1333 N LARAMIE		CHICAGO	IL	UST
60651	1004697320	110003055229	LAFOLLETTE PARK	1333 N LARAMIE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269083		LAFOLLETTE PARK	1333 N LARAMIE AVE		CHICAGO	IL	
60651	1000906969	110005909927	HAY JOHN COMMUNITY ACADEMY	1018 N LARAMINE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269103		JOHN HAY SCHOOL	1018 N LARMIE AVE		CHICAGO	IL	
60651	S113269060		WHITE RACKER CO INC	1818 N LATROBE AVE		CHICAGO	IL	
60651	1004692492	110005802015	IL STATE PSYCHIATRIC INSTITUTE	1153 N LAVERGNE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1018605377		GLORIAS CLEANERS	3359 W LE MOYNE		CHICAGO	IL	
60651	S117534134		MARIAN ROSOL / ESTATE OF JOE MIZE	4027 WEST LE MOYNE STREET		CHICAGO	IL	Inst Control, ENG CONTROLS, SRP
60651	1000907401	110005804111	LESLIE LEWIS SCHOOL	1431 N LEAMINGTON AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269102		LESLIE LEWIS SCHOOL	1431 N LEAMINGTON AVE		CHICAGO	IL	
60651	1012088372	110038508219	SAN MIGUEL SCHOOL	819 LEAMINGTON		CHICAGO	IL	FINDS
60651	1011852575	110037147441	OUR LADY OF CHRISTIANS	833-51 N LEAMINGTON		CHICAGO	IL	FINDS
60651	S113269116		RONALD E MCNAIR ACADEMIC CTR	849 N LEAMINGTON		CHICAGO	IL	
60651	1004696878	110003047435	RONALD E MCNAIR ACADEMIC CTR	849 N LEAMINGTON AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	U001965169	2033189	TRAMCO INC	4027 W LEMOYNE		CHICAGO	IL	UST
60651	1008125439	110018220888	MARIAN ROSOL/EST OF JOE MIZE	4027 W LEMOYNE ST		CHICAGO	IL	FINDS
60651	1000887158	110005799706	ROSOL MARIAN FOR EST JOS J MIZE	4027 W LEMOYNE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269562		MARIAN ROSOL/EST OF JOE MIZE	4027 W LEMOYNE ST		CHICAGO	IL	
60651	S113269081		PK TOOL & MACHINE	4700 W LEMOYNE		CHICAGO	IL	
60651	1000463142	110005885024	PK TOOL & MACHINE	4700 W LEMOYNE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269505		FISHER SCIENTIFIC CO	4901 W LEMOYNE ST		CHICAGO	IL	
60651	1000240652	110005812040	FISHER SCIENTIFIC CO	4901 W LEMOYNE ST		CHICAGO	IL	RCRAInfo-SQG, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	S111888754		ADVANCED WINDOWS CORP	4935 W LEMOYNE AVE		CHICAGO	IL	
60651	1004694519	110005921841	UNITED DISPLAY CRAFT	4935 W LEMOYNE AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	U003668035	2036881	UNITED DISPLAYCRAFT	4935 W LEMOYNE ST		CHICAGO	IL	UST
60651	S104523671		UNITED DISPLAYCRAFT	4935 WEST LEMOYNE		CHICAGO	IL	LUST
60651	1008133639	110018303218	MASAYO COMPANY APARTMENT BLDG	808 N LOCKWOOD		CHICAGO	IL	FINDS
60651	S113269097		MASAYO COMPANY APARTMENT BLDG	808 N LOCKWOOD		CHICAGO	IL	
60651	1008123954	110018205985	GOOD LOE USED & WASTE TIRE DISPOS/	934 N LOREL		CHICAGO	IL	FINDS
60651	S113269638		GOOD LOE USED & WASTE TIRE DISPOS/	934 N LOREL		CHICAGO	IL	
60651	U003762975	2040239	VACANT LOT	4940 W MADISON		CHICAGO	IL	UST
60651	1012131427	110039126228	ST ANGLELA	1332 N MASSASOIT AVE		CHICAGO	IL	FINDS
60651	1020042277		MK CLEANERS CHICAGO CHGO	1040 N MAYFIELD AVE		CHICAGO	IL	
60651	1001123546	110001293001	CAMERON	1234 N MONTICELLO		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113268782		KABAYAMA CONSTRUCTION	1243-47 N MONTICELLO		CHICAGO	IL	
60651	U003995118	2042709	MCDONALD'S RESTAURANT	3241 W. NORTH AVENUE		CHICAGO	IL	UST
60651	S109327457		VAS FOREMOST LIQUORS	3301 W NORTH AVE		CHICAGO	IL	
60651	U004123099		FOREMOST LIQUORS	3301 W. NORTH AVE.		CHICAGO	IL	UST
60651	S109327881		VAS FOREMOST LIQUORS	3301 WEST NORTH AVENUE		CHICAGO	IL	LUST
60651	S107740797	13086	CHICAGO TRANSIT AUTHORITY	4801 W NORTH AVE		CHICAGO	IL	AIRS
60651	1009461926	110024864351	MILWAUKEE DEVELOPMENT TRUST	1651 NORTHWESTERN AVE		CHICAGO	IL	FINDS
60651	S105958604		MILWAUKEE DEVELOPMENT TRUST	1651 NORTHWESTERN AVE.		CHICAGO	IL	LUST
60651	1021866526		ARCO	801 N PALASKI	**	CHICAGO	IL	
60651	1016054950	110001851345	YOUNG SCHOOL-CHGO BD ED	1434 N PARKSIDE		CHICAGO	IL	FINDS
60651	S107747424	3619	YOUNG SCHOOL-CHGO BD ED	1434 N PARKSIDE		CHICAGO	IL	AIRS
60651	1004697000	ILR000061465	YOUNG ELLA SCHOOL	1434 N PARKSIDE AVE		CHICAGO	IL	RCRA-CESQG
60651	1019947130		CAIN LAQUENCA	834 N PARKSIDE AVE		CHICAGO	IL	
60651	1009646233			3523 WEST PIERCE AVE		CHICAGO	IL	DOT OPS
60651	S113269145		CHICAGO, CITY OF ABANDONMENT	800 N PINE		CHICAGO	IL	
60651	1005905096	110013295816	CHICAGO, CITY OF ABANDONMENT	800 N PINE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269593		DILEO WOODWORKING	3421 W POTOMAC		CHICAGO	IL	
60651	1001196043	110005955494	DILEO WOODWORKIN	3421 W POTOMAC		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113269118		PABLO CASALS SCHOOL	3501 W POTOMAC		CHICAGO	IL	
60651	1005415907	110012271086	CASALS PABLO ELEMENTARY SCHOOL	3501 W POTOMAC AVE		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1008134332	110018310166	TRIPPI, JACK	3522 W POTOMAC		CHICAGO	IL	FINDS
60651	S111894440		TRIPPI, JACK	3522 W POTOMAC		CHICAGO	IL	
60651	U001965191	2033096	TRIPPI JOHN	3522 W POTOMAC		CHICAGO	IL	UST
60651	S104522427		TRIPPI, JACK	3522 WEST POTOMAC ST.		CHICAGO	IL	LUST
60651	U000864997	2031159	RYSER BROS	3525 W POTOMAC		CHICAGO	IL	UST
60651	S104524550		CHICAGO TITLE & TRUST #33976	3525 WEST POTOMAC AVE.		CHICAGO	IL	LUST
60651	U003152214	2035506	TARKOWSKI BUILDING	3600 W POTOMAC		CHICAGO	IL	UST
60651	S113269111		TARKOWSKI BLDG	3600 W POTOMAC		CHICAGO	IL	
60651	1008133674	110018303548	TARKOWSKI BLDG	3600 W POTOMAC		CHICAGO	IL	FINDS
60651	1001024574	110005933437	BEL AIR MFG	5525 W POTOMAC AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1016367732	110046150623	CELADON VERNON LLC	1015 N PULASKI		CHICAGO	IL	FINDS
60651	S113269170		VACANT LOT	1028-1032 N PULASKI RD		CHICAGO	IL	
60651	S113269563		ROYAL CLEANERS	1111 N PULASKI		CHICAGO	IL	
60651	1000887106	110005799314	ROYAL CLEANERS	1111 N PULASKI		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1020077761		ROYAL CLEANERS CO	1111 N PULASKI RD		CHICAGO	IL	
60651	S107739237		ROYAL CLEANERS	1111 NORTH PULASKI ROAD		CHICAGO	IL	SRP
60651	1008133600	110018302816	FLORES, MIGUEL & CARMEN	1230 N PULASKI		CHICAGO	IL	FINDS
60651	S111876797		FLORES, MIGUEL & CARMEN	1230 N PULASKI		CHICAGO	IL	
60651	1009076091		PULASKI SERVICE CENTER	1230 N PULASKI		CHICAGO	IL	
60651	S113269167		ROBERTO TIRE RECYCLING	1232 N PULASKI RD		CHICAGO	IL	
60651	S113269524		BULK PETROLEUM CORP	1246 N PULASKI		CHICAGO	IL	
60651	1008134220	110018309043	BULK PETROLEUM CORP	1246 N PULASKI		CHICAGO	IL	FINDS
60651	S113269156		BUDGET MUFFLER & AUTO	1250 N PULASKI		CHICAGO	IL	
60651	S113269526		JB AUTO RESTORATION INC	1330 N PULASKI		CHICAGO	IL	
60651	U000102977	110005858679	J B AUTO RESTORATION INC	1330 N PULASKI		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	U000792159	2021039	CITGO SERVICE STATION	1345 NORTH PULASKI ROAD		CHICAGO	IL	UST
60651	1001404618	110056413260	FAMILY DOLLAR INC 6280	1360 N PULASKI		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1018274675	110067265863	KAMRAN AUTO EXCHANGE	1425-1433 N PULASKI RD		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S118661267		KAMRAN AUTO EXCHANGE	1425-1433 N PULASKI RD	**	CHICAGO	IL	
60651	S113269626		PK TOOL	1440 N PULASKI		CHICAGO	IL	
60651	1004697389	110003056488	PK TOOL CORP	1440 N PULASKI		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S107744689	3960	NOBERT PLATING CO	1445 N PULASKI		CHICAGO	IL	AIRS
60651	S107742399	11201	NOBERT PLATING CO	1445 N PULASKI		CHICAGO	IL	AIRS
60651	1000309699	110000435967	NOBERT PLATING CO	1445 N PULASKI RD		CHICAGO	IL	FINDS, RCRAInfo-LQG, TRIS
60651	S110154771		NOBERT PLATING COMPANY -- PLANT #2	1445 N. PULASKI ROAD		CHICAGO	IL	AIRS, TIER 2
60651	1004693788	110005903068	MYERS BODY SHOP	1524 N PULASKI		CHICAGO	IL	RCRA-CESQG, FINDS
60651	S113269086		MYERS BODY SHOP	1524 N PULASKI		CHICAGO	IL	
60651	U004123093		BANCO POPULAR PARKING LOT	1655 N. PULASKI ROAD		CHICAGO	IL	UST

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	1011847710	110037065564	23555 S PULASKI	23555 S PULASKI	**	CHICAGO	IL	FINDS
60651	1021086230		RAYS SERVICE STATIONS INC	801 N PULASKI		CHICAGO	IL	
60651	U001141887	2020291	AMOCO SS #15938 FACILITY #11473	801 NORTH PULASKI 18052		CHICAGO	IL	UST
60651	S111912802		BHARAT GAS INC	901 N PULASKI RD		CHICAGO	IL	
60651	1009072489		JALAL ENTERPRISES INC	901 N PULASKI RD		CHICAGO	IL	
60651	U001965097	2032857	SHELL	901 N. PULASKI RD.		CHICAGO	IL	UST
60651	S105743974		BHARAT GAS, INC.	901 NORTH PULASKI RD.		CHICAGO	IL	LUST
60651	S103688049		FLORES, MIGUEL & CARMEN	PULASKI RD. & CRYSTAL ST.		CHICAGO	IL	LUST
60651	S113269165		BLACKHAWK	656 W RANDOLPH ST		CHICAGO	IL	
60651	U003668320	2037489	KERRIGAN LEWIS WIRE CDT	4421 W RICE ST	E, North, 1/8 - 1/4	CHICAGO	IL	UST
60651	S107743360	11161	KERRIGAN LEWIS CO	4421 W RICE ST		CHICAGO	IL	AIRS
60651	1012208260	60651DRBRN44	KERRIGAN LEWIS CO.	4421 W RICE ST		CHICAGO	IL	TRIS
60651	1001404616	110001228779	KERRIGAN-LEWIS LAWYER-CDT	4421 WEST RICE ST.	E, North, 1/8 - 1/4	CHICAGO	IL	ICIS, RCRAInfo-SQG, FINDS, LUST
60651	S110153914		KERRIGAN-LEWIS WIRE PRODUCTS INC.	4421 WEST RICE STREET		CHICAGO	IL	TIER 2
60651	1008151578	110018484059	PARAGON SPRING AND STAMPING CO	4435 RICE ST		CHICAGO	IL	AIRS, FINDS
60651	1008123886	110018205299	YOUNG, LEO PROPERTY	4700-4710 W RICE ST		CHICAGO	IL	FINDS
60651	S113269508		YOUNG, LEO PROPERTY	4700-4710 W RICE ST		CHICAGO	IL	
60651	U004271927		CHAMBERS GASKET & MFG CO	4701 W. RICE ST.		CHICAGO	IL	UST
60651	1007087590	110015671334	HOFFMAN RESTORATION	4724 W RICE ST		CHICAGO	IL	FINDS
60651	S113269147		HOFFMAN RESTORATION	4724 W RICE ST		CHICAGO	IL	
60651	U006930451	ILR000123190	HOFFMAN RESTORATION	4724 W RICE ST		CHICAGO	IL	RCRAInfo-SQG
60651	U004200795		HOFFMAN FURNITURE RESTORAGE	4732-4734 W. RICE STREET		CHICAGO	IL	UST
60651	S109092966		PIAST AUTO REBUILDERS	4752 W RICE ST		CHICAGO	IL	
60651	U004115091	2043932	FORMER SERVICE STATION	4752 WEST RICE		CHICAGO	IL	LUST, UST
60651	1011852550	110037147192	SHED & 4 PARKING BAYS	1533-37 N RIDGEWAY		CHICAGO	IL	FINDS
60651	1010370347	110030822947	BRONZEVILLE LIGHTHOUSE	8 W ROOT ST		CHICAGO	IL	FINDS
60651	1008209602	110020855537	SAMPLER LOCATED AT SE CORNER OF E	SCENTEX INC, 4645 W. AUGUSTA		CHICAGO	IL	FINDS
60651	S113269602		MULLIGAN SCHOOL	1855 N SHEFFIELD		CHICAGO	IL	
60651	1008119776	110018163976	COOPER & CO, WILLIAM H	816 N SPAULDING		CHICAGO	IL	FINDS
60651	S107740920	13780	COOPER & CO, WILLIAM H	816 N SPAULDING		CHICAGO	IL	AIRS
60651	1000359812	110009368861	AMERICAN SPRING AND WIRE	816 N SPAULDING		CHICAGO	IL	Inst Control, ENG CONTROLS, RCRA-NonGen, SRP, FINDS, LUST
60651	1004474421	110001381184	CLEAR MOUNTAIN PRODUCTS	816 N. SPAULDING AVE.		CHICAGO	IL	FINDS
60651	1000265133	110009366863	MIKE'S ANODIZING CO	859 N SPAULDING		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S110154515		MIKE'S ANODIZING COMPANY	859 N. SPAULDING		CHICAGO	IL	TIER 2
60651	1017802325	110063976149	1538 N SPRINGFIELD	1538 N SPRINGFIELD		CHICAGO	IL	FINDS
60651	S113269587		ANCHOR SPRAY	4516-20 W THOMAS		CHICAGO	IL	
60651	1010317319	ILR000144527	BLACK SWAN	4540 W THOMAS ST		CHICAGO	IL	RCRAInfo-SQG
60651	U000864765	2001774	BLACK SWAN MFG CO	4540 W THOMAS ST		CHICAGO	IL	UST
60651	S111905891		BLACK SWAN MFG CORP	4540 W THOMAS ST		CHICAGO	IL	
60651	1014346898		BLACK SWAN MFG. CO.	4540 W THOMAS ST		CHICAGO	IL	SSTS
60651	1004472357		BLACK SWAN MANUFACTURING COMPAN	4540 W. THOMAS ST		CHICAGO	IL	SSTS
60651	S110151163		BLACK SWAN MFG. COMPANY	4540 W. THOMAS STREET		CHICAGO	IL	TIER 2
60651	1001645860		BLACK SWAN MFG. CO.	4540 WEST THOMAS AVE.		CHICAGO	IL	LUST
60651	1006265331	110001380906	BLACK SWAN MANUFACTURING	4540 WEST THOMAS STREET		CHICAGO	IL	ICIS, FINDS
60651	S113269089		IL ST PSYCHIATRIC INST	4930 W THOMAS ST		CHICAGO	IL	
60651	1008133631	110018303129	IL ST PSYCHIATRIC INST	4930 W THOMAS ST		CHICAGO	IL	FINDS
60651	U000865892	2014470	BETH ANNE FOUNDATION	4950 W THOMAS		CHICAGO	IL	UST
60651	1006334423		ST. ANNE'S HOSPITAL	4950 WEST THOMAS STREET		CHICAGO	IL	MLTS
60651	1000979113	110005807172	APARTMENT BUILDING	1022 THRU 1024 N AUSTIN BLVD		CHICAGO	IL	RCRA-CESQG, FINDS
60651	1000453278	110005876846	SUPERIOR TOOL AND STAMPING	4519 THRU 29 W HADDON AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	1000907145	110005802471	SUPERIOR AUTOMTOVIE RPR	5449 THRU 53 W CHICAGO AVE		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S113270494		ABANDON BUILDING	1308 S TRIPP ST		CHICAGO	IL	
60651	1014197700		ALLIED METAL CO - CHICAGO	4528 W. VISON STREET		CHICAGO	IL	TSCA
60651	1010343098	110030733990	3802 -04 W CHICAGO AVE	3802 -04 W CHICAGO AVE		CHICAGO	IL	FINDS
60651	1017816251	110064439530	3922 -26 W CHICAGO	3922 -26 W CHICAGO		CHICAGO	IL	FINDS
60651	1001123537	110005951522	ANCHOR SPRAY	4520 16 W THOMAS		CHICAGO	IL	RCRAInfo-SQG, FINDS
60651	S111885405		CHICAGO DEPT OF WATER BW	3826 W WABANSIA AVE		CHICAGO	IL	
60651	1008123726	110018203683	CHICAGO DEPT OF WATER BW	3826 W WABANSIA AVE		CHICAGO	IL	FINDS
60651	S104524536		CHICAGO DEPT. OF WATER	3826 WEST WABANSIA AVE.		CHICAGO	IL	LUST
60651	1010729011	110033598989	W R WEIS BLDG	2537 WABASH		CHICAGO	IL	FINDS
60651	1017812226	110064371647	3341 N WALTON VACANT LOT	3341 N WALTON ST		CHICAGO	IL	FINDS
60651	S118661265		3341 N WALTON VACANT LOT	3341 N WALTON ST		CHICAGO	IL	
60651	1015937137	110046095408	3341 W WALTON & 816 N SPAULDING	3341 W WALTON & 816 N SPAULDING	**	CHICAGO	IL	FINDS
60651	1012293487	110040410819	ROSE OF SHARON COMMUNITY CHURCH	4256 W WALTON		CHICAGO	IL	FINDS
60651	S113269163		901 N KILPATRICK LLC	4645 W WALTON		CHICAGO	IL	
60651	1021000048		HARTNEY FUEL OIL CO*	4701-09 W WALTON		CHICAGO	IL	
60651	1005636015	110001677542	HARTNEY FUEL OIL CO INC	4709 W WALTON		CHICAGO	IL	AIRS, FINDS
60651	1000688743	110005908937	NORTHWEST CRANKSHAFT	4714 W WALTON		CHICAGO	IL	RCRAInfo-SQG, FINDS

EDR ZIP Code Scan Report

ZIP	EDR-ID	Facility ID	Name	Address	Map/Dir/Dist	City	State	Databases
60651	S113269552		NORTHWEST CRANKSHAFT	4714 W WALTON		CHICAGO	IL	
60651	S113269169		LAMPLEY, FREDERICK	5831 W WALTON		CHICAGO	IL	
60651	1008133174	110018298554	I&R INVESTMENTS	1756-58 N WESTERN		CHICAGO	IL	FINDS
60651	S113268644		I&R INVESTMENTS	1756-58 N WESTERN		CHICAGO	IL	

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 05/30/2017	Source: EPA
Date Data Arrived at EDR: 06/08/2017	Telephone: N/A
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 99	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 6
Telephone: 214-655-6659

EPA Region 3
Telephone 215-814-5418

EPA Region 7
Telephone: 913-551-7247

EPA Region 4
Telephone 404-562-8033

EPA Region 8
Telephone: 303-312-6774

EPA Region 5
Telephone 312-886-6686

EPA Region 9
Telephone: 415-947-4246

EPA Region 10
Telephone 206-553-8665

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 05/30/2017	Source: EPA
Date Data Arrived at EDR: 06/09/2017	Telephone: N/A
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 98	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991	Source: EPA
Date Data Arrived at EDR: 02/02/1994	Telephone: 202-564-4267
Date Made Active in Reports: 03/30/1994	Last EDR Contact: 08/15/2011
Number of Days to Update: 56	Next Scheduled EDR Contact: 11/28/2011
	Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 05/30/2017	Source: EPA
Date Data Arrived at EDR: 06/09/2017	Telephone: N/A
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 98	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 11/07/2016	Source: Environmental Protection Agency
Date Data Arrived at EDR: 01/05/2017	Telephone: 703-603-8704
Date Made Active in Reports: 04/07/2017	Last EDR Contact: 10/06/2017
Number of Days to Update: 92	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Varies

SEMS: Superfund Enterprise Management System

SEMS (Superfund Enterprise Management System) tracks hazardous waste sites, potentially hazardous waste sites, and remedial activities performed in support of EPA's Superfund Program across the United States. The list was formerly know as CERCLIS, renamed to SEMS by the EPA in 2015. The list contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). This dataset also contains sites which are either proposed to or on the National Priorities List (NPL) and the sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 07/11/2017	Source: EPA
Date Data Arrived at EDR: 07/21/2017	Telephone: 800-424-9346
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 77	Next Scheduled EDR Contact: 01/29/2018
	Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site list

SEMS-ARCHIVE: Superfund Enterprise Management System Archive

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

SEMS-ARCHIVE (Superfund Enterprise Management System Archive) tracks sites that have no further interest under the Federal Superfund Program based on available information. The list was formerly known as the CERCLIS-NFRAP, renamed to SEMS ARCHIVE by the EPA in 2015. EPA may perform a minimal level of assessment work at a site while it is archived if site conditions change and/or new information becomes available. Archived sites have been removed and archived from the inventory of SEMS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list the site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. The decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be potential NPL site.

Date of Government Version: 07/11/2017	Source: EPA
Date Data Arrived at EDR: 07/28/2017	Telephone: 800-424-9346
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 70	Next Scheduled EDR Contact: 01/29/2018
	Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 09/13/2017	Source: EPA
Date Data Arrived at EDR: 09/26/2017	Telephone: 800-424-9346
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 09/26/2017
Number of Days to Update: 10	Next Scheduled EDR Contact: 01/08/2018
	Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: 312-886-6186
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 09/26/2017
Number of Days to Update: 10	Next Scheduled EDR Contact: 01/08/2018
	Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: 312-886-6186
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 09/26/2017
Number of Days to Update: 10	Next Scheduled EDR Contact: 01/08/2018
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: 312-886-6186
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 09/26/2017
Number of Days to Update: 10	Next Scheduled EDR Contact: 01/08/2018
	Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 09/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/26/2017	Telephone: 312-886-6186
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 09/26/2017
Number of Days to Update: 10	Next Scheduled EDR Contact: 01/08/2018
	Data Release Frequency: Quarterly

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/22/2017	Source: Department of the Navy
Date Data Arrived at EDR: 06/13/2017	Telephone: 843-820-7326
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/08/2017
Number of Days to Update: 94	Next Scheduled EDR Contact: 02/26/2018
	Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 08/10/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/30/2017	Telephone: 703-603-0695
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 08/30/2017
Number of Days to Update: 44	Next Scheduled EDR Contact: 12/11/2017
	Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 08/10/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 08/30/2017	Telephone: 703-603-0695
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 08/30/2017
Number of Days to Update: 44	Next Scheduled EDR Contact: 12/11/2017
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 09/18/2017
Date Data Arrived at EDR: 09/21/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 22

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 09/21/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Quarterly

State- and tribal - equivalent CERCLIS

SSU: State Sites Unit Listing

The State Response Action Program database identifies the status of all sites under the responsibility of the Illinois EPA's State Sites Unit.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 07/29/2015
Date Made Active in Reports: 09/01/2015
Number of Days to Update: 34

Source: Illinois Environmental Protection Agency
Telephone: 217-524-4826
Last EDR Contact: 10/23/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

SWF/LF: Available Disposal for Solid Waste in Illinois - Solid Waste Landfills Subject to State Surcharge

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 08/03/2017
Date Made Active in Reports: 09/19/2017
Number of Days to Update: 47

Source: Illinois Environmental Protection Agency
Telephone: 217-785-8604
Last EDR Contact: 10/27/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Annually

CCDD: Clean Construction or Demolition Debris

Construction and demolition (C and D) debris is nonhazardous, uncontaminated material resulting from construction, remodeling, repair, or demolition of utilities, structures, and roads.

Date of Government Version: 05/23/2017
Date Data Arrived at EDR: 07/12/2017
Date Made Active in Reports: 09/20/2017
Number of Days to Update: 70

Source: Illinois EPA
Telephone: 217-524-3300
Last EDR Contact: 10/13/2017
Next Scheduled EDR Contact: 01/22/2018
Data Release Frequency: Varies

LF WMRC: Waste Management & Research Center Landfill Database

The Waste Management & Research Center Landfill Database includes records from the Department of Public Health, Department of Mines & Minerals, Illinois Environmental Protection Agency, State Geological Survey, Northeastern Illinois Planning Commission and Pollution Control Board.

Date of Government Version: 12/31/2001
Date Data Arrived at EDR: 10/06/2006
Date Made Active in Reports: 11/06/2006
Number of Days to Update: 31

Source: Department of Natural Resources
Telephone: 217-333-8940
Last EDR Contact: 09/18/2009
Next Scheduled EDR Contact: 12/28/2009
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

LF SPECIAL WASTE: Special Waste Site List

These landfills, as of January 1, 1990, accept non-hazardous special waste pursuant to the Illinois EPA Non-Hazardous Special Waste Definition. List A includes landfills that may receive any non-hazardous waste, Non-Regional Pollution Control Facilities are so noted. List B includes landfills designed to receive specific non-hazardous wastes. List B landfills are designated as a Regional Pollution Control Facility by RPCF, or Non-Regional Pollution Control Facility by Non-RPCF.

Date of Government Version: 01/01/1990	Source: Illinois EPA
Date Data Arrived at EDR: 06/17/2009	Telephone: 217-782-9288
Date Made Active in Reports: 07/15/2009	Last EDR Contact: 06/10/2009
Number of Days to Update: 28	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

IL NIPC: Solid Waste Landfill Inventory

Solid Waste Landfill Inventory. NIPC is an inventory of active and inactive solid waste disposal sites, based on state, local government and historical archive data. Included are numerous sites which previously had never been identified largely because there was no obligation to register such sites prior to 1971.

Date of Government Version: 08/01/1988	Source: Northeastern Illinois Planning Commission
Date Data Arrived at EDR: 08/01/1994	Telephone: 312-454-0400
Date Made Active in Reports: 08/12/1994	Last EDR Contact: 05/23/2006
Number of Days to Update: 11	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank Sites

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 07/24/2017	Source: Illinois Environmental Protection Agency
Date Data Arrived at EDR: 07/26/2017	Telephone: 217-524-3300
Date Made Active in Reports: 09/20/2017	Last EDR Contact: 10/24/2017
Number of Days to Update: 56	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Semi-Annually

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land

Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 04/26/2017	Source: EPA, Region 5
Date Data Arrived at EDR: 07/27/2017	Telephone: 312-886-7439
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 78	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 04/24/2017	Source: EPA Region 6
Date Data Arrived at EDR: 07/27/2017	Telephone: 214-665-6597
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 71	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 10/07/2016	Source: EPA Region 10
Date Data Arrived at EDR: 01/26/2017	Telephone: 206-553-2857
Date Made Active in Reports: 05/05/2017	Last EDR Contact: 11/07/2017
Number of Days to Update: 99	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 04/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 07/27/2017	Telephone: 415-972-3372
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 78	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 05/01/2017	Source: EPA Region 8
Date Data Arrived at EDR: 07/27/2017	Telephone: 303-312-6271
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 78	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 04/14/2017	Source: EPA Region 7
Date Data Arrived at EDR: 07/27/2017	Telephone: 913-551-7003
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 71	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 10/14/2016	Source: EPA Region 4
Date Data Arrived at EDR: 01/27/2017	Telephone: 404-562-8677
Date Made Active in Reports: 05/05/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 98	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Semi-Annually

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land
A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 04/14/2017	Source: EPA Region 1
Date Data Arrived at EDR: 07/27/2017	Telephone: 617-918-1313
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 71	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

LUST TRUST: Underground Storage Tank Fund Payment Priority List

In case sufficient funds are not available in the Underground Storage Tank Fund, requests for payment are entered on the Payment Priority List by "queue date" order. As required by the Environmental Protection Act, the queue date is the date that a complete request for partial or final payment was received by the Agency. The queue date is "officially" confirmed at the end of the payment review process when a Final Decision Letter is sent to the site owner.

Date of Government Version: 06/06/2016	Source: Illinois EPA
Date Data Arrived at EDR: 07/27/2016	Telephone: 217-782-6762
Date Made Active in Reports: 10/18/2016	Last EDR Contact: 10/27/2017
Number of Days to Update: 83	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

State and tribal registered storage tank lists

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FEMA UST: Underground Storage Tank Listing

A listing of all FEMA owned underground storage tanks.

Date of Government Version: 05/15/2017	Source: FEMA
Date Data Arrived at EDR: 05/30/2017	Telephone: 202-646-5797
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/13/2017
Number of Days to Update: 136	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Varies

UST: Underground Storage Tank Facility List

Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 07/24/2017	Source: Illinois State Fire Marshal
Date Data Arrived at EDR: 07/26/2017	Telephone: 217-785-0969
Date Made Active in Reports: 09/21/2017	Last EDR Contact: 10/25/2017
Number of Days to Update: 57	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Quarterly

AST: Above Ground Storage Tanks

Listing of all aboveground tanks inspected by Office of State Fire Marshal.

Date of Government Version: 07/03/2017	Source: State Fire Marshal
Date Data Arrived at EDR: 09/01/2017	Telephone: 217-785-1011
Date Made Active in Reports: 09/22/2017	Last EDR Contact: 11/14/2017
Number of Days to Update: 21	Next Scheduled EDR Contact: 03/05/2018
	Data Release Frequency: Varies

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 04/26/2017	Source: EPA Region 5
Date Data Arrived at EDR: 07/27/2017	Telephone: 312-886-6136
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 71	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN UST R8: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 05/01/2017	Source: EPA Region 8
Date Data Arrived at EDR: 07/27/2017	Telephone: 303-312-6137
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 78	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 05/02/2017	Source: EPA Region 7
Date Data Arrived at EDR: 07/27/2017	Telephone: 913-551-7003
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 71	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 10/01/2016	Source: EPA Region 6
Date Data Arrived at EDR: 01/26/2017	Telephone: 214-665-7591
Date Made Active in Reports: 05/05/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 99	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Semi-Annually

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 04/25/2017	Source: EPA Region 10
Date Data Arrived at EDR: 07/27/2017	Telephone: 206-553-2857
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 78	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 04/13/2017	Source: EPA Region 9
Date Data Arrived at EDR: 07/27/2017	Telephone: 415-972-3368
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 78	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN UST R1: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 04/14/2017	Source: EPA, Region 1
Date Data Arrived at EDR: 07/27/2017	Telephone: 617-918-1313
Date Made Active in Reports: 10/06/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 71	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 10/14/2016	Source: EPA Region 4
Date Data Arrived at EDR: 01/27/2017	Telephone: 404-562-9424
Date Made Active in Reports: 05/05/2017	Last EDR Contact: 10/27/2017
Number of Days to Update: 98	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Semi-Annually

State and tribal institutional control / engineering control registries

ENG CONTROLS: Sites with Engineering Controls

Sites using of engineered barriers (e.g., asphalt or concrete paving).

Date of Government Version: 06/29/2017	Source: Illinois Environmental Protection Agency
Date Data Arrived at EDR: 07/07/2017	Telephone: 217-782-6761
Date Made Active in Reports: 09/19/2017	Last EDR Contact: 10/03/2017
Number of Days to Update: 74	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Inst Control: Institutional Controls

Legal or administrative restrictions on land use and/or other activities (e.g., groundwater use restrictions) which effectively limit exposure to contamination may be employed as alternatives to removal or treatment of contamination.

Date of Government Version: 06/29/2017
Date Data Arrived at EDR: 07/07/2017
Date Made Active in Reports: 09/19/2017
Number of Days to Update: 74

Source: Illinois Environmental Protection Agency
Telephone: 217-782-6761
Last EDR Contact: 10/03/2017
Next Scheduled EDR Contact: 01/15/2018
Data Release Frequency: Quarterly

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing

A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 07/27/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 02/18/2016
Number of Days to Update: 142

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 09/25/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Varies

SRP: Site Remediation Program Database

The database identifies the status of all voluntary remediation projects administered through the pre-notice site cleanup program (1989 to 1995) and the site remediation program (1996 to the present).

Date of Government Version: 06/29/2017
Date Data Arrived at EDR: 07/07/2017
Date Made Active in Reports: 09/19/2017
Number of Days to Update: 74

Source: Illinois Environmental Protection Agency
Telephone: 217-785-9407
Last EDR Contact: 10/03/2017
Next Scheduled EDR Contact: 01/15/2018
Data Release Frequency: Semi-Annually

State and tribal Brownfields sites

BROWNFIELDS: Municipal Brownfields Redevelopment Grant Program Project Descriptions

The Illinois Municipal Brownfields Redevelopment Grant Program (MBRGP) offers grants worth a maximum of \$240,000 each to municipalities to assist in site investigation activities, development of cleanup objectives, and performance of cleanup activities. Brownfields are abandoned or underused industrial and/or commercial properties that are contaminated (or thought to be contaminated) and have an active potential for redevelopment.

Date of Government Version: 02/11/2010
Date Data Arrived at EDR: 07/31/2014
Date Made Active in Reports: 09/08/2014
Number of Days to Update: 39

Source: Illinois Environmental Protection Agency
Telephone: 217-785-3486
Last EDR Contact: 10/27/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Varies

BROWNFIELDS: Redevelopment Assessment Database

The Office of Site Evaluations Redevelopment Assessment database identifies the status of all properties within the State in which the Illinois EPA's Office of Site Evaluation has conducted a municipal Brownfield Redevelopment Assessment.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 07/24/2017
Date Data Arrived at EDR: 07/26/2017
Date Made Active in Reports: 09/18/2017
Number of Days to Update: 54

Source: Illinois Environmental Protection Agency
Telephone: 217-524-1658
Last EDR Contact: 10/24/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/19/2017
Date Data Arrived at EDR: 06/20/2017
Date Made Active in Reports: 09/15/2017
Number of Days to Update: 87

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 09/20/2017
Next Scheduled EDR Contact: 01/01/2018
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 10/30/2017
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/20/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: No Update Planned

IHS OPEN DUMPS: Open Dumps on Indian Land

A listing of all open dumps located on Indian Land in the United States.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 04/01/2014
Date Data Arrived at EDR: 08/06/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 176

Source: Department of Health & Human Services, Indian Health Service
Telephone: 301-443-1452
Last EDR Contact: 11/03/2017
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Varies

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations that have been removed from the DEAs National Clandestine Laboratory Register.

Date of Government Version: 07/13/2017
Date Data Arrived at EDR: 09/06/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 30

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 08/30/2017
Next Scheduled EDR Contact: 12/11/2017
Data Release Frequency: No Update Planned

CDL: Meth Drug Lab Site Listing

A listing of clandestine/meth drug lab locations.

Date of Government Version: 07/26/2017
Date Data Arrived at EDR: 07/31/2017
Date Made Active in Reports: 09/18/2017
Number of Days to Update: 49

Source: Department of Public Health
Telephone: 217-782-5750
Last EDR Contact: 10/10/2017
Next Scheduled EDR Contact: 01/22/2018
Data Release Frequency: Varies

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 07/13/2017
Date Data Arrived at EDR: 09/06/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 30

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 08/30/2017
Next Scheduled EDR Contact: 12/11/2017
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 07/11/2017
Date Data Arrived at EDR: 07/26/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 79

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 11/03/2017
Next Scheduled EDR Contact: 02/05/2018
Data Release Frequency: Semi-Annually

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System

Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 09/21/2017
Date Data Arrived at EDR: 09/21/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 22

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 09/21/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Quarterly

IEMA SPILLS: Illinois Emergency Management Agency Spills

A listing of hazardous materials incidents reported to the Illinois Emergency Management Agency.

Date of Government Version: 07/31/2017
Date Data Arrived at EDR: 08/01/2017
Date Made Active in Reports: 09/20/2017
Number of Days to Update: 50

Source: Illinois Emergency Management Agency
Telephone: 217-524-0770
Last EDR Contact: 11/01/2017
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Quarterly

SPILLS: State spills

A listing of incidents reported to the Office of Emergency Response.

Date of Government Version: 07/13/2017
Date Data Arrived at EDR: 07/25/2017
Date Made Active in Reports: 09/20/2017
Number of Days to Update: 57

Source: Illinois EPA
Telephone: 217-782-3637
Last EDR Contact: 10/03/2017
Next Scheduled EDR Contact: 01/22/2018
Data Release Frequency: Varies

SPILLS 90: SPILLS90 data from FirstSearch

Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 07/18/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 03/15/2013
Number of Days to Update: 71

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 09/13/2017
Date Data Arrived at EDR: 09/26/2017
Date Made Active in Reports: 10/06/2017
Number of Days to Update: 10

Source: Environmental Protection Agency
Telephone: 312-886-6186
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Quarterly

FUDS: Formerly Used Defense Sites

The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015
Date Data Arrived at EDR: 07/08/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 97

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 08/25/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

DOD: Department of Defense Sites

This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005	Source: USGS
Date Data Arrived at EDR: 11/10/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/13/2017
Number of Days to Update: 62	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005	Source: U.S. Geological Survey
Date Data Arrived at EDR: 02/06/2006	Telephone: 888-275-8747
Date Made Active in Reports: 01/11/2007	Last EDR Contact: 10/11/2017
Number of Days to Update: 339	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 01/01/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/03/2017	Telephone: 615-532-8599
Date Made Active in Reports: 04/07/2017	Last EDR Contact: 08/18/2017
Number of Days to Update: 63	Next Scheduled EDR Contact: 11/27/2017
	Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 05/10/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 05/17/2017	Telephone: 202-566-1917
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/01/2017
Number of Days to Update: 121	Next Scheduled EDR Contact: 01/08/2018
	Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/21/2014	Telephone: 617-520-3000
Date Made Active in Reports: 06/17/2014	Last EDR Contact: 11/06/2017
Number of Days to Update: 88	Next Scheduled EDR Contact: 02/19/2018
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013	Source: Environmental Protection Agency
Date Data Arrived at EDR: 03/03/2015	Telephone: 703-308-4044
Date Made Active in Reports: 03/09/2015	Last EDR Contact: 11/09/2017
Number of Days to Update: 6	Next Scheduled EDR Contact: 02/19/2018
	Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2012	Source: EPA
Date Data Arrived at EDR: 01/15/2015	Telephone: 202-260-5521
Date Made Active in Reports: 01/29/2015	Last EDR Contact: 09/22/2017
Number of Days to Update: 14	Next Scheduled EDR Contact: 01/01/2018
	Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2014	Source: EPA
Date Data Arrived at EDR: 11/24/2015	Telephone: 202-566-0250
Date Made Active in Reports: 04/05/2016	Last EDR Contact: 08/23/2017
Number of Days to Update: 133	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009	Source: EPA
Date Data Arrived at EDR: 12/10/2010	Telephone: 202-564-4203
Date Made Active in Reports: 02/25/2011	Last EDR Contact: 10/27/2017
Number of Days to Update: 77	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 09/27/2017	Source: EPA
Date Data Arrived at EDR: 10/12/2017	Telephone: 703-416-0223
Date Made Active in Reports: 10/20/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 8	Next Scheduled EDR Contact: 12/18/2017
	Data Release Frequency: Annually

RMP: Risk Management Plans

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 02/01/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/09/2017	Telephone: 202-564-8600
Date Made Active in Reports: 04/07/2017	Last EDR Contact: 10/23/2017
Number of Days to Update: 57	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995	Source: EPA
Date Data Arrived at EDR: 07/03/1995	Telephone: 202-564-4104
Date Made Active in Reports: 08/07/1995	Last EDR Contact: 06/02/2008
Number of Days to Update: 35	Next Scheduled EDR Contact: 09/01/2008
	Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013	Source: EPA
Date Data Arrived at EDR: 10/17/2014	Telephone: 202-564-6023
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 11/03/2017
Number of Days to Update: 3	Next Scheduled EDR Contact: 02/19/2018
	Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 06/01/2017	Source: EPA
Date Data Arrived at EDR: 06/09/2017	Telephone: 202-566-0500
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/13/2017
Number of Days to Update: 126	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 11/18/2016	Source: Environmental Protection Agency
Date Data Arrived at EDR: 11/23/2016	Telephone: 202-564-2501
Date Made Active in Reports: 02/10/2017	Last EDR Contact: 10/11/2017
Number of Days to Update: 79	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009	Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009	Source: EPA
Date Data Arrived at EDR: 04/16/2009	Telephone: 202-566-1667
Date Made Active in Reports: 05/11/2009	Last EDR Contact: 08/18/2017
Number of Days to Update: 25	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 08/30/2016	Source: Nuclear Regulatory Commission
Date Data Arrived at EDR: 09/08/2016	Telephone: 301-415-7169
Date Made Active in Reports: 10/21/2016	Last EDR Contact: 10/16/2017
Number of Days to Update: 43	Next Scheduled EDR Contact: 11/20/2017
	Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005	Source: Department of Energy
Date Data Arrived at EDR: 08/07/2009	Telephone: 202-586-8719
Date Made Active in Reports: 10/22/2009	Last EDR Contact: 10/03/2017
Number of Days to Update: 76	Next Scheduled EDR Contact: 12/18/2017
	Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/10/2014	Telephone: N/A
Date Made Active in Reports: 10/20/2014	Last EDR Contact: 09/08/2017
Number of Days to Update: 40	Next Scheduled EDR Contact: 12/18/2017
	Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011	Source: Environmental Protection Agency
Date Data Arrived at EDR: 10/19/2011	Telephone: 202-566-0517
Date Made Active in Reports: 01/10/2012	Last EDR Contact: 10/26/2017
Number of Days to Update: 83	Next Scheduled EDR Contact: 02/05/2018
	Data Release Frequency: Varies

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 10/02/2017
Date Data Arrived at EDR: 10/05/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 8

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/05/2017
Next Scheduled EDR Contact: 01/15/2018
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transportation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transportation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 10/31/2017
Next Scheduled EDR Contact: 02/12/2018
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 06/30/2017
Date Data Arrived at EDR: 08/03/2017
Date Made Active in Reports: 10/20/2017
Number of Days to Update: 78

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 09/25/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 02/22/2017
Date Made Active in Reports: 09/28/2017
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 09/21/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: Biennially

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2014	Source: USGS
Date Data Arrived at EDR: 07/14/2015	Telephone: 202-208-3710
Date Made Active in Reports: 01/10/2017	Last EDR Contact: 10/11/2017
Number of Days to Update: 546	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Semi-Annually

FUSRAP: Formerly Utilized Sites Remedial Action Program

DOE established the Formerly Utilized Sites Remedial Action Program (FUSRAP) in 1974 to remediate sites where radioactive contamination remained from Manhattan Project and early U.S. Atomic Energy Commission (AEC) operations.

Date of Government Version: 12/23/2016	Source: Department of Energy
Date Data Arrived at EDR: 12/27/2016	Telephone: 202-586-3559
Date Made Active in Reports: 02/17/2017	Last EDR Contact: 11/02/2017
Number of Days to Update: 52	Next Scheduled EDR Contact: 02/19/2018
	Data Release Frequency: Varies

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 06/23/2017	Source: Department of Energy
Date Data Arrived at EDR: 10/11/2017	Telephone: 505-845-0011
Date Made Active in Reports: 11/03/2017	Last EDR Contact: 10/10/2017
Number of Days to Update: 23	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 05/30/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 06/09/2017	Telephone: 703-603-8787
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 11/03/2017
Number of Days to Update: 98	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931 and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001	Source: American Journal of Public Health
Date Data Arrived at EDR: 10/27/2010	Telephone: 703-305-6451
Date Made Active in Reports: 12/02/2010	Last EDR Contact: 12/02/2009
Number of Days to Update: 36	Next Scheduled EDR Contact: N/A
	Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data A listing of minor source facilities.

Date of Government Version: 10/12/2016
Date Data Arrived at EDR: 10/26/2016
Date Made Active in Reports: 02/03/2017
Number of Days to Update: 100

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 09/26/2017
Next Scheduled EDR Contact: 01/08/2018
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 07/31/2017
Date Data Arrived at EDR: 08/30/2017
Date Made Active in Reports: 10/13/2017
Number of Days to Update: 44

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 08/30/2017
Next Scheduled EDR Contact: 12/11/2017
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 09/01/2017
Next Scheduled EDR Contact: 12/11/2017
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 09/01/2017
Next Scheduled EDR Contact: 12/11/2017
Data Release Frequency: Varies

ABANDONED MINES: Abandoned Mines

An inventory of land and water impacted by past mining (primarily coal mining) is maintained by OSMRE to provide information needed to implement the Surface Mining Control and Reclamation Act of 1977 (SMCRA). The inventory contains information on the location, type, and extent of AML impacts, as well as, information on the cost associated with the reclamation of those problems. The inventory is based upon field surveys by State, Tribal, and OSMRE program officials. It is dynamic to the extent that it is modified as new problems are identified and existing problems are reclaimed.

Date of Government Version: 09/25/2017
Date Data Arrived at EDR: 09/26/2017
Date Made Active in Reports: 10/20/2017
Number of Days to Update: 24

Source: Department of Interior
Telephone: 202-208-2609
Last EDR Contact: 09/25/2017
Next Scheduled EDR Contact: 12/25/2017
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/23/2017	Source: EPA
Date Data Arrived at EDR: 09/06/2017	Telephone: (312) 353-2000
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 09/06/2017
Number of Days to Update: 9	Next Scheduled EDR Contact: 12/18/2017
	Data Release Frequency: Quarterly

DOCKET HWC: Hazardous Waste Compliance Docket Listing

A complete list of the Federal Agency Hazardous Waste Compliance Docket Facilities.

Date of Government Version: 02/13/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 02/15/2017	Telephone: 202-564-0527
Date Made Active in Reports: 11/03/2017	Last EDR Contact: 09/21/2017
Number of Days to Update: 261	Next Scheduled EDR Contact: 12/11/2017
	Data Release Frequency: Varies

ECHO: Enforcement & Compliance History Information

ECHO provides integrated compliance and enforcement information for about 800,000 regulated facilities nationwide.

Date of Government Version: 09/02/2017	Source: Environmental Protection Agency
Date Data Arrived at EDR: 09/06/2017	Telephone: 202-564-2280
Date Made Active in Reports: 10/20/2017	Last EDR Contact: 09/06/2017
Number of Days to Update: 44	Next Scheduled EDR Contact: 12/18/2017
	Data Release Frequency: Quarterly

UXO: Unexploded Ordnance Sites

A listing of unexploded ordnance site locations

Date of Government Version: 10/25/2016	Source: Department of Defense
Date Data Arrived at EDR: 06/02/2017	Telephone: 703-704-1564
Date Made Active in Reports: 10/13/2017	Last EDR Contact: 10/16/2017
Number of Days to Update: 133	Next Scheduled EDR Contact: 01/29/2018
	Data Release Frequency: Varies

FUELS PROGRAM: EPA Fuels Program Registered Listing

This listing includes facilities that are registered under the Part 80 (Code of Federal Regulations) EPA Fuels Programs. All companies now are required to submit new and updated registrations.

Date of Government Version: 08/17/2017	Source: EPA
Date Data Arrived at EDR: 08/17/2017	Telephone: 800-385-6164
Date Made Active in Reports: 09/15/2017	Last EDR Contact: 08/17/2017
Number of Days to Update: 29	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Quarterly

AIRS: Air Inventory Listing

A listing of air permits and emissions information.

Date of Government Version: 12/31/2016	Source: Illinois EPA
Date Data Arrived at EDR: 04/27/2017	Telephone: 217-557-0314
Date Made Active in Reports: 09/18/2017	Last EDR Contact: 09/28/2017
Number of Days to Update: 144	Next Scheduled EDR Contact: 01/15/2018
	Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

BOL: Bureau of Land Inventory Database

Bureau of Land inventory for facility information. Data results are cross-linked with all on-line database system applications from IEPA - Bureau of Land as well as USEPA FRS database.

Date of Government Version: 06/12/2017	Source: Illinois Environmental Protection Agency
Date Data Arrived at EDR: 09/08/2017	Telephone: 217-785-9407
Date Made Active in Reports: 10/11/2017	Last EDR Contact: 08/24/2017
Number of Days to Update: 33	Next Scheduled EDR Contact: 12/11/2017
	Data Release Frequency: Varies

CHICAGO ENV: Environmental Records Dataset

This dataset serves as a lookup table to determine if environmental records exist in a Chicago Department of Public Health (CDPH) environmental dataset for a given address. COMPLAINTS: A "Y" indicates that one or more records exist in the CDPH Environmental Complaints dataset. NESHAPS and DEMOLITON NOTICES: A "Y" indicates that one or more records exist in the CDPH Asbestos and Demolition Notification dataset. ENFORCEMENT: A "Y" indicates that one or more records exist in the CDPH Environmental Enforcement dataset. INSPECTIONS: A "Y" indicates that one or more records exist in the CDPH Environmental Inspections dataset. PERMITS: A "Y" indicates that one or more records exist in the CDPH Environmental Permits dataset. TANKS: A "Y" indicates that one or more records exist in the CDPH Storage Tanks dataset.

Date of Government Version: 09/06/2017	Source: Chicago Department of Public Health
Date Data Arrived at EDR: 09/20/2017	Telephone: 312-745-3136
Date Made Active in Reports: 10/11/2017	Last EDR Contact: 09/20/2017
Number of Days to Update: 21	Next Scheduled EDR Contact: 01/01/2018
	Data Release Frequency: Varies

COAL ASH: Coal Ash Site Listing

A listing of coal ash site locations.

Date of Government Version: 10/01/2011	Source: Illinois EPA
Date Data Arrived at EDR: 03/09/2012	Telephone: 217-782-1654
Date Made Active in Reports: 04/10/2012	Last EDR Contact: 09/01/2017
Number of Days to Update: 32	Next Scheduled EDR Contact: 12/11/2017
	Data Release Frequency: Annually

DRYCLEANERS: Illinois Licensed Drycleaners

Any retail drycleaning facility in Illinois must apply for a license through the Illinois Drycleaner Environmental Response Trust Fund. Drycleaner Environmental Response Trust Fund of Illinois.

Date of Government Version: 08/20/2017	Source: Drycleaner Environmental Response Trust Fund of Illinois
Date Data Arrived at EDR: 08/23/2017	Telephone: 800-765-4041
Date Made Active in Reports: 09/18/2017	Last EDR Contact: 08/23/2017
Number of Days to Update: 26	Next Scheduled EDR Contact: 12/04/2017
	Data Release Frequency: Varies

Financial Assurance: Financial Assurance Information Listing

Information for hazardous waste facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 12/15/2015	Source: Illinois Environmental Protection Agency
Date Data Arrived at EDR: 12/18/2015	Telephone: 217-782-9887
Date Made Active in Reports: 02/18/2016	Last EDR Contact: 11/14/2017
Number of Days to Update: 62	Next Scheduled EDR Contact: 03/05/2018
	Data Release Frequency: Varies

HWAR: Hazard Waste Annual Report

Each year, Illinois hazardous-waste generators tell the Illinois EPA the amounts and kinds of hazardous waste they produced during the previous year. Generators indicate by code the types of wastes produced and the steps they took to manage these wastes. If some or all of these wastes were sent to commercial treatment, storage, and disposal facilities (TSDFs), that information and the identity of each receiving facility also are submitted.

Illinois TSDFs likewise report the types and quantities of wastes received from in-state and out-of-state generators; they also report the procedures they used to manage these wastes.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Date of Government Version: 12/31/2015
Date Data Arrived at EDR: 01/25/2017
Date Made Active in Reports: 02/09/2017
Number of Days to Update: 15

Source: Illinois EPA
Telephone: 217-524-3300
Last EDR Contact: 10/03/2017
Next Scheduled EDR Contact: 01/22/2018
Data Release Frequency: Annually

IMPDMNT: Surface Impoundment Inventory

Statewide inventory of industrial, municipal, mining, oil & gas, and large agricultural impoundment. This study was conducted by the Illinois EPA to assess potential for contamination of shallow aquifers. This was a one-time study. Although many of the impoundments may no longer be present, the sites may be contaminated.

Date of Government Version: 12/31/1980
Date Data Arrived at EDR: 03/08/2002
Date Made Active in Reports: 06/03/2002
Number of Days to Update: 87

Source: Illinois Waste Management & Research Center
Telephone: 217-333-8940
Last EDR Contact: 02/20/2002
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

NPDES: A Listing of Active Permits

A listing of facilities currently active in the state. The types of permits are public, private, federal and state.

Date of Government Version: 04/16/2014
Date Data Arrived at EDR: 04/18/2014
Date Made Active in Reports: 05/20/2014
Number of Days to Update: 32

Source: Illinois EPA
Telephone: 217-782-0610
Last EDR Contact: 09/28/2017
Next Scheduled EDR Contact: 01/15/2018
Data Release Frequency: Varies

PIMW: Potentially Infectious Medical Waste

Potentially Infectious Medical Waste (PIMW) is waste generated in connection with the diagnosis, treatment (i.e., provision of medical services), or immunization of human beings or animals; research pertaining to the provision of medical services; or the provision or testing of biologicals.

Date of Government Version: 09/18/2017
Date Data Arrived at EDR: 09/21/2017
Date Made Active in Reports: 10/11/2017
Number of Days to Update: 20

Source: Illinois EPA
Telephone: 217-524-3289
Last EDR Contact: 09/18/2017
Next Scheduled EDR Contact: 01/01/2018
Data Release Frequency: Varies

TIER 2: Tier 2 Information Listing

A listing of facilities which store or manufacture hazardous materials and submit a chemical inventory report.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 08/17/2017
Date Made Active in Reports: 10/11/2017
Number of Days to Update: 55

Source: Illinois Emergency Management Agency
Telephone: 217-785-9860
Last EDR Contact: 11/08/2017
Next Scheduled EDR Contact: 02/26/2018
Data Release Frequency: Annually

UIC: Underground Injection Wells

Injection wells are used for disposal of fluids by "injection" into the subsurface. The construction of injection wells range from very technical designs with twenty-four hour monitoring to simply a hole dug in the ground to control runoff. As a result of this diversity, the UIC Program divides injection wells into five different classes.

Date of Government Version: 08/30/2017
Date Data Arrived at EDR: 08/31/2017
Date Made Active in Reports: 10/11/2017
Number of Days to Update: 41

Source: Illinois EPA
Telephone: 217-782-9878
Last EDR Contact: 11/14/2017
Next Scheduled EDR Contact: 03/05/2018
Data Release Frequency: Semi-Annually

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historic Auto Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historic Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Natural Resources in Illinois.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 12/30/2013
Number of Days to Update: 182

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Illinois Environmental Protection Agency in Illinois.

Date of Government Version: N/A	Source: Illinois Environmental Protection Agency
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 01/10/2014	Last EDR Contact: 06/01/2012
Number of Days to Update: 193	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Illinois Environmental Protection Agency in Illinois.

Date of Government Version: N/A	Source: Illinois Environmental Protection Agency
Date Data Arrived at EDR: 07/01/2013	Telephone: N/A
Date Made Active in Reports: 12/30/2013	Last EDR Contact: 06/01/2012
Number of Days to Update: 182	Next Scheduled EDR Contact: N/A
	Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

CT MANIFEST: Hazardous Waste Manifest Data

Facility and manifest data. Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a tsd facility.

Date of Government Version: 07/28/2017	Source: Department of Energy & Environmental Protection
Date Data Arrived at EDR: 08/18/2017	Telephone: 860-424-3375
Date Made Active in Reports: 11/14/2017	Last EDR Contact: 11/14/2017
Number of Days to Update: 88	Next Scheduled EDR Contact: 02/26/2018
	Data Release Frequency: No Update Planned

NJ MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2016	Source: Department of Environmental Protection
Date Data Arrived at EDR: 04/11/2017	Telephone: N/A
Date Made Active in Reports: 07/27/2017	Last EDR Contact: 10/05/2017
Number of Days to Update: 107	Next Scheduled EDR Contact: 01/22/2018
	Data Release Frequency: Annually

NY MANIFEST: Facility and Manifest Data

Manifest is a document that lists and tracks hazardous waste from the generator through transporters to a TSD facility.

Date of Government Version: 10/01/2017	Source: Department of Environmental Conservation
Date Data Arrived at EDR: 11/01/2017	Telephone: 518-402-8651
Date Made Active in Reports: 11/13/2017	Last EDR Contact: 11/01/2017
Number of Days to Update: 12	Next Scheduled EDR Contact: 02/12/2018
	Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

PA MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 07/25/2017
Date Made Active in Reports: 09/25/2017
Number of Days to Update: 62

Source: Department of Environmental Protection
Telephone: 717-783-8990
Last EDR Contact: 10/16/2017
Next Scheduled EDR Contact: 01/29/2018
Data Release Frequency: Annually

RI MANIFEST: Manifest information

Hazardous waste manifest information

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 06/19/2015
Date Made Active in Reports: 07/15/2015
Number of Days to Update: 26

Source: Department of Environmental Management
Telephone: 401-222-2797
Last EDR Contact: 08/21/2017
Next Scheduled EDR Contact: 12/04/2017
Data Release Frequency: Annually

WI MANIFEST: Manifest Information

Hazardous waste manifest information.

Date of Government Version: 12/31/2016
Date Data Arrived at EDR: 04/13/2017
Date Made Active in Reports: 07/14/2017
Number of Days to Update: 92

Source: Department of Natural Resources
Telephone: N/A
Last EDR Contact: 09/11/2017
Next Scheduled EDR Contact: 12/25/2017
Data Release Frequency: Annually

Oil/Gas Pipelines

Source: PennWell Corporation

Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data

Source: PennWell Corporation

This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:

Source: American Hospital Association, Inc.

Telephone: 312-280-5991

The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing

Source: Centers for Medicare & Medicaid Services

Telephone: 410-786-3000

A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes

Source: National Institutes of Health

Telephone: 301-594-6248

Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools

Source: National Center for Education Statistics

Telephone: 202-502-7300

The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Private Schools

Source: National Center for Education Statistics

Telephone: 202-502-7300

The National Center for Education Statistics' primary database on private school locations in the United States.

Daycare Centers: Homes & Centers Listing

Source: Department of Children & Family Services

Telephone: 312-814-4150

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.

Source: FEMA

Telephone: 877-336-2627

Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory

Source: Illinois State Geological Survey

Telephone: 217-333-4747

Current USGS 7.5 Minute Topographic Map

Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

© 2015 TomTom North America, Inc. All rights reserved. This material is proprietary and the subject of copyright protection and other intellectual property rights owned by or licensed to Tele Atlas North America, Inc. The use of this material is subject to the terms of a license agreement. You will be held liable for any unauthorized copying or disclosure of this material.

GEOCHECK® - PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

VACANT PARCEL
4301 W. CHICAGO AVE
CHICAGO, IL 60651

TARGET PROPERTY COORDINATES

Latitude (North):	41.893803 - 41° 53' 37.69"
Longitude (West):	87.735743 - 87° 44' 8.67"
Universal Transverse Mercator:	Zone 16
UTM X (Meters):	438964.4
UTM Y (Meters):	4638033.5
Elevation:	610 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5681444 CHICAGO LOOP, IL
Version Date:	2012
Northwest Map:	5680695 RIVER FOREST, IL
Version Date:	2012

EDR's GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

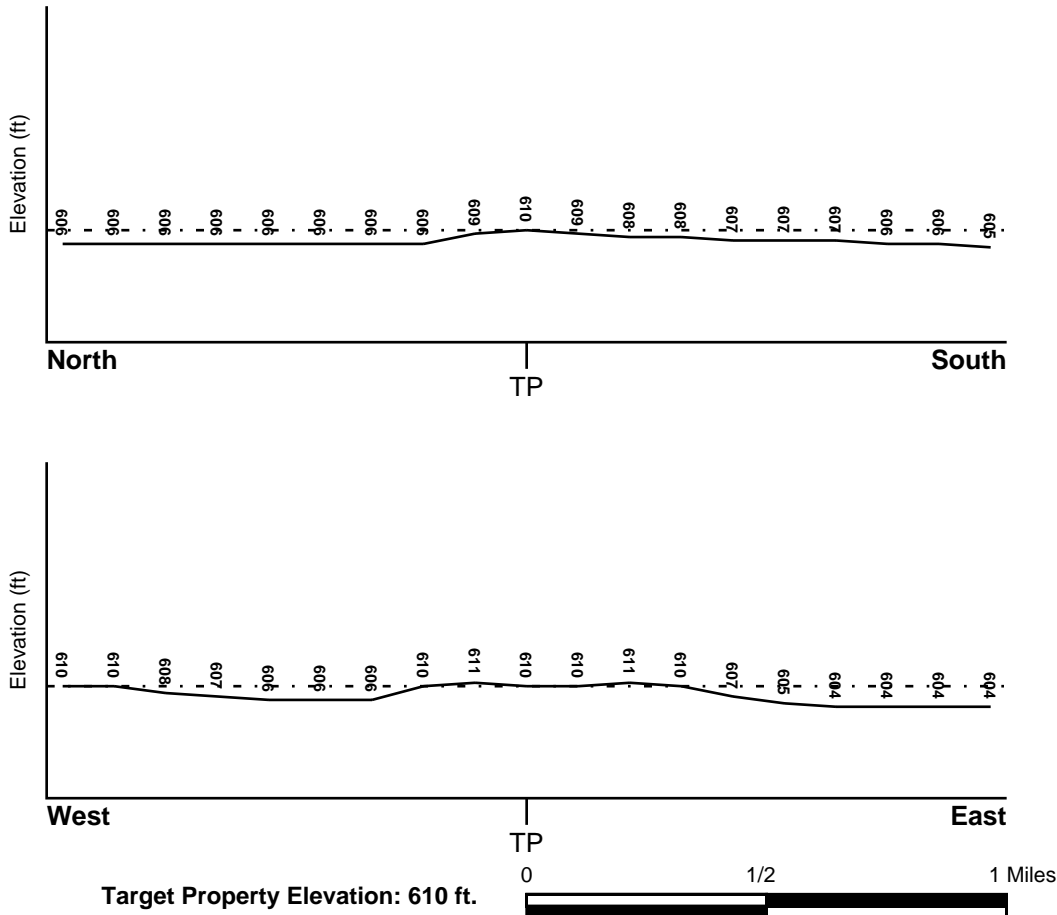
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General NNW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

<u>Flood Plain Panel at Target Property</u>	<u>FEMA Source Type</u>
17031C0415J	FEMA FIRM Flood data
<u>Additional Panels in search area:</u>	<u>FEMA Source Type</u>
1700740050B	FEMA Q3 Flood data

NATIONAL WETLAND INVENTORY

<u>NWI Quad at Target Property</u>	<u>NWI Electronic Data Coverage</u>
CHICAGO LOOP	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Site-Specific Hydrogeological Data*:

Search Radius:	1.25 miles
Status:	Not found

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

<u>MAP ID</u>	<u>LOCATION FROM TP</u>	<u>GENERAL DIRECTION GROUNDWATER FLOW</u>
1	1/8 - 1/4 Mile SW	Not Reported
2	1/4 - 1/2 Mile ENE	Not Reported
4	1/4 - 1/2 Mile NW	NE - SW
14	1/2 - 1 Mile WNW	SW
17	1/2 - 1 Mile SSW	Not Reported
1G	1/2 - 1 Mile WNW	SW
2G	1/4 - 1/2 Mile NW	NE - SW
4G	1/4 - 1/2 Mile ENE	Not Reported

* ©1996 Site-specific hydrogeological data gathered by CERCLIS Alerts, Inc., Bainbridge Island, WA. All rights reserved. All of the information and opinions presented are those of the cited EPA report(s), which were completed under a Comprehensive Environmental Response Compensation and Liability Information System (CERCLIS) investigation.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

<u>MAP ID</u>	<u>LOCATION FROM TP</u>	<u>GENERAL DIRECTION GROUNDWATER FLOW</u>
5G	1/8 - 1/4 Mile SW	Not Reported
6G	1/2 - 1 Mile SSW	Not Reported

For additional site information, refer to Physical Setting Source Map Findings.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

Era: Paleozoic
System: Silurian
Series: Middle Silurian (Niagoaran)
Code: S2 *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: Stratified Sequence

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps. The following information is based on Soil Conservation Service STATSGO data.

Soil Component Name: URBANLAND

Soil Surface Texture: variable

Hydrologic Group: Not reported

Soil Drainage Class: Not reported

Hydric Status: Soil does not meet the requirements for a hydric soil.

Corrosion Potential - Uncoated Steel: Not Reported

Depth to Bedrock Min: > 0 inches

Depth to Bedrock Max: > 0 inches

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Soil Layer Information							
Layer	Boundary		Soil Texture Class	Classification		Permeability Rate (in/hr)	Soil Reaction (pH)
	Upper	Lower		AASHTO Group	Unified Soil		
1	0 inches	60 inches	variable	Not reported	Not reported	Max: 0.00 Min: 0.00	Max: 0.00 Min: 0.00

OTHER SOIL TYPES IN AREA

Based on Soil Conservation Service STATSGO data, the following additional subordinant soil types may appear within the general area of target property.

Soil Surface Textures: fine sand
 fine sandy loam
 silty clay loam
 loamy fine sand

Surficial Soil Types: fine sand
 fine sandy loam
 silty clay loam
 loamy fine sand

Shallow Soil Types: No Other Soil Types

Deeper Soil Types: sand
 fine sand
 loamy sand
 silty clay loam

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

<u>DATABASE</u>	<u>SEARCH DISTANCE (miles)</u>
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL USGS WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
16	USGS40000299452	1/2 - 1 Mile ESE

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

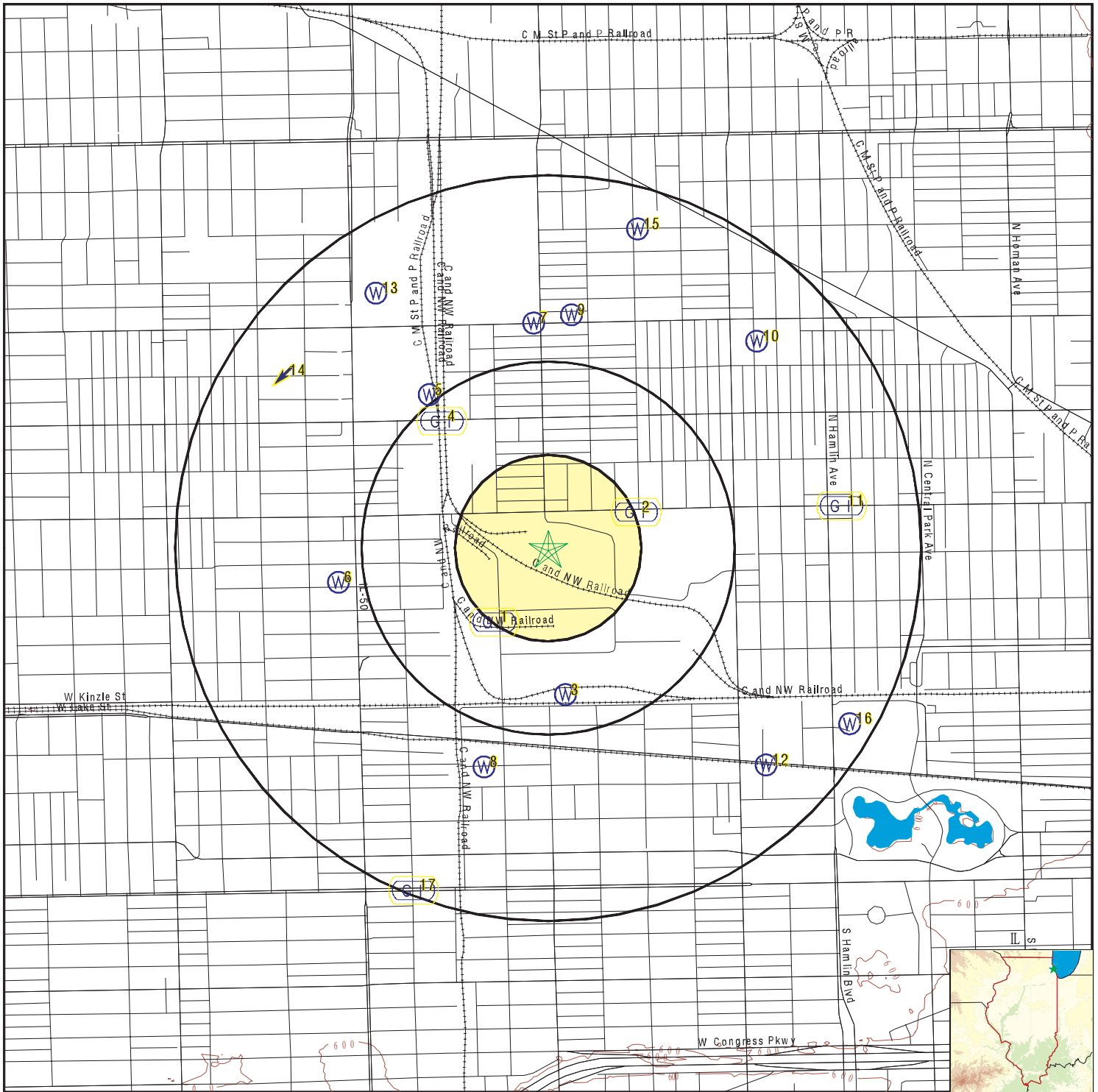
<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

<u>MAP ID</u>	<u>WELL ID</u>	<u>LOCATION FROM TP</u>
3	P6926	1/4 - 1/2 Mile South
5	ILSG20000220126	1/2 - 1 Mile NW
6	ILSG20000219136	1/2 - 1 Mile West
7	ILSG20000220479	1/2 - 1 Mile North
8	ILSG20000218178	1/2 - 1 Mile SSW
9	P6908	1/2 - 1 Mile North
10	ILSG20000220382	1/2 - 1 Mile NE
12	ILSG20000218189	1/2 - 1 Mile SE
13	P6909	1/2 - 1 Mile NW
15	ILSG20000220872	1/2 - 1 Mile NNE

PHYSICAL SETTING SOURCE MAP - 5109170.2s



- County Boundary
- Major Roads
- Contour Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons

- Groundwater Flow Direction
- Indeterminate Groundwater Flow at Location
- Groundwater Flow Varies at Location
- Closest Hydrogeological Data



SITE NAME: Vacant Parcel
 ADDRESS: 4301 W. Chicago Ave
 CHICAGO IL 60651
 LAT/LONG: 41.893803 / 87.735743

CLIENT: AMEC Environment & Infrastructure, Inc.
 CONTACT: Mary Jank
 INQUIRY #: 5109170.2s
 DATE: November 15, 2017 6:06 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

1 SW 1/8 - 1/4 Mile Lower	Site ID: S100530523 Groundwater Flow: Not Reported Deep Water Depth: Not Reported Average Water Depth: 25 Shallow Water Depth: Not Reported Current Deep Depth: Not Reported Current Average Depth: 25 Current Shallow Depth: Not Reported Date: 11/08/93	AQUIFLOW	24807
--	---	-----------------	--------------

2 ENE 1/4 - 1/2 Mile Lower	Site ID: S100530251 Groundwater Flow: Not Reported Deep Water Depth: Not Reported Average Water Depth: 7 Shallow Water Depth: Not Reported Current Deep Depth: Not Reported Current Average Depth: Not Reported Current Shallow Depth: Not Reported Date: 02/18/1997	AQUIFLOW	62315
---	--	-----------------	--------------

3 South 1/4 - 1/2 Mile Lower		IL WELLS	P6926
Well ID: 033762	Second ID: Not Reported		
Info Source: IL Private Water Wells Survey			
Owner: GITS MOULDING CO			
Permit: Not Reported	Date Drilled: 00/00/0000		
Depth (in feet): 180	Aquifer Type: Bedrock		
County Code: 031	County: COOK		
Township: 39N	Range: 13E		
Section: 10	Plot Location: Not Reported		
Well Use: IN	Well Type:		
Record Type: Inventory			
Driller: Not Reported			

4 NW 1/4 - 1/2 Mile Lower	Site ID: S102943620 Groundwater Flow: NE - SW Deep Water Depth: 6.5 Average Water Depth: Not Reported Shallow Water Depth: 4.5 Current Deep Depth: 8.57 Current Average Depth: Not Reported Current Shallow Depth: 5.65 Date: 01/09/96	AQUIFLOW	24875
--	--	-----------------	--------------

5 NW 1/2 - 1 Mile Lower		IL WELLS	ILSG20000220126
--	--	-----------------	------------------------

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Pt api number:	120312657300	Pt status:	ENG
Pt longitude:	-87.741921		
Pt latitude:	41.899767		
Api number:	120312657300		
Longitude :	-87.741921		
Latitude :	41.899767		
Section:	3	Twp:	39
Tdir:	N	Rng:	13
Rdir:	E	Farm name:	Oak St Intrchnng
Farm num:	Mo3	Company name:	Chicago Pub. Works Dept.
Status:	Engineering Test	Elevation:	584
Elevref:	Ground level	Total depth:	104
Wformation:	Not Reported	Wfmfrom:	0
Wfmto:	0	Pumpgpm:	0

6
West
1/2 - 1 Mile
Lower

IL WELLS ILSG20000219136

Pt api number:	120310087800	Pt status:	ENG
Pt longitude:	-87.746644		
Pt latitude:	41.892473		
Api number:	120310087800		
Longitude :	-87.746644		
Latitude :	41.892473		
Section:	9	Twp:	39
Tdir:	N	Rng:	13
Rdir:	E	Farm name:	Deep Tunnel Test
Farm num:	Dh-4	Company name:	Chicago Sanitary Dist.
Status:	Engineering Test	Elevation:	609
Elevref:	Ground level	Total depth:	815
Wformation:	Not Reported	Wfmfrom:	0
Wfmto:	0	Pumpgpm:	0

7
North
1/2 - 1 Mile
Lower

IL WELLS ILSG20000220479

Pt api number:	120310283700	Pt status:	WATER
Pt longitude:	-87.736492		
Pt latitude:	41.902547		
Api number:	120310283700		
Longitude :	-87.736492		
Latitude :	41.902547		
Section:	3	Twp:	39
Tdir:	N	Rng:	13
Rdir:	E	Farm name:	Peerless Tool & Engr
Farm num:	Not Reported	Company name:	Boysen, Henry, Jr.
Status:	Water Well	Elevation:	606
Elevref:	Ground level	Total depth:	212
Wformation:	Not Reported	Wfmfrom:	0
Wfmto:	0	Pumpgpm:	0

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
Direction
Distance
Elevation

Database EDR ID Number

8
SSW
1/2 - 1 Mile
Lower

IL WELLS ILSG20000218178

Pt api number:	120312657400	Pt status:	ENG
Pt longitude:	-87.739075		
Pt latitude:	41.885299		
Api number:	120312657400		
Longitude :	-87.739075		
Latitude :	41.885299		
Section:	10	Twp:	39
Tdir:	N	Rng:	13
Rdir:	E	Farm name:	Il Center Plaza
Farm num:	213	Company name:	Chicago Pub. Works Dept.
Status:	Engineering Test	Elevation:	599
Elevref:	Ground level	Total depth:	110
Wformation:	Not Reported	Wfmfrom:	0
Wfmto:	0	Pumpgpm:	0

9
North
1/2 - 1 Mile
Lower

IL WELLS P6908

Well ID:	033785	Second ID:	Not Reported
Info Source:	IL Private Water Wells Survey		
Owner:	PEERLESS TOOL & ENG CO		
Permit:	Not Reported	Date Drilled:	00/00/1941
Depth (in feet):	212	Aquifer Type:	Bedrock
County Code:	031	County:	COOK
Township:	39N	Range:	13E
Section:	03	Plot Location:	Not Reported
Well Use:	IN	Well Type:	
Record Type:	Chemical Analysis		
Driller:	Not Reported		

10
NE
1/2 - 1 Mile
Lower

IL WELLS ILSG20000220382

Pt api number:	120313140700	Pt status:	MONIT
Pt longitude:	-87.724891		
Pt latitude:	41.901843		
Api number:	120313140700		
Longitude :	-87.724891		
Latitude :	41.901843		
Section:	2	Twp:	39
Tdir:	N	Rng:	13
Rdir:	E	Farm name:	Amoco Oil Co.
Farm num:	MW-1	Company name:	Environmental Constr. Co.

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Status:	Water Well Monitoring Well	Elevation:	0
Elevref:	Not Reported	Total depth:	15
Wformation:	sand & gravel	Wfmfrom:	4
Wfmto:	14	Pumpgpm:	0

11 East 1/2 - 1 Mile Lower	Site ID:	S100530722	AQUIFLOW	62425
	Groundwater Flow:	Not Reported		
	Deep Water Depth:	Not Reported		
	Average Water Depth:	Not Reported		
	Shallow Water Depth:	Not Reported		
	Current Deep Depth:	7		
	Current Average Depth:	Not Reported		
	Current Shallow Depth:	6		
	Date:	07/23/1996		

12 SE 1/2 - 1 Mile Lower			IL WELLS	ILSG20000218189
	Pt api number:	120312657500	Pt status:	ENG
	Pt longitude:	-87.724406		
	Pt latitude:	41.885377		
	Api number:	120312657500		
	Longitude :	-87.724406		
	Latitude :	41.885377		
	Section:	11	Twp:	39
	Tdir:	N	Rng:	13
	Rdir:	E	Farm name:	Cta Lk & Pulaski
	Farm num:	1	Company name:	Chicago Pub. Works Dept.
	Status:	Engineering Test	Elevation:	603
	Elevref:	Ground level	Total depth:	55
	Wformation:	Not Reported	Wfmfrom:	0
	Wfmto:	0	Pumpgpm:	0

13 NW 1/2 - 1 Mile Lower			IL WELLS	P6909
	Well ID:	033787	Second ID:	Not Reported
	Info Source:	IL Private Water Wells Survey		
	Owner:	PETTIBONE-MULLIKEN CO		
	Permit:	Not Reported	Date Drilled:	00/00/1907
	Depth (in feet):	1700	Aquifer Type:	Bedrock
	County Code:	031	County:	COOK
	Township:	39N	Range:	13E
	Section:	03	Plot Location:	8E
	Well Use:	IN	Well Type:	
	Record Type:	Any other type of record		
	Driller:	GEIGER		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

14
WNW
1/2 - 1 Mile
Higher

Site ID: S102943738
 Groundwater Flow: SW
 Deep Water Depth: 6.63
 Average Water Depth: Not Reported
 Shallow Water Depth: 1.04
 Current Deep Depth: Not Reported
 Current Average Depth: 30
 Current Shallow Depth: Not Reported
 Date: 03/05/1993

AQUIFLOW 62758

15
NNE
1/2 - 1 Mile
Lower

Pt api number: 120313255400
 Pt longitude: -87.731091
 Pt latitude: 41.906206
 Api number: 120313255400
 Longitude : -87.731091
 Latitude : 41.906206
 Section: 3
 Tdir: N
 Rdir: E
 Farm num: Not Reported
 Status: Engineering Test
 Elevref: Not Reported
 Wformation: Not Reported
 Wfmto: 0

Pt status: ENG
 Twp: 39
 Rng: 13
 Farm name: Confidential (per driller)
 Company name: Enviromnetal Restoration Systm
 Elevation: 0
 Total depth: 15
 Wfmfrom: 0
 Pumpgpm: 0

IL WELLS ILSG20000220872

16
ESE
1/2 - 1 Mile
Lower

Org. Identifier: USGS-IL
 Formal name: USGS Illinois Water Science Center
 Monloc Identifier: USGS-415313087431201
 Monloc name: 39N13E-11.6d1
 Monloc type: Well
 Monloc desc: Not Reported
 Huc code: 07120003
 Drainagearea Units: Not Reported
 Contrib drainagearea units: Not Reported
 Longitude: -87.7200558
 Horiz Acc measure: 5
 Horiz Collection method: Interpolated from map
 Horiz coord refsys: NAD83
 Vert measure units: feet
 Vert accmeasure units: feet
 Vertcollection method: Unknown
 Vert coord refsys: NGVD29
 Aquifername: Not Reported
 Formation type: Not Reported

Drainagearea value: Not Reported
 Contrib drainagearea: Not Reported
 Latitude: 41.8869767
 Sourcemap scale: 24000
 Horiz Acc measure units: seconds
 Vert measure val: 602
 Vertacc measure val: 5
 Countrycode: US

FED USGS USGS40000299452

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Aquifer type:	Not Reported	Welldepth:	1959
Construction date:	19190101	Wellholedepth:	Not Reported
Welldepth units:	ft		
Wellholedepth units:	Not Reported		

Ground-water levels, Number of Measurements: 0

17 SSW 1/2 - 1 Mile Lower	Site ID:	S100530114		
	Groundwater Flow:	Not Reported	AQUIFLOW	25002
	Deep Water Depth:	Not Reported		
	Average Water Depth:	11		
	Shallow Water Depth:	Not Reported		
	Current Deep Depth:	10.15		
	Current Average Depth:	Not Reported		
	Current Shallow Depth:	4.36		
	Date:	1/26/98		

1G WNW 1/2 - 1 Mile Lower	Site ID:	S102943738		
	Groundwater Flow:	SW	AQUIFLOW	62758
	Deep Water Depth:	6.63		
	Average Water Depth:	Not Reported		
	Shallow Water Depth:	1.04		
	Current Deep Depth:	Not Reported		
	Current Average Depth:	30		
	Current Shallow Depth:	Not Reported		
	Date:	03/05/1993		

2G NW 1/4 - 1/2 Mile Lower	Site ID:	S102943620		
	Groundwater Flow:	NE - SW	AQUIFLOW	24875
	Deep Water Depth:	6.5		
	Average Water Depth:	Not Reported		
	Shallow Water Depth:	4.5		
	Current Deep Depth:	8.57		
	Current Average Depth:	Not Reported		
	Current Shallow Depth:	5.65		
	Date:	01/09/96		

3G East 1/2 - 1 Mile Lower	Site ID:	S100530722		
	Groundwater Flow:	Not Reported	AQUIFLOW	62425
	Deep Water Depth:	Not Reported		
	Average Water Depth:	Not Reported		
	Shallow Water Depth:	Not Reported		
	Current Deep Depth:	7		
	Current Average Depth:	Not Reported		
	Current Shallow Depth:	6		
	Date:	07/23/1996		

4G ENE 1/4 - 1/2 Mile Lower	Site ID:	S100530251		
	Groundwater Flow:	Not Reported	AQUIFLOW	62315
	Deep Water Depth:	Not Reported		
	Average Water Depth:	7		
	Shallow Water Depth:	Not Reported		
	Current Deep Depth:	Not Reported		
	Current Average Depth:	Not Reported		
	Current Shallow Depth:	Not Reported		
	Date:	02/18/1997		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS

Map ID
 Direction
 Distance
 Elevation

Database EDR ID Number

5G	Site ID:	S100530523		
SW	Groundwater Flow:	Not Reported	AQUIFLOW	24807
1/8 - 1/4 Mile	Deep Water Depth:	Not Reported		
Lower	Average Water Depth:	25		
	Shallow Water Depth:	Not Reported		
	Current Deep Depth:	Not Reported		
	Current Average Depth:	25		
	Current Shallow Depth:	Not Reported		
	Date:	11/08/93		

6G	Site ID:	S100530114		
SSW	Groundwater Flow:	Not Reported	AQUIFLOW	25002
1/2 - 1 Mile	Deep Water Depth:	Not Reported		
Lower	Average Water Depth:	11		
	Shallow Water Depth:	Not Reported		
	Current Deep Depth:	10.15		
	Current Average Depth:	Not Reported		
	Current Shallow Depth:	4.36		
	Date:	1/26/98		

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for COOK County: 2

- Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level \geq 2 pCi/L and \leq 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for COOK COUNTY, IL

Number of sites tested: 82

<u>Area</u>	<u>Average Activity</u>	<u>% <4 pCi/L</u>	<u>% 4-20 pCi/L</u>	<u>% >20 pCi/L</u>
Living Area - 1st Floor	1.273 pCi/L	96%	4%	0%
Living Area - 2nd Floor	0.900 pCi/L	100%	0%	0%
Basement	1.740 pCi/L	93%	7%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)

Source: United States Geologic Survey

EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map

Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data was obtained from the Federal Emergency Management Agency (FEMA). It depicts 100-year and 500-year flood zones as defined by FEMA. It includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.

Source: FEMA

Telephone: 877-336-2627

Date of Government Version: 2003, 2015

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetland Inventory

Source: Illinois State Geological Survey

Telephone: 217-333-4747

HYDROGEOLOGIC INFORMATION

AQUIFLOW^R Information System

Source: EDR proprietary database of groundwater flow information

EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit

Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)

The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database

Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)

Telephone: 800-672-5559

SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems

Source: EPA/Office of Drinking Water

Telephone: 202-564-3750

Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data

Source: EPA/Office of Drinking Water

Telephone: 202-564-3750

Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)

This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Water Well Records

Source: Illinois Geological Survey

Telephone: 217-333-4747

Illinois Private Well Database and PICS (Public, Industrial, Commercial Survey)

Source: Illinois State Water Survey

Telephone: 217-333-9043

Water Well Location Information

Source: Illinois Environmental Protection Agency

Telephone: 217-782-0810

OTHER STATE DATABASE INFORMATION

RADON

State Database: IL Radon

Source: Department of Nuclear Safety

Telephone: 217-785-9958

County Radon Results

Area Radon Information

Source: USGS

Telephone: 703-356-4020

The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones

Source: EPA

Telephone: 703-356-4020

Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities

Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater

Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR's Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

© 2015 TomTom North America, Inc. All rights reserved. This material is proprietary and the subject of copyright protection and other intellectual property rights owned by or licensed to Tele Atlas North America, Inc. The use of this material is subject to the terms of a license agreement. You will be held liable for any unauthorized copying or disclosure of this material.



APPENDIX G

Interview Documentation

USER QUESTIONNAIRE – ASTM 1527-13 STANDARD PRACTICE

Phase 1 Environmental Site Assessment

In order to qualify for one of the *Landowner Liability Protections (LLPs)* offered by the Small Business Liability Relief and Brownfields Revitalization Act of 2001 (the “*Brownfields Amendments*”), the *user* must conduct the following inquiries required by 40 CFR 312.25, 312.28, 312.29, 312.30, and 312.31. These inquiries must also be conducted by EPA Brownfield Assessment and Characterization grantees.

The *user* should provide the following information to the *environmental professional*. Failure to conduct these inquiries could result in a determination that “*all appropriate inquiries*” is not complete.

(1.) Environmental liens that are filed or recorded against the property (40 CFR 312.25).

Did a search of recorded land title records (or judicial records where appropriate, see Note 1 below) identify any environmental liens filed or recorded against the property under federal, tribal, state or local law?

NOTE 1—In certain jurisdictions, federal, tribal, state, or local statutes, or regulations specify that environmental liens and AULs be filed in judicial records rather than in land title records. In such cases judicial records must be searched for environmental liens and AULs.

At this time, we are not aware of any liens. The current owner will be providing a title commitment which I'll forward upon receipt. We have requested that AMEC conduct a separate AUL/lien search as part of the Phase I.

(2.) Activity and use limitations that are in place on the property or that have been filed or recorded against the property (40 CFR 312.26(a)(1)(v) and vi)).

Did a search of recorded land title records (or judicial records where appropriate, see Note 1 above) identify any AULs, such as engineering controls, land use restrictions or institutional controls that are in place at the property and/or have been filed or recorded against the property under federal, tribal, state or local law?

At this time, we are not aware of any AULs. The current owner will be providing a title commitment which I'll forward upon receipt. We have requested that AMEC conduct a separate AUL/lien search as part of the Phase I.

(3.) Specialized knowledge or experience of the person seeking to qualify for the LLP (40 CFR 312.28).

Do you have any specialized knowledge or experience related to the property or nearby properties? For example, are you involved in the same line of business as the current or former occupants of the property or an adjoining property so that you would have specialized knowledge of the chemicals and processes used by this type of business?

No

(4.) Relationship of the purchase price to the fair market value of the property if it were not contaminated (40 CFR 312.29).

Does the purchase price being paid for this property reasonably reflect the fair market value of the property? If you conclude that there is a difference, have you considered whether the lower purchase price is because contamination is known or believed to be present at the property?

Yes, based on discussions with the Chicago Department of Planning and Development, who is handling the purchase, the price is based on fair market value.

(5.) Commonly known or reasonably ascertainable information about the property (40 CFR 312.30).

Are you aware of commonly known or reasonably ascertainable information about the property that would help the environmental professional to identify conditions indicative of releases or threatened releases? For example,

(a.) Do you know the past uses of the property?

See previous reports provided by the owner as well as the property screen conducted by 2FM.

(b.) Do you know of specific chemicals that are present or once were present at the property?

See previous reports provided by the owner as well as the property screen conducted by 2FM.

(c.) Do you know of spills or other chemical releases that have taken place at the property?

See previous reports provided by the owner as well as the property screen conducted by 2FM.

(d.) Do you know of any environmental cleanups that have taken place at the property?

See previous reports provided by the owner as well as the property screen conducted by 2FM.

(6.) The degree of obviousness of the presence or likely presence of contamination at the property, and the ability to detect the contamination by appropriate investigation (40 CFR 312.31).

Based on your knowledge and experience related to the property are there any obvious indicators that point to the presence or likely presence of releases at the property?

See previous reports provided by the owner as well as the property screen conducted by 2FM.

Amec Foster Wheeler
4301 W. Chicago Avenue, Chicago, IL

June 2017

COMPLETED BY:

Abby Mazza Environmental Engineer III 6-21-17

Name

Title

Date

Representing User: City of Chicago

INTERVIEWS WITH PAST and PRESENT OWNERS, OPERATORS, and OCCUPANTS

This worksheet should help complete of the "Interview" portion of the All Appropriate Inquiry land acquisition screening. The worksheets are not exhaustive and should be tailored based on professional judgment and site conditions.

The AAI rule requires interviews with the current owner and occupant of the subject property. If the property has multiple occupants, the inquiry of the environmental professional should include interviewing major occupants, as well as those occupants likely to use, store, treat, handle or dispose of hazardous substances, pollutants, contaminants, petroleum and petroleum products, and controlled substances, or those who have likely done so in the past. Additionally, if the current owner is a third party holding company who obtained title to the property with the sole intent of selling it to the Federal government, it is suggested that the previous owner also be interviewed. In either case, at least one of the following individuals should also be interviewed.

- Representative of the local fire department that serves the property;
- Representative of the State and/or local health agency or local/regional office of state health agency serving the area in which the property is located;
- Representative of the State and/or local agency or local/regional office of state agency having jurisdiction over hazardous waste disposal or other environmental matters in the area in which the property is located; or
- Representatives of Local agencies responsible for the issuance of building permits or groundwater use permits that document the presence of AULs that may identify issues of concern in the area in which the property is located.
- Current and past facility managers with relevant knowledge of uses and physical characteristics of the property;
- Past owners, occupants, or operators of the property; or
- Employees of current and past occupants of the property.

In the case of inquiries done at "abandoned properties," where there is evidence of potential unauthorized uses of the subject property or evidence of uncontrolled access to the subject property, the inquiry must include interviewing one or more (as necessary) owners or occupants of neighboring or nearby properties from which it appears possible to have observed uses of, or releases at, such abandoned properties.

(Separate questionnaires must be completed for each interview)

Name of person interviewed: **Matthew J. Grusecki, Sr Vice President, Northern Builders, Inc. and Ed Garske, Carlson Environmental – his environmental consultant**
Telephone number: 773-266-6438

Affiliation with Property:

Northern Builders is a part-owner of the property through an entity called Chia LLC
(E.g., Owner, operator, caretaker, previous owner, or neighbor)

He has been associated with the property for 19 years

Time frame affiliated with Property:

"To the Best of Your Knowledge..."

A. Property Use(s)

1. Do you have or know of the existence of any of the following records related to the property? If yes, please provide copies or make them available. Yes ___ No X Unknown ___

- a. Radon, Asbestos, or Lead-Based Paint Surveys No X Copy/s Attached ___ No copy avail. ___
- b. Environmental Compliance Audit Reports No X Copy/s Attached ___ No copy avail. ___
- c. Environmental Permits Related to Current or Previous Site Activities (e.g., waste disposal permits, wastewater permits, NPDES permits) No X Copy/s Attached ___ No copy avail. ___
- d. Registrations for underground and above-ground storage tanks. No X Copy/s Attached ___ No copy avail. ___
- e. Hazardous Materials Management Plans (Emergency Planning and Community

Right-To-Know Act (EPCRA)) No Copy/s Attached No copy avail.

f. Facility safety plans No Copy/s Attached No copy avail.

Unknown

g. Preparedness and prevention plans No Copy/s Attached No copy avail.

Unknown

h. Spill Prevention, Control, and Countermeasure (SPCC) plans No Copy/s Attached No copy avail.

i. Hydrogeologic and geotechnical reports on the property or surrounding area. No Copy/s Attached * No copy avail.

j. Notices or other correspondence from any government agency relating to past or current violations of environmental laws with respect to the property. No Copy/s Attached No copy avail.

k. Notices or other correspondence from any government agency relating to environmental liens encumbering the property. No Copy/s Attached No copy avail.

l. Hazardous waste generator notices or reports. No Copy/s Attached No copy avail.

Unknown

m. Risk assessments No Copy/s Attached No copy avail.

n. Recorded deed or environmental land use restrictions No Copy/s Attached No copy avail.

Unknown

o. Other environmental studies or investigations No Copy/s Attached * No copy avail.

*Information on reports provided is in the Phase I text

2. Has the property ever been used for an industrial or commercial use (e.g., official and unofficial shooting ranges; processing, handling, management, disposal, storage, manufacture, or transportation of hazardous substances or petroleum products, such as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photographic developing laboratory, methamphetamine laboratory, junkyard, bone yard, or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility). If yes, describe the activities and provide the time frame, types, location(s) and quantities of hazardous substance use and storage.

Yes No Unknown

Was a railyard

3. Has there ever been permitted or planned mining activity or oil and gas exploration or development on the property? If yes, describe the activities and provide the time frame, location(s), and scope of operations.

Yes ___ No X Unknown ___

Not to their knowledge

4. Has the property ever been used for agricultural purposes, such as livestock or crops? If yes, describe the operations and indicate the location(s) and time frames involved.

Yes ___ No ___ Unknown X

May have been before it was a railyard

If yes, did the operation involve the use or storage of chemicals such as pesticides, fertilizers, and or solvents? If yes, describe and provide location(s) and the type, quantity, duration of use, and management practices.

Yes ___ No ___ Unknown X

5. Are there, or has there been, any improvements, such as buildings, water towers, smokestacks, smelters, and old building foundations on the property? If yes, describe each improvement, including construction date for each improvement; location on the property; square footage; past and current uses; dates of major renovations, additions, modifications; number of stories; type of construction; heating and cooling sources; water sources; sewage, solid and hazardous waste disposal; and removal date (if applicable).

Yes ___ No ___ Unknown ___

Some small buildings were onsite when it was a railyard. They believe there were 2 near the middle of the site

6. Other Questions as necessary based on the records review:

Not applicable

B. Hazardous Materials and Substances

1. Do the current operations on the property involve the use and storage of chemicals? If yes, please describe the operations and indicate the location(s), type, and quantities of materials used. Describe locations of chemical storage, mixing, and loading. Discuss any use, storage, mixing, or disposal of automotive or other batteries, pesticides (e.g., insecticides, herbicides, and fungicides), paints, solvents, or other chemicals on fence lines, rights-of-way, or other structures such as airstrips, heliports, or crop duster operations.

Yes ___ No X Unknown ___

If yes, has there been a spill or release of hazardous substances, petroleum products, or other potential environmental problems on the property associated with current operations? If yes, describe the nature and location(s) of the release and the quantities and types of hazardous substances. This includes staining or soils and floors in areas utilized for the use and storage of hazardous materials.

Yes ___ No ___ Unknown ___

Not applicable

If there had been a spill or release of hazardous substances or petroleum products, did someone report the incident to the National Response Center or a local or State emergency response authority? If yes, identify the agency.

Yes ___ No ___ N/A ___X___ Unknown ___

If a spill or release of hazardous substances or petroleum products has occurred, has the release been mitigated? If yes, describe the mitigation, identify the lead regulatory agency that oversaw the mitigation and indicate if the lead regulatory agency issued a no-further action (NFA) determination.

Yes ___ No ___ N/A ___X___ Unknown ___

If remediation is completed, does the property have contamination or residual contamination? If yes, are there any institutional controls/land use restrictions in place or long term monitoring and maintenance requirements?

Yes ___ No ___ N/A ___X___ Unknown ___

2. Are there any past operations at the property that involved the use or storage of hazardous materials and substances? If yes, describe the operations and the location(s), types, and quantities of materials.

Yes ___ No ___ Unknown X

If yes, has there been a spill or release of hazardous substances, petroleum products, or other potential environmental problems on the property associated with past operations or tenants? If yes, describe the nature and location(s) of the release and the quantities and types of hazardous substances.

Yes X No ___ N/A ___ Unknown ___

PNAs and metals were detected in previous investigations

If a spill or release of hazardous substances or petroleum products had occurred, was it reported to the National Response Center or a local or State emergency response authority? If yes, identify the agency.

Yes ___ No ___ N/A ___ Unknown X

If a release of hazardous substances or petroleum products had occurred, was the release been mitigated? If yes, describe the mitigation, identify the regulatory agency that oversaw the mitigation and indicate if the lead regulatory agency issued a no-further action (NFA) determination.

Yes ___ No X N/A ___ Unknown ___

If remediation is completed, does the property now have contamination or residual contamination present? If yes, are there any institutional controls or land use restrictions in place or long-term monitoring and maintenance requirements?

Yes ___ No ___ N/A X Unknown ___

3. Have there ever been any easements, rights-of-way, pipelines, utility lines, railways, entry or exit ports and associated structures, either buried or overhead, crossing the property? If yes, please describe and indicate the location(s), approximate construction date, and the owner's identity.

Yes ___ No ___ Unknown ___

Railways - property was a railyard. Matt indicates that there are utility lines and a storm sewer easement shown on the site survey

If yes, are you aware of any spills or releases associated with these features? If yes, please describe the spills and releases and indicate the date, type and quantities of materials involved.

Yes ___ No ___ Unknown X

If a spill or release has occurred, are you aware if the release has been mitigated? If yes, who did the mitigation and what regulatory agency oversaw the mitigation? If known, indicate whether the lead regulatory agency issued a no-further action (NFA) determination.

Yes ___ No ___ N/A X Unknown ___

If remediation is completed, are you aware if there the property still has contamination or residual contamination? If yes, are there any institutional controls or land use restrictions in place or long-term monitoring and maintenance requirements?

Yes ___ No ___ N/A X Unknown ___

4. Are you aware if the property's topography has been altered or if the property has any unnatural topographic features present? If yes, please describe the topographic alterations or unnatural features. Indicate their location(s) on the property and, if known, when the alterations occurred and by whom.

Yes X No ___ Unknown ___

Historical grading occurred.

5. Has fill material ever been brought onto the property that originated from a contaminated site or that was of an unknown origin? If yes, describe the date and quantity of material brought to the property, indicate the location where the material was placed.

Yes ___ No X Unknown ___

Matt and Ed are not aware of any fill being brought to the site

If fill material came from a contaminated site, identify the fill's origin and describe the contamination.

Not applicable

6. Is there any evidence that waste materials were dumped above grade, buried, or burned, either currently or previously, on the property? Examples include hazardous materials, petroleum products, labeled or unlabeled drums or containers, pesticide containers, household and farm debris, automotive or industrial batteries, building demolition debris, or other waste materials.

Yes ___ No ___ Unknown X

7. Are there any floor drains in the on-site structures or areas where chemicals (e.g., waste oil, antifreeze, solvents, and pesticides) were used or stored? If yes, indicate the location(s) of the structures and the types, quantities, and time frames related to the associated chemical use or storage. For each area or structure, also indicate the discharge location for the floor drains.

Yes ___ No ___ Unknown ___

Not applicable

8. Do the walls, floors, or ceilings of the structures used to store hazardous materials have any chemical stains? If yes, indicate the areas in each structure that has chemical staining.

Yes ___ No ___ Unknown ___

Not applicable

9. Are there or have there been any floors, drains, walls, or ceilings stained by substances other than water or that are emitting foul or unnatural odors (e.g., mold, mildew, algae)? If yes, describe the location(s) and the nature of the past and current site operations.

Yes ___ No ___ Unknown ___

Not applicable

10. Are there electrical transmission lines, transformers, capacitors, lighting ballast, or hydraulic equipment (e.g., elevators, presses, lifts, or doors) on the property? If yes, identify the location(s) and approximate age of the equipment.

Yes ___ No ___ Unknown X

There may be a transformer offsite on Kilbourn Avenue side of property

If the site has electrical transmission lines, transformers, capacitors, lighting ballast, or hydraulic equipment, has testing been done to determine the presence of polychlorinated biphenyls (PCBs) or has any on-site equipment contained PCBs? If yes, indicate the location(s), type of equipment, and dates.

Yes ___ No ___ Unknown ___

Not applicable

If the site has or had PCBs, are you aware of any release of PCBs that have occurred? If yes, describe the release and indicate the date, location(s) and whether the release was mitigated.

Yes ___ No ___ N/A X Unknown ___

11. Has there ever been any mercury-containing equipment (e.g., switches, thermostats, thermometers, manometers, or sink traps) on the property? If yes, indicate the location(s) and type of equipment and dates.

Yes _____ No _____ Unknown X_____

12. Are you aware of any radon, asbestos-containing materials, or lead-based paint on the property? If yes, indicate the type, locations and dates.

Yes _____ No _____ Unknown X_____

If yes, has anyone done any radon, asbestos-containing materials, or lead-based paint surveys on the property? If yes, indicate whether radon, asbestos-containing materials, or lead-based paint has been identified in any on-site buildings. Identify the dates of the surveys, the structures, the results, and condition of the materials.

Yes ___ No ___ Unknown X

13. Is there current or past use of above-ground or underground storage tanks, including drums or other fuel containers, on the property? If yes, identify the tanks locations, installation dates, and the types and quantities of materials stored. If the tanks were removed, indicate the removal date and whether the lead regulatory agency issued a closure certification notice.

Yes ___ No ___ Unknown X

If above-ground or underground storage tanks are or were used on the property, was there ever a spill or release of hazardous substances associated with the tank system? If yes, indicate the date and nature of the spill or release.

Yes ___ No ___ Unknown ___

Not applicable

If a spill or release has occurred related to an on-site tank system, was it mitigated to the satisfaction of the lead regulatory agency? If no, describe further actions that must be undertaken to address the spill or release.

Yes ___ No ___ Not Applicable X Unknown ___

14. Are you aware of any hazardous substance or pollutant or contaminant spill or release, or other potential environmental problems on any adjacent or nearby properties? If yes, please describe (if known) the location(s) of the release, the type and quantities of materials involved, and the approximate dates. If known, also indicate the owner of the property where the release occurred.

Yes No Unknown

PNAs and metals detected in previous Phase IIs

If there was a release of hazardous substances, petroleum products on any adjacent or nearby properties are you aware if the release was mitigated?

Yes No Not Applicable Unknown

Phase I by Carlson identified nearby properties with known releases

15. Are you aware of contamination or residual contamination on adjacent or nearby properties that poses a threat or may pose a future threat to the property? If yes, describe the threat or potential threat.

Yes No Unknown

16. Are you aware of any institutional controls, land use restrictions, long-term monitoring, or maintenance requirements in place on adjacent or nearby properties that affect the property? If yes, please describe and identify the adjacent or nearby property and the property owner.

Yes No Not Applicable Unknown

17. Other Questions as necessary based on the records review:

Not applicable

C. Water and Wastewater

1. Does the property currently or has it ever been supplied by an on-site drinking water supply well?
If yes, provide the well location(s) and construction dates.

Yes ___ No ___ Unknown X___

None known

Have contaminants ever been identified in the on-site drinking water well or the water system that exceeded acceptable levels? If yes, describe the contamination and indicate the dates, contaminant levels and the source of the contamination, if known.

Yes ___ No ___ Not Applicable_X_ Unknown ___

If an on-site drinking water well is no longer used, has it been properly abandoned according to applicable regulatory requirements? If yes, indicate the date the well was abandoned.

Yes ___ No ___ Not Applicable_X_ Unknown ___

2. Has the property ever had an on-site wastewater treatment and disposal systems (e.g., septic systems or sewage lagoons). If yes, please describe of the system, including the location(s), size, date constructed, and which buildings discharge to the system.

Yes ___ No ___ Unknown_X_

Not to their knowledge

If the on-site wastewater treatment and disposal system is no longer used, has it been closed? If yes, describe method of closure and date closed.

Yes ___ No ___ Not Applicable___ Unknown ___

3. Does the property have any monitoring wells? If yes, explain the purpose of the wells and provide the location(s), dates of construction, and any analytical results.

Yes No Unknown

Phase I indicates 15, placed due to planned transfer station

If the monitoring wells are no longer used, were they properly abandoned according to applicable regulatory requirements? If yes, indicate the date the well was abandoned.

Yes No Not Applicable Unknown

4. Does the property have surface water (e.g., pits, ponds, lagoons, rivers, creeks, or oceans)? If yes, describe the location(s) and type of surface water.

Yes No Unknown

If the property has surface water, are you aware of any unnatural characteristics such as color, sheens, odors, or sterility? If yes, please describe and indicate whether the situation is new or pre-existing.

Yes No Not Applicable Unknown

5. Has the property ever discharged industrial or other wastewater (excluding storm water runoff or sanitary wastewater discharges from restrooms, kitchens, or other household-type uses) onto or adjacent to the property? If yes, describe the discharge and indicate the location(s) and dates.
Yes ___ No ___ Unknown X

6. Other Questions as necessary based on the records review:

Not applicable

D. Compliance/Permits

1. Have there been any environmental permits or licenses issued for current or past operations associated with the property (e.g., air quality, water discharge, or landfills)? If yes, describe the permitted operations, indicate the permitting agency, date the permit was issued, and whether the permit is still effective.

Yes ___ No ___ Unknown X

2. Are you aware of any environmental liens against the property that were filed or recorded under Federal, Tribal, State or local law? If yes, describe the lien and indicate the date and effect on the current and future use of the property.

Yes ___ No ___ Unknown X

3. Are you aware of any activity and land use limitations that are in place on the property or that were filed or recorded under Federal, Tribal, State or local environmental laws? If yes, describe the land use restrictions, identify the party that issued the restrictions and the date.

Yes ___ No ___ Unknown X

None known

4. Are you aware of any compliance/enforcement notices relating to past or current violations of environmental laws with respect to the property or any facility on the property? If yes, describe the violations and the dates involved.

Yes ___ No ___ Unknown X

None known

5. Are you aware if any environmental site assessment, or other environmental investigations, of the property, or any other property or site records ever indicated the presence of hazardous substances, petroleum products, or other potential environmental problems on the property? If yes, describe the report and findings.

Yes No Unknown

Phase I and Phase IIs - Ed Garske thinks there may have been another Phase I or Phase II by his firm - he will check and follow up - PNAS and metals detected

6. Are you aware of any environmental site assessment, or other environmental investigations, of the property, or any other property or site records that recommended further assessment of the property? If yes, identify the report and indicate if the further assessment was done.

Yes No Unknown

See above

7. Are you aware of any past, threatened, or pending lawsuits or administrative proceedings concerning a release or threatened release of any hazardous substances or petroleum products on the real property? If yes, describe the action and identify the party that is initiating the action.

Yes No Unknown

None known

8. Other Questions as necessary based on the records review:

Not applicable

E. Other

1. Are you aware any past or current occurrences of anomalous vegetation (e.g., stressed or dead) on the property? If yes, indicate the location(s) and approximate dates.

Yes ___ No X Unknown ___

Have any vegetative control programs (e.g., along transmission lines, fence lines, rights-of-ways, or pipelines) been done on the property? If yes, describe the program and types of activities.

Yes___ No___ Unknown X___

2. If not mentioned above, is there anything else that could indicate the presence of hazardous substances, petroleum products or other environmental conditions that may affect the property?

Yes ___ No ___ Unknown X___

Not to their knowledge - potentially other reports, Ed will check

Name, Title, and signature of person conducting interview: Mary Jank, Sr. Associate



Date of interview: 6/22/17 10 AM

Jank, Mary E

From: Kahnweiler, David R <david.kahnweiler@colliers.com>
Sent: Wednesday, November 29, 2017 4:42 PM
To: Jank, Mary E
Cc: Matt Grusecki; Edward Garske; Tom Kenrich; Mazza, Abigail
Subject: Re: City's due diligence for 4301 W Chicago Ave - ROE agreement

No further information

On Nov 29, 2017, at 4:34 PM, Jank, Mary E <mary.jank@woodplc.com> wrote:

As you know, we are updating our due diligence work (Phase I) for the site since it is out of date per the ASTM standard. I wanted to ask if you have any additional information since we talked in July to add to our knowledge of the site history. Please respond to this e-mail indicating if you have further information or not. Thanks for your attention to this - Mary

Mary E. Jank

Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

From: Matt Grusecki [<mailto:MGrusecki@northernbuilders.com>]
Sent: Saturday, July 22, 2017 3:11 PM
To: Jank, Mary E <Mary.Jank@amecfw.com>
Cc: Kahnweiler, David R <david.kahnweiler@colliers.com>; Edward Garske <EGarske@carlsonenv.com>; Tom Kenrich <kenrich@northernbuilders.com>; Mazza, Abigail <Abby.Mazza@cityofchicago.org>
Subject: Re: City's due diligence for 4301 W Chicago Ave - ROE agreement

Hi Mary.

We have provided all reports known to be in our possession. I will defer to Ed Garske to elaborate or to answer any additional questions.

Thank you.
-Matt

Matthew J. Grusecki
Senior Vice President
Northern Builders, Inc.
[5060 River Road](http://5060RiverRoad.com)
[Schiller Park, IL 60176-1076](http://SchillerPark,IL60176-1076.com)

Ph: [847-678-5060](tel:847-678-5060) Ext. 299
Cell: [773-266-6438](tel:773-266-6438)
Fax: [847-678-7670](tel:847-678-7670)

Jank, Mary E

From: Matt Grusecki <MGrusecki@northernbuilders.com>
Sent: Wednesday, November 29, 2017 5:23 PM
To: Jank, Mary E
Cc: Kahnweiler, David R; Edward Garske; Tom Kenrich; Mazza, Abigail
Subject: RE: City's due diligence for 4301 W Chicago Ave - ROE agreement

Hi Mary. No, there are no new updates. Thank you.

Matthew J. Grusecki
Senior Vice President
Northern Builders, Inc.
5060 River Road
Schiller Park, IL 60176-1076

Office: 847-678-5060 Ext. 299
Cell: 773-266-6438

Follow us on LinkedIn 



From: Jank, Mary E [mailto:mary.jank@woodplc.com]
Sent: Wednesday, November 29, 2017 4:34 PM
To: Matt Grusecki
Cc: Kahnweiler, David R; Edward Garske; Tom Kenrich; Mazza, Abigail
Subject: RE: City's due diligence for 4301 W Chicago Ave - ROE agreement

As you know, we are updating our due diligence work (Phase I) for the site since it is out of date per the ASTM standard. I wanted to ask if you have any additional information since we talked in July to add to our knowledge of the site history. Please respond to this e-mail indicating if you have further information or not. Thanks for your attention to this - Mary

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com

Jank, Mary E

From: Edward Garske <EGarske@carlsonenv.com>
Sent: Wednesday, November 29, 2017 5:25 PM
To: Kahnweiler, David R
Cc: Jank, Mary E; Matt Grusecki; Tom Kenrich; Mazza, Abigail
Subject: Re: City's due diligence for 4301 W Chicago Ave - ROE agreement

None for me either.

Edward Garske
President
Carlson Environmental
312-593-2100

On Nov 29, 2017, at 5:42 PM, Kahnweiler, David R <david.kahnweiler@colliers.com> wrote:

No further information

On Nov 29, 2017, at 4:34 PM, Jank, Mary E <mary.jank@woodplc.com> wrote:

As you know, we are updating our due diligence work (Phase I) for the site since it is out of date per the ASTM standard. I wanted to ask if you have any additional information since we talked in July to add to our knowledge of the site history. Please respond to this e-mail indicating if you have further information or not. Thanks for your attention to this - Mary

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

From: Matt Grusecki [<mailto:MGrusecki@northernbuilders.com>]
Sent: Saturday, July 22, 2017 3:11 PM
To: Jank, Mary E <Mary.Jank@amecfw.com>
Cc: Kahnweiler, David R <david.kahnweiler@colliers.com>; Edward Garske <EGarske@carlsonenv.com>; Tom Kenrich <tkenrich@northernbuilders.com>; Mazza, Abigail <Abby.Mazza@cityofchicago.org>
Subject: Re: City's due diligence for 4301 W Chicago Ave - ROE agreement

Hi Mary.

We have provided all reports known to be in our possession. I will defer to Ed Garske to elaborate or to answer any additional questions.

Thank you.

-Matt

Matthew J. Grusecki
Senior Vice President
Northern Builders, Inc.
[5060 River Road](#)
[Schiller Park, IL 60176-1076](#)

Ph: [847-678-5060 Ext. 299](#)
Cell: [773-266-6438](#)
Fax: [847-678-7670](#)

On Jul 21, 2017, at 6:20 PM, Jank, Mary E <Mary.Jank@amecfw.com> wrote:

All – per request from the City, I am double checking. Do any of you have any further information on the construction or location of the previously installed 15 wells for the solid waste transfer station abandoned permit? Please let me know – Thank you - Mary

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

From: Matt Grusecki [<mailto:MGrusecki@northernbuilders.com>]
Sent: Wednesday, June 21, 2017 1:28 PM
To: Jank, Mary E <Mary.Jank@amecfw.com>
Cc: Kahnweiler, David R <david.kahnweiler@colliers.com>; Edward Garske <EGarske@carlsonenv.com>; Tom Kenrich <tkenrich@northernbuilders.com>; Mazza, Abigail <Abby.Mazza@cityofchicago.org>
Subject: Re: City's due diligence for 4301 W Chicago Ave - ROE agreement

Hi Mary.

Yes, Ed Garske and I are both available at 10am. If you would please provide a call-in number to the group, that would be most appreciated.

Thank you.

Matthew J. Grusecki
Senior Vice President
Northern Builders, Inc.
[5060 River Road](#)
[Schiller Park, IL 60176-1076](#)



APPENDIX H

FOIA Requests/Responses

Jank, Mary E

From: Jank, Mary E
Sent: Monday, June 19, 2017 10:40 AM
To: 'DOBfoia@cityofchicago.org'; 'CDPHfoia@cityofchicago.org'; 'CFDfoia@cityofchicago.org'
Subject: 4301 W Chicago Avenue

Hello –

I would like to request information on environmental conditions, the presence of above ground and underground storage tanks, the release of petroleum and hazardous substances, environmental permits and violations for the property listed below:

4301 West Chicago Avenue, Chicago, IL

Thank you for your assistance-

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

Jank, Mary E

From: CDPHFOIA <CDPHFOIA@cityofchicago.org>
Sent: Wednesday, June 21, 2017 4:39 PM
To: Jank, Mary E
Subject: Re: 4301 W Chicago Avenue

Dear Mary,

I received your request below. However, please note that environmental records maintained by CDPH are available on line through the City's Open Data Portal at <https://data.cityofchicago.org/>. You may start your search in the Environmental Records Lookup Table (<https://data.cityofchicago.org/d/a9u4-3dwb>). Click on the "View Data" button, and then enter a street address (in the filter on the right of your screen) to determine whether records exist in any of the seven environmental datasets: Complaints, Asbestos/Demolition Notices, Enforcement, Inspections, Permits, Above ground/Underground Tanks, and Environmental Permit Holds. If there is a "y" for yes in the Lookup Table, then click on the "y" to go to the indicated dataset and find the information you have requested.

I hope that this is helpful. Please let me know if you have any questions.

Sincerely,

Jennifer Hesse

From: Jank, Mary E <Mary.Jank@amecfw.com>
Sent: Monday, June 19, 2017 10:39 AM
To: DOBFOIA; CDPHFOIA; CFDFOIA
Subject: 4301 W Chicago Avenue

Hello –

I would like to request information on environmental conditions, the presence of above ground and underground storage tanks, the release of petroleum and hazardous substances, environmental permits and violations for the property listed below:

4301 West Chicago Avenue, Chicago, IL

Thank you for your assistance-

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com



CHICAGO FIRE DEPARTMENT
CITY OF CHICAGO

June 26, 2017

VIA EMAIL

Mary E. Jank
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, Il
Mary.jank@amecfw.com

CFD FOIA RESPONSE: 17-5247

Dear Ms. Jank:

Thank you for writing to the Chicago Fire Department (CFD) with your request for information pursuant to the Illinois Freedom of Information Act, 5 ILCS 140/1 et seq. On June 19, 2017, the attached request was received.

Your request has been granted and enclosed is a responsive document.

Sincerely,

Sherri Logan Hicks
Freedom of Information Officer
CHICAGO FIRE DEPARTMENT

Hicks, Sherri

From: Jank, Mary E <Mary.Jank@amecfw.com>
Sent: Monday, June 19, 2017 10:40 AM
To: DOBFOIA; CDPHFOIA; CFDFOIA
Subject: 4301 W Chicago Avenue

17-5247

Hello –

I would like to request information on environmental conditions, the presence of above ground and underground storage tanks, the release of petroleum and hazardous substances, environmental permits and violations for the property listed below:

4301 West Chicago Avenue, Chicago, IL

Thank you for your assistance-

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

This message is the property of Amec Foster Wheeler plc and/or its subsidiaries and/or affiliates and is intended only for the named recipient(s). Its contents (including any attachments) may be confidential, legally privileged or otherwise protected from disclosure by law. Unauthorised use, copying, distribution or disclosure of any of it may be unlawful and is strictly prohibited. We assume no responsibility to persons other than the intended named recipient(s) and do not accept liability for any errors or omissions which are a result of email transmission. If you have received this message in error, please notify us immediately by reply email to the sender and confirm that the original message and any attachments and copies have been destroyed and deleted from your system. If you do not wish to receive future unsolicited commercial electronic messages from us, please forward this email to: unsubscribe@amecfw.com and include "Unsubscribe" in the subject line. If applicable, you will continue to receive invoices, project communications and similar factual, non-commercial electronic communications.

Please click <http://amecfw.com/email-disclaimer> for notices and company information in relation to emails originating in the UK, Italy or France.

FB

LOCATION 4301 W. Chicago Ave
OCCUPANCY _____ APPL Chicago W. W. Riley

DATE	PERMIT	CAPAC.	CONTS.	FINAL	REMARKS
1/2/59	B152570	1/550	Gas.		
6-1-65	B361010	Renew	1/550 Gal. Gas.		

Jank, Mary E

From: epa.foia@illinois.gov
Sent: Monday, June 19, 2017 11:00 AM
To: Jank, Mary E
Subject: Illinois EPA FOIA Request Received - Mary Jank



Illinois Environmental Protection Agency

FOIA Request Received

Monday, June 19, 2017

Ms. Mary Jank
Amec Foster Wheeler Environment & Infrastructure
8745 W Higgins Road
Suite 300
Chicago, IL 60631

Requester Type: Other

Dear Mary Jank,

We have received your request for information under the Illinois Freedom of Information Act. Listed below is a summary of what we received in your online request.

Please do not reply to this email. If you have questions about your request please call (217) 558-5101.

Request Summary

Received 6/19/2017 11:00:28 AM

Reference Id(s)

Date Range 01/01/1900 - 06/16/2017

Request Narrative Any records for the property located at 4301 W Chicago Ave, Chicago, IL from the Bureau of Land, the Bureau of Air or the Bureau of Water. Thank you

Jank, Mary E

From: Kates, Kelly <Kelly.Kates@Illinois.gov>
Sent: Wednesday, June 21, 2017 8:58 AM
To: Jank, Mary E
Subject: Illinois EPA FOIA Response



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397

BRUCE RAUNER, GOVERNOR

ALEC MESSINA, DIRECTOR

June 21, 2017

Amec Foster Wheeler Environment & Infrastructure
Attn: Ms. Mary Jank
8745 W Higgins Road
Suite 300
Chicago, IL 60631

Re: Freedom of Information Act Request - 100164

Dear Ms. Jank:

This letter is in response to your Freedom of Information Act (FOIA) (5 ILCS 140/1 et seq.) request dated June 19, 2017 and received by the Illinois Environmental Protection Agency (Illinois EPA) on June 19, 2017.

Following a search, the Illinois EPA has determined there to be no information responsive to your request.

Requested Information
1. Chicago – 4301 West Chicago Avenue

Thank you for your patience in this matter.

Sincerely,

A handwritten signature in blue ink, appearing to read "Anwar Johnson".

Anwar Johnson
Illinois EPA
FOIA Officer
217.558.5101

<http://www.epa.illinois.gov/foia/index>

Jank, Mary E

From: r5foia@epa.gov
Sent: Sunday, June 25, 2017 5:10 PM
To: Jank, Mary E
Subject: FOIA Request EPA-R5-2017-008799 Submitted

This message is to confirm your request submission to the FOIAonline application: [View Request](#). Request information is as follows:

- Tracking Number: EPA-R5-2017-008799
- Requester Name: Mary E. Jank
- Date Submitted: 06/25/2017
- Request Status: Submitted
- Description: I would like to request information on environmental conditions, the presence of above ground and underground storage tanks, the release of petroleum and hazardous substances, environmental permits and violations for the property listed below: 4301 West Chicago Avenue, Chicago, IL Thank you for your assistance-



Kates, Kelly <Kelly.Kates@illinois.gov>

to me ▾



ILLINOIS ENVIRONMENTAL PROTECTION AGENCY

1021 NORTH GRAND AVENUE EAST, P.O. BOX 19276, SPRINGFIELD, ILLINOIS 62794-9276 • (217) 782-3397

BRUCE RAUNER, GOVERNOR

ALEC MESSINA, DIRECTOR

November 21, 2017

Yung Environmental, Inc.

Attn: Ms. Carmen Yung

[6855 Didrikson Lane](#)

[Woodridge, IL 60517](#)

Re: Freedom of Information Act Request - 102062

Dear Ms. Yung:

This letter is in response to your Freedom of Information Act (FOIA) (5 ILCS 140/1 et seq.) request dated November 19, 2017 and received by the Illinois Environmental Protection Agency (Illinois EPA) on November 19, 2017.

Following a search, the Illinois EPA has determined there to be no information responsive to your request.

Requested Information

- | |
|---|
| 1. Chicago – 4301 West Chicago Avenue |
|---|

Thank you for your patience in this matter.

Sincerely,

Anwar Johnson

Illinois EPA

FOIA Officer

[217.558.5101](tel:217.558.5101)

<http://www.epa.illinois.gov/foia/index>

**Kaufman, Cheryle** <Cheryle.Kaufman@illinois.gov>

to me ▾

Nov 20 (1 day ago) ☆



November 20, 2017

Carmen Yung
6855 DIDRIKSON LANE
Woodridge, IL 60517

Dear Carmen Yung,

The Office of the State Fire Marshal ("OSFM") received your request for records, pursuant to the Freedom of Information Act, on 11/19/2017. The OSFM has reviewed its files and, unfortunately cannot fulfill your request for the following reason:

The documentation and/or information you seek is not of the type prepared or maintained by the OSFM.

We have carefully searched our office records in response to your request. Unfortunately, the OSFM does not have any records that are responsive to your specific request.

Pursuant to Section 9.5 of the Act, "any person whose request to inspect or copy a public record is denied by a public body . . . may file a request for review with the Public Access Counselor established in the Office of the Attorney General not later than 60 days after the date of the final denial." Such requests must be in writing, signed by the requester and include (1) a copy of the request for access to records and (2) any response from the OSFM. Further information on such requests contact:

Sarah Pratt
Acting Public Access
Counselor Office of the Attorney General
500 S. 2nd Street
Springfield, Illinois 62706
Phone: 1-877-299-FOIA
[1-877-299-3642](tel:1-877-299-3642)
Fax: (217) 782-1396

For your added convenience, we now also offer electronic submission of FOIA requests. To use this feature please go to <http://www.sfm.illinois.gov/public/foia.aspx> and simply fill out our electronic FOIA request form.

Should you have further questions regarding this matter, please contact me at your earliest convenience.

Sincerely,

Matt Sebek
Deputy General Counsel FOIA Officer
Office of the State Fire Marshal
[217-785-1011](tel:217-785-1011)



Gray, Deidra gray.deidra@epa.gov via usepa.onmicrosoft.com

to me ▾

2:05 PM (1 hour ago) ☆



Good afternoon Ms. Yung,

This email is a follow up to my phone call, a message was left on your voicemail. My name is Deidra Gray from the U.S. EPA. In regards to your FOIA request# 001830, for the property address at [4301 West Chicago Avenue, Chicago, Illinois](#). Our database searches have not found any Superfund Division records responsive to your request, a no response letter will be sent to you from the Superfund Division. Another division is also assigned to your request, they will send you a separate response. Do you have any additional information to add to the search? If a response to this message is not received within (3) business days, by Tuesday November 28, 2017, we will assume that you are no longer interested in pursuing your FOIA request, and your request will be automatically closed the following business day.


Thank You.


Deidra Gray
[312 353-3240](tel:3123533240)





APPENDIX I

Photographs

Photograph #1	Remarks
	<p>North central perimeter of the Site along Kostner Avenue.</p>

Photograph #2	Remarks
	<p>View west from the north central area of the Site.</p>


Photograph #3	Remarks
	<p>View south from the north central area of the Site.</p>

Photograph #4	Remarks
	<p>View east from the north central area of the Site.</p>

Photograph #5	Remarks
	West central area of the Site.

Photograph #6	Remarks
	Monitoring well at the west central area of the Site.


Photograph #7	Remarks
	<p>Building debris at the west central area of the Site.</p>


Photograph #8	Remarks
	<p>Stone pile at the northwest perimeter of the Site.</p>

Photograph #9	Remarks
	<p>Two monitoring wells at the west end of the Site.</p>

Photograph #10	Remarks
	<p>Railroad ties at the west end of the Site.</p>


Photograph #11	Remarks
	Debris at the southwest area of the Site.

Photograph #12	Remarks
	Mounded soil at the southwest area of the Site.


Photograph #13	Remarks
	<p>Railroad spur at the southwest perimeter of the Site.</p>


Photograph #14	Remarks
	<p>Abandoned railroad spurs at the south central perimeter of the Site.</p>

Photograph #15	Remarks
 A photograph showing a gravel path and railroad tracks running west. On the left, there are trees and utility poles. In the distance, industrial buildings with tall chimneys are visible under a cloudy sky.	South central perimeter of the Site looking west.

Photograph #16	Remarks
 A photograph showing a gravel path and railroad tracks running east. On the right, there is a long brick building. Utility poles and trees are visible in the background under a cloudy sky.	South central perimeter of the Site looking east.

Photograph #17	Remarks
	<p>Railroad ties at the southeast perimeter of the Site.</p>

Photograph #18	Remarks
	<p>East perimeter of the Site.</p>

Photograph #19	Remarks
 A photograph showing a pile of several large, rectangular concrete blocks or slabs lying on the ground. The blocks are surrounded by dense, tall green weeds and grasses. In the background, there is a line of trees under a bright sky.	Concrete pile at the east central perimeter of the Site.

Photograph #20	Remarks
 A photograph showing a wide view of a field filled with tall green weeds and grasses. In the background, there is a dense line of trees. The sky is overcast and grey.	Northeast corner area of the Site.


Photograph #21	Remarks
 A photograph showing a dense field of green, leafy vegetation in the foreground. In the background, there are several trees and a fence line. The ground appears to be a mix of soil and some scattered debris.	<p>Broken clay pipe pieces at the northeast corner of the Site.</p>

Photograph #22	Remarks
 A photograph showing a narrow dirt path or trail cutting through a dense thicket of green vegetation. The path is composed of loose soil and small stones. The surrounding area is filled with various types of green plants and trees.	<p>Mounded soil at the north central area of the Site.</p>


Photograph #23	Remarks
	Central view of the Site looking west.

Photograph #24	Remarks
	Two monitoring wells at the east central area of the Site.


Photograph #25	Remarks
	<p>Monitoring well at the central area of the Site.</p>

Photograph #26	Remarks
	<p>View north of the Site from the north central perimeter.</p>


Photograph #27	Remarks
 A photograph showing an industrial site. On the left, two tall, cylindrical smokestacks rise into a cloudy sky. In the center and right, there is a large, light-colored industrial building with a corrugated metal roof and a large open bay door. The foreground is a dirt and gravel lot. The top of a dark car is visible at the bottom of the frame.	<p>View to the southwest of the Site – City of Chicago Transfer Station.</p>


Photograph #1	Remarks
	Adjacent property to the north - parking lot across Chicago Avenue. Bus Stop and sidewalk.


Photograph #2	Remarks
	View of adjacent properties to the North across Chicago Avenue - Truck Parking

Photograph #3	Remarks
	<p>Adjacent properties to the north across Kilbourn Avenue - smoke stacks. A stake labeled B-7 in a grass field next to dirt road.</p>

Photograph #4	Remarks
	<p>View of adjacent properties to the south - industrial facilities across North Kilbourn Avenue.</p>

Photograph #5	Remarks
 A photograph showing a set of railroad tracks running parallel to a long, multi-story brick industrial building. The tracks are covered with gravel and some fallen leaves. To the left of the tracks is a muddy, leaf-strewn path. The sky is overcast and grey.	<p>View of Southern boundary of the southeast portion of the subject Site - rail road tracks and neighboring industrial park.</p>


Photograph #6	Remarks
 A photograph showing a perspective view of railroad tracks receding into the distance. The tracks are flanked by a muddy, leaf-covered area with sparse, low-lying vegetation. The background is hazy and overcast.	<p>Another view of Southern boundary, East to West view. Railroad Tracks and area of low vegetation.</p>

Photograph #7	Remarks
	<p>Another view of southern boundary, North East to South West - neighboring Industrial Park to the south.</p>

Photograph #8	Remarks
	<p>Adjacent properties to the east - CTA Facility.</p>

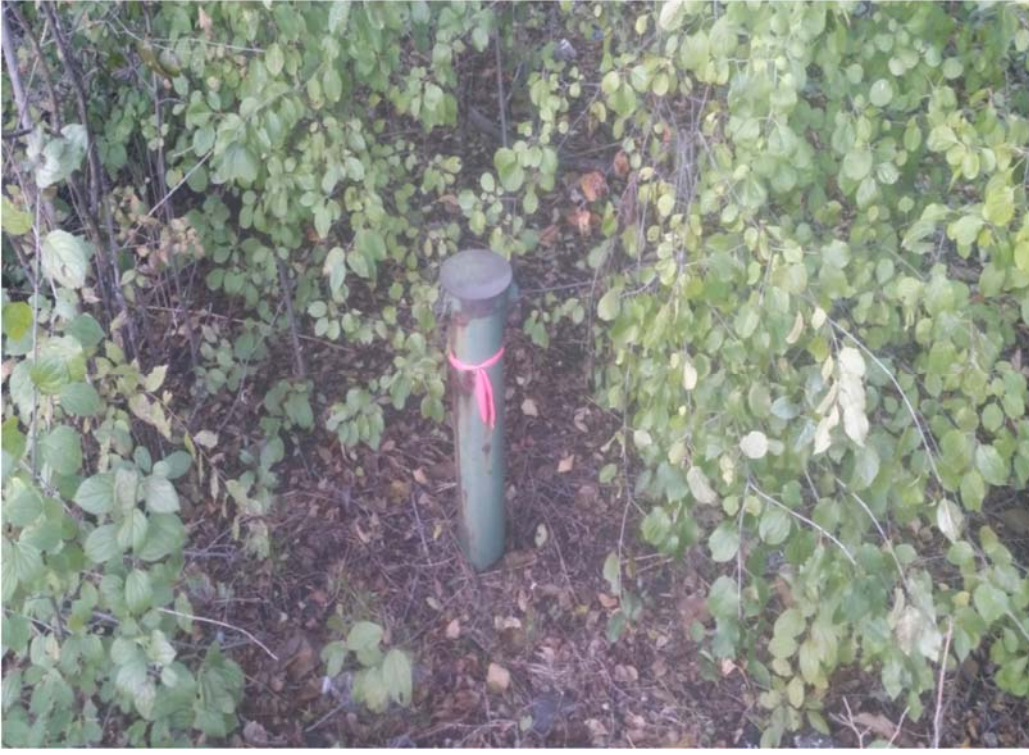

Photograph #9	Remarks
	Another view of east adjacent property - CTA facility.
Photograph #10	Remarks
	The subject Site, west central portion - scattered building materials and roofing tiles.


Photograph #11	Remarks
 A photograph showing a field of tall, dry, brown grass. Two dark, cylindrical monitoring wells are visible, one in the foreground and one further back. The background shows a line of bare trees under a pale sky.	<p>The subject Site, west central portion - northwest to southeast and two unmarked monitoring wells.</p>
Photograph #12	Remarks
 A photograph of a wooded area with a homeless camp. The ground is covered in fallen leaves and is littered with trash, including a white bucket, a pile of cans, and other debris. Bare trees and a misty background are visible.	<p>The subject Site - looking northwest - trash and homeless camp</p>

Photograph #13	Remarks
	<p>Pile of Railroad Ties and tires along North boundary of site.</p>


Photograph #14	Remarks
	<p>The subject Site - central portion, looking northeast to southwest - prairie vegetation.</p>


Photograph #15	Remarks
	<p>The subject Site, central portion - unmarked Monitoring Well. Trash and signs of potential vandalism.</p>
Photograph #16	Remarks
	<p>The subject site, looking southwest - field and dirt road East to West.</p>


Photograph #19	Remarks
	View of an unmarked monitoring well .
Photograph #20	Remarks
	The subject Site, looking east to west - Small ridges of gravel and low vegetation.


Photograph #25	Remarks
	<p>The subject Site, looking southeast - pile of railroad ties and neighboring building in the industrial park to the south.</p>

Photograph #26	Remarks
	<p>The subject Site, looking southeast - ESB- 6 and area of low vegetation.</p>

Photograph #27	Remarks
	<p>The subject Site, looking southwest - area of mounds.</p>

Photograph #28	Remarks
	<p>The subject site, looking southwest - stake of boring location and area of low vegetation.</p>

Photograph #33	Remarks
 A photograph showing a dirt path leading through a wooded area. The path is covered with fallen leaves and leads towards a line of trees. The vegetation is dense, with tall grasses and trees visible in the background.	<p>The subject Site, looking south - a road leading from the ridge (8 to 15 feet high) to the low area in the center of the site. Small to Medium vegetation (0 to 6 feet high)</p>

Photograph #34	Remarks
 A photograph showing a field of tall, brown vegetation, likely a ridge or small hills. The vegetation is dense and appears to be a mix of grasses and other plants. In the background, there are trees and a fence.	<p>The subject Site, looking west - area of ridge and small hills (8 to 15 feet high) and medium vegetation (2 to 5 feet high)</p>



APPENDIX J

Addendum Information

(Reserved)



APPENDIX K

Consultant Qualifications

SALVATORE CONSALVI, P.G.

Project Geologist

EDUCATION

Purdue University: B.S. Geology

CERTIFICATION

Professional Geologist, Florida
OSHA 40-Hour HAZWOPPER Training
US Forest Service Radio Operator
Wildland Firefighter Type II
Prescribed Fire Crew Member

SUMMARY OF QUALIFICATION

Mr. Consalvi is a registered Professional Geologist and has more than 20 years experience in environmental consulting services. Mr. Consalvi has extensive field experience in performing site assessments and remediation. He has performed numerous hydrogeological studies, soil and groundwater sampling, construction and remediation oversight, remedial investigation and feasibility studies at complex industrial and RCRA sites, leaking underground storage tank sites, landfills and naval stations. In addition to environmental investigations, Mr. Consalvi's other expertise includes geotechnical investigations and concrete testing, aquifer testing, hydric soil investigations, wetland delineations, air sampling and asbestos abatements.

EXPERIENCE

Mr. Consalvi has performed numerous Phase I ESAs at commercial and industrial properties involving real estate transactions. Due to his vast environmental consulting experiences, he can identify recognized environmental issues and liabilities involved, and advise clients with problem solving solutions.

Mr. Consalvi has managed asbestos abatement projects in educational, commercial, and health care facilities.

Mr. Consalvi was the field operations leader for an extensive Remedial Investigation/Feasibility Study at the US Naval Air Station. He managed field operations, conducted subsurface soil and groundwater sampling, aquifer testing, prepared investigation reports and served as the liaison for state and federal agencies. He also conducted Remedial Investigations at Glenview naval Air Station.

Mr. Consalvi has developed Post Closure Care Plans for municipal landfills in Illinois and conducted landfill closure activities.

Mr. Consalvi has also performed numerous geotechnical investigations and concrete testing for Illinois Department of Transportation properties. Mr Consalvi's other experiences include risk-based assessments for leaking underground storage tanks sites, hydric soil investigation for wetland delineations and waste water sampling.



Craig T. Cabrera

Senior Scientist

Core skills

Project Management, Phase I ESA, Phase II ESA, Soil and Groundwater Investigation and Remediation, Solid Waste Management, UST Removal and Remediation,

Professional summary

Craig Cabrera is a Principal Scientist with 25 years of professional experience as an environmental consultant serving in a variety of technical and managerial roles for commercial and industrial clients. Craig has managed a wide variety of projects that include: soil and groundwater investigations and remediation; removal and remediation of underground storage tank systems, hydraulic lift systems and oil/water separator systems; Phase I Environmental Site Assessments and Phase II Environmental Site Assessments for due diligence purposes in support of property transfers, mergers, and acquisitions.

Employment history

Amec Foster Wheeler Environment & Infrastructure, Inc., Senior Scientist, Chicago, Illinois, 1990 to present

Representative projects

Environmental Services, Loparex Plant, UPM Kymmene Corporation, Iowa City, Iowa. Project Manager. Coordinated Phase I ESA, subsurface investigations, and groundwater monitoring, at a 15-acre paper coating manufacturing facility. Investigative activities completed to determine vertical / lateral extent of impacts detected in soil and groundwater. Evaluation included the completion of a Risk Evaluation and Response Action Plan submitted to the Contaminated Sites Section of the Iowa Department of Natural Resources (IDNR) Land Recycling Program (LRP) with the intent to receive a No Further Action designation for the property. Responsible for managing environmental services, coordinating field work and scheduling, and preparing project budgets.

Environmental Services, Nationwide Service Facilities, Sears Holdings Management Corporation, Nationwide, US. 1995-2012. Program Manager.

Provided project management on a nationwide basis for environmental services at over 200 facilities since 1995. Environmental services included: Phase I Environmental Site Assessments; Phase II Environmental Site Assessments; removal and remediation of automotive and elevator hydraulic lift systems; removal and remediation of underground storage tanks and oil/water separators; soil and groundwater investigations and remediation; and technical environmental consultation. Acted as the Program Manager for all local Amec Foster Wheeler offices providing specifications development, cost estimates, contractor bid analysis and selection, project direction, technical guidance, report review, administrative functions, and serving as the prime point-of contact with the Program Director and supporting staff.

Environmental Services, Danville Works Plant, CONFIDENTIAL CLIENT, Danville, Illinois. 08/2008-02/2009. Project Coordinator. Coordinated Phase I ESA, subsurface investigations, groundwater monitoring, and UST removal and remediation at an 86-acre industrial manufacturing complex with multiple buildings

Education

Bachelor of Science, Biological Sciences, University of Illinois, Champaign, Illinois, 1989

Certifications and training

OSHA Hazardous Waste Site Supervisor (29CFR 1910.120)

OSHA Hazardous Waste Site Worker Training (29 CFR 1910.120)

First Aid / CPR Certified

Experience

Amec Foster Wheeler: 1990

Industry: 1990

Continued.

(main plant and support facilities), onsite aboveground tanks, railroad spurs and capped waste ponds. Investigative activities completed to determine vertical / lateral extent of impacts detected in soil and groundwater. Investigation evaluated eight onsite solid waste management units (SWMUs) to determine necessary steps to meet U.S. EPA and state EPA cleanup goals. Responsible for developing scope of work, cost estimates, coordinating field work, and developing reports.

Harbor Belt Railroad Property, PCS Sales (USA), Inc., Hammond, Indiana.

02/2010-02/2012. Project Coordinator. Phase I Environmental Site Assessment of Indiana Harbor Belt (IHB) Railroad Property in Hammond, Indiana. The property is currently owned by Conrail and occupied by IHB. The IHB Railroad Property comprises approximately 93 acres south of Michigan Street between Columbia Avenue and Kennedy Boulevard in Hammond, Indiana. Based on the recommendations of the Phase 1 ESA, an invasive Phase II Environmental Site Assessment was conducted of the site. The scope of work included: completion of soil borings; installation of temporary groundwater monitoring wells; gauging water levels; purging the temporary wells prior to sampling; and collecting soil, groundwater and surface water samples for laboratory analysis. Subsequent remediation included the removal of two underground storage tanks, and associated impacted soils. Responsible for work plan development, budgeting, field work coordination, and report development and review.

Remedial Design and Implementation, Avaya, Inc., Montgomery, Illinois.

11/2003-04/2016. Project Manager. Environmental services to assist Avaya with compliance with the Illinois Environmental Protection Agency Resource Conservation and Recovery Act (RCRA) Remedial Action Plan Permit (RAPP) for Post-Closure Care for this site. Environmental Services include, quarterly groundwater monitoring, and maintenance on asphalt cap that serves as an engineered barrier over the RCRA Corrective Action Management Unit (CAMU). Responsible for managing environmental services, coordinating field work and scheduling, and preparing project budgets to control costs.

Environmental Services, United States Postal Service (USPS), Illinois Region.

1995-2000. Program Manager. Provided project management for a broad scope of USPS environmental service areas, including pre-acquisition Phase I and Phase II Environmental Site Assessments, underground storage tank removal and remediation, indoor air quality assessment and sample collection, storm water site assessments, lead-based paint inspections, and identification of asbestos containing building materials. Served as the primary contact for the USPS Great Lakes Area contract for over two years and successfully managed over 40 projects for the USPS.

Phase I and Phase II ESAs, Centrella Street and Belmont Avenue Locations, Ridge Property Trust, Franklin Park, Illinois. 06/2008-01/2009. Project Manager.

Managed Phase I ESAs and Phase II ESAs for two properties formerly used for grocery store product distribution and considered for acquisition by client. Subsurface investigation included soil boring and monitoring well installation and sampling for soil and groundwater impacts associated with former USTs, petroleum and chemical storage, underground hydraulic components, and potential offsite concerns. Responsible for developing scope of work, cost estimates, coordinating field work, report production and review, and client liaison.

Subsurface Investigation, Retail Distribution Facility, Confidential Client, Corpus Christi, Texas. 01/2005-12/2012. Project Manager. Managed

Continued.

environmental investigation of two-acre retail warehouse/distribution facility impacted by petroleum from leaking underground storage tanks (LUSTs). Ongoing investigation includes soil and groundwater monitoring, plume delineation, and close interaction with the Texas Commission on Environmental Quality (TCEQ) for remediation plan development. Managed remediation consisting of excavation and disposal of 180 tons of impacted soil and site restoration. Received a No Further Action status from the TCEQ. Also completed report reviews, and served as client liaison.

Pesticide Subsurface Investigation, Retail Distribution Facility, Confidential Client, Orlando, Florida. 10/2001-11/2012. Project Coordinator. Long-term environmental investigation and delineation at major retailer's former distribution center, including fleet vehicle maintenance and repair shop, in urban location. Services consisted of groundwater monitoring, soil sampling and remediation for pesticide impacts, which include excavation and source removal, phased chemical oxidation groundwater treatments utilizing various application techniques, and groundwater monitoring. Worked with a local Amec Foster Wheeler Project Manager to develop the scope of work and cost estimates, coordination and correspondence with the Florida Department of Environmental Protection Project Manager, report reviews, and served as client liaison.

Subsurface Investigation and Remediation, Former Retail Facility and Auto Service Center, Confidential Client, Washington, District of Columbia. 2004-2011. Project Coordinator. Site investigations and corrective actions to address two historical releases of petroleum on vacant lot formerly occupied by retailer vehicle service center. Conducted comprehensive site assessment (including soil borings and well installations), removal of two 1,000-gallon storage tanks, geophysical surveys, and excavation and removal of impacted soils. Approximately 2,000 tons of contaminated soil removed from one location and 5,000 tons from the other. Worked with a local Amec Foster Wheeler Project Manager to develop the scope of work and cost estimates, completed report reviews, and served as client liaison.

Installation and Up-Grades of Underground Storage Tanks, Village of Wheeling, Wheeling, Illinois. 01/2002-12/2002. Project Coordinator. Provided management and oversight for the installation of one 550 gallon, fiberglass UST and the up-grade of two 1,000 gallon steel USTs which included installation of an automated leak detection and inventory control system, and the replacement of access ports and underground conduit lines.

Underground Storage Tank Removal, Confidential Client, Woodstock, Illinois. 1997. Project Manager. Developed work plan and provided management and oversight for the removal of five gasoline and heating oil USTs. Coordinated soil remediation activities that included the removal and disposal of 1,425 cubic yards of soil. Prepared a closure report for the site and obtained a "No Further Action" status.

Underground Storage Tank Removal, Confidential Client, Wheaton, Illinois. 1998. Project Manager. Developed work plan and provided oversight for the removal of one-10,000 gallon fuel oil UST from an active commercial facility. Coordinated removal efforts with a no release status and completed a closure report for the site.

Underground Storage Tank Site Classification, Unimast, Inc., Franklin Park, Illinois. 1998. Project Manager. Prepared site classification work plan and budget and

Continued.

provided direction and oversight for the subsurface investigation efforts. Completed a report in accordance with IEPA reporting requirements and completed reimbursement submittal package for reimbursement from the IEPA LUST Program.

Phase I Environmental Site Assessments. 1995-2012. Project Manager. Performed Phase I ESAs associated with property transactions for industries, law firms, real estate offices and private owners throughout the country. Provided project management for additional sites throughout the country that were completed by Amec Foster Wheeler offices. Managed and coordinated multiple site portfolios for national clients with the largest portfolio consisting of 51 Phase I ESAs completed nationwide within a four week time period. Routinely utilize Amec Foster Wheeler offices, staff and resources nationwide for multiple projects simultaneously. Assessment activities included visual inspections for potential environmental liabilities such as underground storage tanks, chemical and drum storage, suspected water/wastewater contamination and hazardous materials/waste storage. Prepared final reports that included documenting findings, historical and regulatory information, and conclusions and recommendations.

Phase II Environmental Site Assessments. 1995-2012. Project Manager. Developed work plans and provided both project management and oversight for Phase II ESAs of industrial and commercial properties throughout the country. Directed field activities, evaluated the findings of the investigation, and provided interpretation and recommendations in a report of findings.

Environmental Services, United States Army Corp. of Engineering (USACE), Multiple Locations, Midwest. 1995-1997. Field Manager. Performed subsurface field investigations at a waste collection site in Indiana which included the installation of soil borings and monitoring wells. Provided direction and oversight of the removal of approximately 500 gallons of hazardous liquid product from a sump pit at a chemical plant in Willow Springs, Illinois. Performed LUST site classification investigations at an aviation facility in Joliet, Illinois. Completed sampling of monitoring wells at a site undergoing remediation in South Chicago, Illinois.

Storm Water Pollution Prevention Plans, Confidential Client. 1995-1997. Field Technician and Project Manager. Completed field investigations for the development of Storm Water Pollution Prevention Plans associated with National Pollutant Discharge Elimination System (NPDES) permitting for facilities in seven midwest states. Project development included site analysis, compliance analysis, spill identification and development of response procedures.

Air Sampling Professional, Asbestos Abatement, 30 Story Commercial Building, Chicago, Illinois. 1991-1992. Project Manager. Responsibilities included day-to-day abatement monitoring, scheduling, and coordination of activities between the abatement contractor and building management in an occupied building. Enforced contract specifications, observed project activities, performed workplace and clearance inspections, reported progress to the client, and prepared a comprehensive final report.

CARMEN Y. YUNG, LEED AP

EDUCATION

BS Geology – University of Hong Kong

CERTIFICATION

LEED Accredited Professional – Green Building Certification Institute
40-Hour OSHA HAZWOPER Training
OSHA HAZWOPER Supervisor Training
8-Hour OSHA Refresher Training

SUMMARY OF QUALIFICATIONS

Ms. Yung was a project manager of Leaking Underground Storage Tank Program with the Illinois Environmental Protection Agency. She has over 20 years experience in environmental consulting services. She has extensive technical and regulatory experiences in developing site characterization and remedial alternatives, performing risk-based assessments, performance of Phase I and Phase II environmental site assessments, compliance audits, leaking underground storage tank removals, assessments and reporting, air, land and water permitting, and obtaining site closure from the regulatory agencies. She has managed and obtained regulatory closures for numerous projects under the Leaking Underground Storage Tank Program and the Illinois Site Remediation Program. In addition, due to her prior employment with the Illinois Environmental Protection Agency, she is very knowledgeable with state and federal environmental regulations and has front-line experience working with state and federal regulatory agencies.

EXPERIENCE

Ms. Yung has performed over 100 Phase I/Phase II environmental site assessments and compliance audits at commercial and industrial facilities. She is able to identify the environmental issues and can assist the client with problem solving and solutions.

Ms. Yung was a project manager of the Leaking Underground Storage Tank (LUST) Program with the Illinois Environmental Protection Agency. In the past 15 years, she provided project management, technical report writings (45-Day Report, Site Classification Work Plan, Site Investigation Completion Report, Corrective Action Plan and Corrective Action Completion Report) and oversight of site assessment and remediation activities for numerous LUST sites owned by big oil companies. Due to her extensive regulatory and technical experiences and her ability to understand and meet clients' needs enables her to be instrumental in negotiating with regulatory agencies and achieving closure at LUST project sites. Ms. Yung also has performed risk-based assessments (TACO), Tier II and Tier III evaluations and groundwater modeling to evaluate risks related to environmental impact and negotiate site closure. Ms. Yung also specializes in preparing claims for obtaining reimbursement of site assessment and remediation costs from the LUST Trust Fund. She has thorough understanding of the

procedures and requirements for obtaining reimbursement. She has numerous successes in obtaining reimbursements for the clients in a timely manner.

Ms. Yung has provided comprehensive environmental consulting services to industrial clients including a nationwide transportation company and a major railroad company. Services provided including consulting on health and safety and compliance issues, storm water sampling, preparation of Storm Water Pollution Prevention Plans, Spill Prevention Control and Countermeasures Plans, air emission reports, site investigation and remediation for releases of petroleum and hazardous substances, technical reporting and regulatory closures for the releases. She was the clients' main contact and served as regulatory advisor for the clients.

Other experiences include site assessment and site closure activities on a variety commercial, industrial and brownfield sites under the Site Remediation Program. She has strong background in the use of conventional and innovative technologies, including soil excavation, soil vapor extraction and in situ chemical oxidation. She had extensive technical experiences in preparing site investigation reports, remedial action plans and remedial action completion reports.



amec
foster
wheeler

Mary Jank, PG

Senior Geologist

Core skills

Phase I ESA, Phase II ESA, CERCLA, RCRA, LUST, TACO, Hazardous Waste, CCDD, Investigation and Remediation Planning, Asbestos and Lead based Paint Management

Professional summary

Ms. Jank has more than 35 years of experience as a professional geologist and project manager. Her experience has included Phase I and Phase II site assessments, well site supervision, borehole logging, soil sampling, water sampling, soil vapor surveys, dye studies in fractured bedrock, XRF of lead in soils, and UST removal and site closure. Her experience has encompassed CERCLA and RCRA projects, as well as voluntary cleanups under several state programs. Her responsibilities have included site and project management activities. Ms. Jank is experienced at hydrogeological interpretation and the mapping of constituent migration in numerous types of subsurface environments including karst and discontinuous tills. Her client and agency interface experience is extensive and Ms. Jank has been a key contributor during negotiations with the EPA, the Corps of Engineers and other state and local government agencies.

Ms. Jank has prepared quality assurance documentation under both CERCLA and RCRA for both industrial and government clients. Ms. Jank also has completed TACO Tier 2 risk assessments and has assisted in Tier 3 risk assessments at several sites. Ms. Jank has also completed CERCLA risk assessment and feasibility study documents, and participated in CERCLA community relations activities including preparation of community relation plans and public meetings.

Ms. Jank has planned and overseen site remediation and re-development projects since 2000 for Chicago Public Schools and the Public Building Commission of Chicago. Ms. Jank has overseen the asbestos and lead based paint inspection, design and oversight services performed by Amec Foster Wheeler for Chicago Public Schools since 2005 and has been overseeing these same services for the Public Building Commission since 2010. She has also overseen pre-demolition asbestos inspections and lead based paint inspection and risk assessment for the Public/Private Joint Venture which is redeveloping military housing at Great Lakes, Fort Sheridan, Glenview Naval Air Stations and Crane Naval Base in Indiana.

Employment History

Amec Foster Wheeler Environment & Infrastructure, Inc., Senior Geologist, 1996 to Current.
IT Corporation, Chicago IL. Project Manager/Group Leader, 1988-1996
Chevron USA, Chicago IL. Geologist, 1982-1985

Representative projects

Payton Phase I and II, Public Building Commission of Chicago, Chicago, Illinois. 11/2013-10/2015. Project Manager. Investigation, design and oversight of remediation activities at a parking lot adjacent to a Chicago Public School High School. Objective was the development of the parking lot into an Annex connected to the existing school. Responsible for all document preparation, TACO, and project management.

Education

Masters of Science, Geology,
Michigan State University, East
Lansing, Michigan, 1982

Bachelor of Arts, with Honors in
Geology, Skidmore College,
Saratoga Springs, NY, 1978

Professional qualifications/registration(s)

Certified Professional
Geologist, American Institute of
Professional Geologists,
(#CPG-9941)

Professional Geologist (LPG),
Illinois, (#196-000721), 1998

Professional Geologist (PG),
Wisconsin, (#891), 1996

Professional Geologist (LPG),
Indiana, (#1966), 1998

Registered Geologist (RG),
Missouri, (#816), 1996

Certifications and training

CPR Certified

Experience

Amec Foster Wheeler: 1996

Industry: 1982

Continued.

PBC ES Modular, Public Building Commission of Chicago, Chicago, Illinois. 05/2015-12/2015. Project Manager. Investigation, design and oversight of excavation of a playground area and parking area adjacent to two different Chicago Elementary Schools. Objective was the installation of modular classrooms adjacent to the existing schools: Mt. Greenwood and Tonti Elementary Schools. Responsible for all document preparation, review of contractor submittal, TACO, and project management. Ensured project met tight schedule of 3 months and came in below budget.

Lake County Skokie Valley Ped Bridge, Lake County (IL) Division of Transportation, Highland Park, Illinois. 05/2015-12/2016. Senior Associate Geologist. Phase I study for a new pedestrian bridge carrying the existing Skokie Valley Bike Path south into Cook County. This bridge will be built under electrical transmission lines and requires extensive coordination with ComEd, as well as the Union Pacific Railroad, and multiple municipal stakeholders. FHWA coordination for funding, wetland delineations, environmental site assessments, preliminary bridge design, public outreach, and landscape architecture are also all part of this project's scope of work. Type Size and Location plans were submitted to IDOT's Bureau of Bridges and Structures. Responsible for management and review of Phase I Environmental Site Assessment, and management and review of Phase II Environmental Site Assessment should one be necessary, and any other hazardous material or soil management issues.

I-90 Jane Addams Memorial Tollway, Kennedy Expressway to Oakton Street, Illinois Tollway, Cook County, Illinois. 08/2012 – 12/2015. Hazardous Waste. Final design for the Reconstruction and add-lanes of 5.5 miles of I-90 (Jane Addams Memorial Tollway) as part of Illinois Tollway's Move Illinois Program. Work includes preparing a Master Plan Update to address wider inside shoulder and lane for future transit options and improved profile. Amec Foster Wheeler serves as a major subconsultant to Parsons Brinkerhoff. The project will be let as 8 separate construction contracts, 4 of which will be led by Amec Foster Wheeler. Design services include roadway design, bridge design (13 bridges); retaining wall design; hydraulic modeling and drainage design; utility coordination; barrier warrant analyses; maintenance of traffic; signing and striping; 401/404 and IDNR permit applications; Soil Disposal analysis in conformance with new Illinois CCDD regulations; specifications and estimates. Responsible for managing environmental investigation to determine soil disposition.

Environmental Consulting Services for School Facilities, Chicago Public Schools, Chicago, Illinois. 01/2010-01/2013. Project Manager. Asbestos re-inspections of all building materials in more than 200 Chicago Public School facilities throughout the City of Chicago metropolitan area. Amec Foster Wheeler performed a review of all past inspections, reports and pertinent response actions prior to commencing field activities. Amec Foster Wheeler successfully managed asbestos subcontractors for performance of re-inspections with final review by Amec Foster Wheeler's IDPH Licensed Asbestos Management Planners. Management Plans were updated to include any changes noted during the re-inspection and the client's Access Database was updated for each re-inspection conducted. Final reports were provided in electronic and hard copy form. Client contact, project coordinator, and review of documents.

Continued.

Environmental Consulting Services for School Facilities 2005-2009, Chicago Public Schools, Chicago Illinois. 08/2005-07/2009. Project Manager.

Environmental consulting, management and oversight services under four-year (2005-2009) Master Services Agreement for various elementary, middle and high school buildings and support facilities throughout City of Chicago Public School system. Services included planning and oversight of abatement of asbestos-containing materials (ACMs) and lead-based paint; industrial hygiene services; and environmental investigations as needed. Services at more than 70 school facilities throughout City of Chicago metropolitan area. Responsible for review of design documents for asbestos and lead based paint abatement and management of services.

Leech Tishman Fuscaldo & Lampl, LLC Palm Phibrotech Phase I and II, Joliet Illinois. 08/2010-12/2010. Principal. Phase I and Phase II Environmental Site Assessment (ESA) at the Phibro-Tech facility in Joliet, Illinois. At the time, the facility was recycling/recovering materials from inorganic waste streams. Historically, the facility had processed RCRA hazardous waste, but as of about 2004, the facility no longer accepted those types of materials. The facility had an active RCRA Part B Permit and was under a consent decree which required compliance with the permit. Nine Solid Waste Management Units (SWMUs) have been identified and the facility was performing ongoing monitoring of groundwater. There are land use restrictions and open action items for institutional controls at the Site. Through performance of the Phase II ESA, Amec Foster Wheeler was able to provide a baseline characterization of the site prior to acquisition, including input on other areas of concern. Technical lead, reviewed documents, scoped Phase II, handled all technical issues

Zion Asbestos Survey, EnergySolutions, Inc., Zion, Illinois. 05/2008-10/2008. Project Manager. Asbestos inspections of a nuclear power station. A comprehensive NESHAP asbestos inspection survey of the Zion Nuclear Station, including completion of an inspection of all accessible building components for suspect ACM, collection of samples, and laboratory analysis. Then labeled all materials which were asbestos containing and prepared a comprehensive database of the results, identified asbestos containing pipe insulation on facility diagrams, and provided estimates of potential costs for abatement. Unit 2 Turbine Building 2 stories plus basement, mezzanines and platforms over 3000 samples over 35,000 linear feet of piping plus tanks and fittings. Responsible for client contact for procurement oversight of personnel and quality control of data review.

Fire Station #109 Phase II Environmental Site Assessment and Geotechnical Investigation, Public Building Commission of Chicago, Chicago Illinois. 11/2008-04/2009. Quality Assurance / Quality Control. Phase II environmental site assessment and geotechnical investigation for the new Fire Engine Company #109 at 2301-2359 South Kedzie Avenue in Chicago. Responsible for review of documents and assistance with technical issues with regard to TACO (risk assessment) and Site Remediation Program (Illinois Voluntary Remediation Program)

Mt. Greenwood Elementary Asbestos and Lead Based Paint Services, Public Building Commission of Chicago, Chicago, Illinois. 07/2010-09/2011. Project Manager. Asbestos inspection and abatement oversight services to the Public Building Commission of Chicago. Amec Foster Wheeler provided inspection and testing, and design services as well as asbestos project management and air

Continued.

sampling services on the Mt. Greenwood Public School renovation project. Responsible for review of all documentation, and interface with client.

Mt. Greenwood Elementary Phase I and Phase II Environmental Site Assessment and Construction Oversight, Public Building Commission of Chicago, Chicago, Illinois. 07/2010-07/2012. Project Manager. Phase I environmental site assessment and construction oversight for soil removal in conjunction with renovation of Mt. Greenwood School. Responsible for review of all documentation, and interface with client.

East Chicago IN UST Removal, Multiserv Group Ltd., East Chicago Illinois. 04/2009-12/2009. Principal Review. UST investigation and removal at an industrial facility in East Chicago, IN. Completed soil and ground water sampling and analysis. Retained contractor for UST removal. Completed UST removal report and UST site investigation report. Industrial facility - 2 acres. 3 buildings Responsible for reviewing UST reports required by IDEM.

Brownfield Site Remediation and Closure, City of Chicago Department of Environment, Chicago, Illinois. 09/1999-12/2005. Project Manager. Brownfield Redevelopment Environmental investigation and remediation services including site investigation and report, closure activities, risk assessment review, Remedial Objectives Report and Remedial Action Plan for 17-acre brownfield site on Chicago's west side. Site had formerly been location of construction debris disposal firm and contained over 500,000 CY of construction debris. Existing 34,000-SF building on site renovated to comply with "green building" principles and features green technology components. RAP developed to comply with green principles, including specially engineered barriers, geotextile fabric remediation, and tree resin product overlay to form pavement. Closure achieved in January 2003. Project won 2002 Phoenix Award for U.S. EPA Region 5. Responsible for authoring all documentation including, site investigation, remedial action completion report and remedial objectives report.

Sacramento Boulevard Site Investigation Remediation Construction Oversight and RACR Preparation, Chicago Green Works, Chicago, Illinois. 10/2005-05/2007. Principal. Site investigation, remediation construction oversight, and document preparation for 13-acre former "back" section of 445 North Sacramento Boulevard. Site previously occupied by foundry and other industrial operations; entered into Illinois EPA's Site Remediation Program (SRP) in 1999. Site to become new "Green" industrial park with 20,000-SF LEED (gold-certified) office headquarters and warehouse on site. Previous Amec Foster Wheeler Phase II environmental site assessment included 79 soil borings and 105 soil samples, and installation of 4 groundwater monitoring wells. Prepared documents included comprehensive site investigation report, remedial objectives report, remedial action plan (RAP), and remedial action completion report (RACR). All reports compiled in accordance with IEPA SRP program. Responsible for reviewing analytical data and provided Chicago Department of Environment with strategy recommendations for closure. Responsible for providing resource control and overall quality control.

Powell Replacement School Environmental Consultant Management, Public Building Commission of Chicago, Chicago, Illinois. 03/2009-01/2011. Principal. Environmental consulting services during site design through construction for the Powell Replacement Elementary School Project. This project began with a Phase I that Amec Foster Wheeler performed for Chicago Public Schools in 2006. No

Continued.

recognized environmental conditions (RECs) were discovered as a result of this Phase I. However, in 2009, Amec Foster Wheeler was asked to provide construction oversight and design services for the Public Building Commission on this same school site. During trenching activities to investigate subsurface anomalies at the property, free-phase oil was noted in the trench pit. Amec Foster Wheeler investigated this oil and delineated the extent of impacted soils. Based on that delineation, a Comprehensive Site Investigation Report, Remediation Objectives Report and Remedial Action Plan were prepared. Amec Foster Wheeler used averaging to limit the amount of required remediation at the site. Amec Foster Wheeler then oversaw the remediation of the oil and contaminated soils which was performed as part of construction activities at the site. Construction and soil excavation were completed and Amec Foster Wheeler submitted a Remedial Action Completion Report resulting in a No Further Action Letter for the site. Responsible for all technical aspects of project, used TACO (risk assessment) to reduce the amount of remediation needed for this school site.

Avondale/Irving Park Area Elementary School Construction Oversight, Public Building Commission of Chicago, Chicago, Illinois. 03/2009-12/2011. Principal. Environmental Oversight during soil movement and backfill activities during construction at the Avondale/Irving Park Area Elementary School site. Responsible for oversight of technical details of the project including specifications, review of subcontractor submittals and consultation on environmental issues with client.

Phase I and II Environmental Assessments, Leggett & Platt / Sterling Steel Company, LLC, Sterling, Illinois. 07/2001-10/2008. Geologist. Beginning in 2001, performed Phase I and II environmental assessments and provided regulatory support at client site, a 700-acre industrial steel operation acquired by client, including Due Diligence ASTM Phase I and Phase II, past compliance profile, entry of site into Site Remediation Program (2002) Comprehensive Site Investigation Report (CSIR), Remedial Objectives Report. Responsible for reviewing Phase I and Phase II documents and providing technical input with regard to TACO and SRP.

City of Chicago Department of Environment Burnside North Industrial Site Brownfield Phase II Investigation and Remediation, Chicago, Illinois. 09/1997-06/2005. Project Manager. Performed environmental services at 11-acre site of former steel manufacturing facility. Work included Phase II Environmental Investigation and inclusion of site into IEPA Site Remediation Program as "brownfield"; offsite disposal of surface tar and soils in conjunction with PNA's clean-up objectives; and submission of remediation Completion Report to IEPA. Responsible for reviewing analytical data and provided Chicago Department of Environment with strategy recommendations for closure. Responsible for providing resource control and overall quality control.

Brownfield Redevelopment to Roseland Place - Voluntary Site Remediation Program, Neighborhood Housing Services, Chicago (South Side), Illinois. 05/2005-01/2006. Principal Review. Brownfield Redevelopment Phase I and Phase II Environmental Site Assessments and related services under voluntary Site Remediation Program for redevelopment of 4-acre brownfield area into assisted living facility on Chicago's South Side. HUD funding for project required attainment of "No Further Remediation" (NFR) letter. Services included evaluation of prior investigation reports; support for entry into Illinois' Site Remediation Program; development of Site Investigation Report, Remedial Objectives Report, and Remedial Action Plan; and

Continued.

remediation oversight for former industrial property, which included 4 USTs. Brownfield contaminants include soil contaminated with polynuclear aromatics (PNAs), volatile organic compounds (VOCs) and lead in soils to a depth of 5' below surface grade. Responsible for reviewing Phase I documents and providing technical input with regard to TACO and SRP.

Military Housing Privatization and Redevelopment (for U.S. Navy) Environmental and Infrastructure Services, Forest City Military Communities Midwest, Four Cities in IL, IN, Illinois. 04/2005-07/2010. Project Manager.

Environmental and infrastructure services including Phase II environmental assessments, asbestos sampling, lead surveys and risk assessment and geotechnical sampling (for roadway design) for demolition and redevelopment and privatization of military housing units for the U.S. Navy at four locations (three in Illinois and one in Indiana) under long-term lease by public / private venture. Work involves demolition of approximately 1,500 buildings and construction of neighborhoods containing nearly 750 new market-level homes for Navy personnel and their families on portions of the base and enhancing portions of the base for existing tenants. Design work included roadway, drainage, sanitary sewer, water main, and electrical and telecom utilities for the new home sites as well as development of neighborhood centers, active and passive parks, dogs parks, tot lots, irrigation systems, and placement and connection of prefabricated park buildings. Responsible for Environmental portion of project, including planning document production (Hazardous Materials Management, Lead Based Paint Management, Asbestos Management, Pesticide Use, Mold Prevention, Stormwater Management) and overseeing Phase I and Phase II and asbestos lead-based paint activities.

Santa Monica Retail Auto Center Phase II Environmental Site Assessment, Soil Investigation, Confidential Client, Santa Monica California. 10/2008-02/2009.

Principal. Phase II environmental site assessment and subsurface soil investigation on 2-acre site of retail store automotive center, involving underground piping associated with former underground storage tank (UST) located on site. Responsible for overseeing phase II investigation.

Plant I Demolition Decommissioning Plan and Specifications, Confidential Client, Rockford Illinois. 10/2006-07/2009. Principal Review.

Development of decommissioning plan and demolition specifications for Phase I demolition of buildings at Plant I industrial complex. Demolition of approximately 100,000 SF of space, including one four-story office building. Project team assisted with both bid and contractor selection. Responsible for reviewing asbestos inspection report.

Centrella Phase II, Ridge Property Trust, Franklin Park, Illinois. 06/2008-01/2009. Principal Review.

Phase II Environmental Site Assessment for two properties formerly used as grocery stores and considered for acquisition by client, including soil boring subsurface investigation for monitoring well installation and groundwater monitoring. Responsible for review and TACO (IL risk assessment) consultation of Phase II analytical results.

Danville Works Plant Phase II Remedial Investigation, Confidential Client, Danville Illinois. 08/2008-02/2009. Project Coordinator.

Phase II Remedial Investigation for 86-acre industrial manufacturing complex with multiple buildings (main plant and support facilities), onsite aboveground tanks, railroad spurs and capped waste ponds. Facility produced and packaged freon (CFC refrigerants) from 1955 to 1994, then switched to packaging only. Contamination of soil and

Continued.

groundwater with volatile organic compounds (VOCs) identified since 1970s. Investigative activities to determine vertical / lateral extent of carbon tetrachloride and other CFCs and VOCs detected in soil and groundwater, and to verify if contaminant groundwater plume extended offsite. Investigation also evaluated eight onsite solid waste management units (SWMUs) to determine necessary steps to meet U.S. EPA and state EPA cleanup goals. Responsible for developing cost estimates, overseeing field work and developing reports.

Great Lakes Naval Training Center Residential Units Renovation Asbestos and Lead-Based Paint Assessments, Confidential Client, North Chicago Illinois.

06/2006-06/2009. Project Manager. Asbestos and lead-based paint inspection, testing and risk assessment services in specified portions of 20 residential homes in the Main Side and Hospital Cove residential areas near the Great Lakes Naval Training Center. Services provided in accordance with NESHAP regulations and performed prior to renovation efforts. Additional services included oversight of removal of soils in the vicinity shown to be contaminated with lead from lead-based paint, and assessment of one residential unit for presence of mold. Responsible for reviewing reports and letter reports for asbestos removal and lead-based paint testing.

Unity Junior High School Site Brownfield Redevelopment, Cook County Regional Office of Education, Mattson Associates, Inc., Cicero, Illinois. 08/2000-12/2002. Project Manager.

Environmental investigations, site assessments, soil remediation and building demolition services on accelerated basis at site of former industrial facility in operation for over a century. Site was contaminated with PNAs, PAHs, PCBs, metals and chlorinated solvents. More than 65,000 CY of contaminated soil removed. Site was divided into seven zones based on construction schedule so that remediation and closure of each zone could be performed separately to meet construction needs. Amec Foster Wheeler performed as subcontractor to prime consultant. Site was 2003 Phoenix Award - Community Impact Winner. Responsible for preparing all SRP program documentation and risk assessment.

Industrial Property Due Diligence Services, Keating Resources / Port of Will County, LLC (IL), Joliet, Illinois. 11/2006-12/2007. Principal.

Due diligence services for possible purchase of approximately 300 acres of industrial and commercial property near Illinois River for possible development of new intermodal shipping hub. Services included conducting research, attending and advising during meetings, and providing other information / technical support with regard to historic and environmental remediation activities, ongoing water permitting activities, and issues of mining operations. Responsible for reviewing Phase I and II reports and radiation reports written by another consulting firm; attended meetings with client, purchaser and purchaser's consultant to discuss report findings.

Mine and Processing Facility Planning and NPDES Permitting, Port of Will County, LLC / Keating Resources, Joliet, Illinois. 08/2003-12/2008. Principal.

Planning and NPDES permit application as part of redevelopment of former chemical facility into new underground mine and processing facility on 117-acre site. Responsible for conducting peer review and managing project tasks.

Manufacturing Facility Groundwater Remediation and Monitoring, Avaya, Inc., Montgomery, Illinois. 11/2003-04/2016. Project Manager.

Environmental services for comprehensive site investigation, risk assessment, and remedial design and

Continued.

implementation efforts associated with decommissioning a 45-acre, former printed circuit board manufacturing facility where decrease of 37% to 99% in total chlorinated-VOC concentrations in groundwater have been documented onsite. Responsible for review of ground monitoring reports, corrective action plans; consulting on hydrogeology and design of dye study.

Village of Wheeling Friendship Park Design-Build Contractor, Construction Management, UST Removal, Wheeling, Illinois. 01/2002-12/2002. Environmental Manager. Served as Prime Contractor for design-build of a municipal park with waterfall feature, lighting, pedestrian walkways and benches and green space, serving as a centerpiece for municipal beautification. Responsible for design, general contractor duties, full-time construction management and environmental services that included removal of 6 previously unidentified Underground Storage Tanks (USTs) and backfilling the site. Responsible for completing closure documents for UST.

Joliet Road Bridge Replacement, Illinois Department of Transportation, Chicago, Illinois. 01/2002-03/2005. Geologist. Transportation engineering and design of plans, specifications and estimates (PS&E) for roadway improvements and 6-span-wide flange steel-beam bridge replacement over the B&O and IHB railroad tracks; involved bridge deck and approach slabs (250' on each side of bridge), profile adjustment, drainage design and lighting design. Responsible for reviewing analytical data.

Lake Michigan Offshore Drilling Geotechnical and Geophysical Services, Raimonde Drilling Corporation, Oak Creek (nearest city), Wisconsin. 04/2004-06/2004. Project Manager. Performed geophysical, geological and hydrographic onshore / offshore subsurface investigation along proposed two-mile water intake tunnel alignment for power generating plant. Offshore investigation involved drilling from barge platform two miles offshore on Lake Michigan. Drilling included 13 boreholes, each up to 250 feet in depth, and geophysical log for each borehole. Performed soil and rock core logging, marine geophysical surveying and downhole geophysical logging. Prepared and submitted to client major report deliverable of all field activities and logging observations. Responsible for overall quality assurance and data acquisition and review, ensuring technical competence and expertise for geologic staff implementing requested services, and overall day-to-day project oversight and management.

Remediation Services Retail Distribution Facility, Confidential Client, Corpus Christi, Texas. 06/2003-12/2007. Principal Geologist. Environmental investigation of two-acre site at retail warehouse / office location impacted by petroleum from leaking underground storage tanks (LUSTs). Ongoing investigation includes soil / groundwater monitoring and plume delineation, and close interaction with TCEQ. Responsible for Principal review of documents and for providing guidance on scope of work for the investigations.

CA Remediation Retail Distribution Facility, Confidential Client, Santa Monica California. 01/2010-11/2010. Principal. Removal of 9 hydraulic lift systems and remediation of impacted soils associated with lift systems and former USTs on one-acre site with one 10,000 square foot building. Responsible for assisting with technical issues regarding remediation and types of analysis required and technical review of documents .

Continued.

CA Lift Removal Retail Distribution Facility, Confidential Client, Visalia, California. 06/2010-09/2010. Principal. Removal and remediation of one underground hydraulic lift system on one acre site for a 10,000 building. Responsible for technical review of documents and assistance with technical issues with regard to analytical issues and site closure.

District of Columbia Site Soil and Groundwater Investigation, Remediation Services, Confidential Client, Washington, District of Columbia. 2004-2011. Principal. Site investigations and corrective actions to address two releases of petroleum on vacant lot formerly occupied by retailer vehicle service center. Conducted comprehensive site assessment (including soil borings and well installations), removal of two 1,000-gallon storage tanks, geophysical surveys and excavation of test pits to conduct subsurface investigation. Approximately 2,000 tons of contaminated soil removed from one site, 5,000 tons from the other. Responsible for reviewing corrective action plan, cost estimates and sampling results.

Environmental Services, Nationwide Service Facilities, Sears Holdings Management Corporation, Nationwide, US. 1995-2012. Project Manager. Environmental services at Sears and Kmart retail stores and facilities throughout the U.S. Master Services Agreement (MSA). Services provided for stores and facilities in California, Florida, Hawaii, Illinois, Missouri, North Carolina and Texas, and included environmental assessments, risk assessments (Tier I), remedial action planning, underground storage tank (UST) assessment and removal, groundwater monitoring, site closure, regulatory compliance (including submittal for CSX rail access at one warehouse location), and removal of automobile lift systems at three auto center locations. Responsible for overseeing implementation of agreement's scope of services and interfacing with client.

Orlando Distribution Center Environmental Services, Confidential Client, Orlando, Florida. 10/2001-11/2012. Principal Geologist. Long-term environmental investigation and delineation at major retailer's former distribution center, including fleet vehicle maintenance and repair shop, in urban location. Services consisted of groundwater monitoring, soil sampling and remedial action, which included excavation source removal, dewatering, and phased chemical oxidation groundwater treatments utilizing various application techniques. Responsible for Principal review of documents and providing guidance on investigation scope of work.

Howard Park Soil Remediation Services, Confidential Client, Wilmette, Illinois. 10/2001-04/2005. Principal. Under IEPA Leaking Underground Storage Tank (LUST) program at site impacted by gasoline UST owned by local municipality, removed USTs, prepared all IEPA LUST submittals, performed Site Classification and delineation, and prepared IEPA-approved LUST Corrective Action Plan. Designed, installed and operated air sparge / soil vapor extraction (AS/SVE) remediation system. Treatment area encompassed sections of police parking lot and active park downgradient from source area. After anticipated remediation period was completed, collected confirmatory soil samples to show site was remediated. Prepared Corrective Action Completion Report requesting pathway exclusion under IEPA Tiered Approach to Corrective Action Objectives (TACO) and No Further Remediation (NFR) determination from IEPA. Responsible for reviewing all technical reports and provided risk assessment (IEPA TACO).

RCRA Closure of former Oil Storage Area, Confidential Client, Indiana. Project Manager. Additional investigation of former oil storage area found to be

Continued.

contaminated with chlorinated solvents. Remedial Action Plan has been accepted by IDEM and the design of soil vapor extraction system has been completed. Construction of the remedial system was completed.

Site Remediation Program Closure of Two Sites, Chicago Public Schools, Chicago, Illinois. Technical Lead. Reviewed previous consultant documents, and entered the sites into the SRP program. At New Sullivan School, the site was entered into the SRP in June 2000. A previous Phase I and Phase II had been completed at the property which was an entire city block in extent. No additional sampling was determined to be necessary after consultation with the IEPA in the context of developing the Remedial Objectives Report/ Remedial Action Plan for the property. Removal of soil, (the soil removal was necessary for construction), and backfill with clean soil were the planned remedial activities. These activities were completed and documented the site was given a "No Further Remediation" letter in November 2000. At the Moos School site, entry into the SRP was only accomplished in January 2001 as the Chicago Public Schools did not acquire the property until December 2000. A previous Phase I and Phase II had been completed at the property. Additional sampling was completed in 2000 and in February 2001. The site was remediated and a No Further Remediation letter obtained in October 2001. Amec Foster Wheeler completed closure under the SRP program for three other Chicago Public School sites.

Remediation of former Gas Station, Confidential Client, Confidential Location. Task Manager. Responsible for coordination of field activities and confirmation sampling for large gas station remediation project. Over 8,000 cubic yards of soil were removed for clean closure. Also responsible for investigation and closure of offsite contamination and groundwater issues. Prepared closure documentation and LUST reimbursement package.

Environmental Site Assessments, Confidential Client, Confidential City Location Illinois. 08/1997-12/2000. Principal Review. Preliminary environmental site assessment (PESA) and subsequent Phase II environmental site assessment on property adjacent to confidential manufacturing client interested in purchasing the property to expand operations. After finding subsurface impacts in groundwater on client's property, delineated the extent of onsite impacts by completing 96 sample points in 4 days, using soil probe and onsite mobile laboratory. Responsible for reviewing reports for issues and regulations.

Chicago District, Environmental Services at FUDS, U.S. Army Corps of Engineers, Chicago, Illinois. Task Manager. Responsible for task order management of multiple environmental investigations and sampling activity at Chicago area sites. Prepared work plans for field investigation, performed data interpretation and prepared project reports. The eleven projects-to-date have included: Brownfields, UST classification, geophysical investigation, groundwater sampling, well installation, sump investigation and sampling, soil sampling and sediment sampling. Two of the projects involved multiple sampling rounds. The most recent project involved the decommissioning of a former FDA laboratory contaminated with asbestos, mercury, dioxin and perchlorate. The project was completed within a very tight timeframe despite additions to the scope.

Warehouse Parcel, Confidential Client, Chicago, Illinois. Project Manager. Completed a SRP Site Characterization and Remedial Objectives report for this Brownfields site which is to be re-developed. IEPA SRP accepted the Site

Continued.

Characterization and the Remedial Objectives report. Free product at the site has been removed and confirmation sampling was completed. Final NFR letter received in August 2001. Client has requested assistance with an adjacent parcel which was entered into the SRP in June 2001. Remediation of this site has been performed and confirmation sampling completed. A completion report was submitted to the IEPA and a NFR letter was received.

TACO Evaluation, North and Cicero Site, Chicago Transit Authority (CTA), Chicago, Illinois. Task Manager. Primary author of TACO Tier 2 and Tier 3 evaluation prepared as a supplement to previous site risk assessment. IEPA has reviewed and accepted the evaluation and provided closure documentation for this former Brownfields site.

Summary Report and TACO Evaluation, 74th and Wood, Chicago Transit Authority (CTA), Chicago, Illinois. Task Manager. Primary author of summary report and TACO evaluation for this site which was remediated to allow construction to proceed in 1992 and 1993. Current evaluation was for a potential sale and lease-back

RCRA Facility Investigation Pharmaceutical Manufacturer Plant, Confidential Pharmaceutical Manufacturer, Illinois. Task Manager. Task manager and primary author for Phase II RFI report for this large, integrated manufacturing plant with six SWMUs remaining in the Corrective Action process. Performed TACO evaluation resulting in proposed closure of all six SWMUs with little or no Corrective Action. Closure documentation was approved by the IEPA.

RCRA Facility Investigation Solvent Distribution Facility, Confidential Solvent Distributor, Illinois. Project Geologist. Conducted RFI investigation at chlorinated solvent distribution facility. RFI activities consist of the installation of 12 soil borings, soil and groundwater sampling. The purpose of the investigation was to complete the horizontal and vertical delineation of soils impacted with chlorinated solvents resulting from operations at the facility's three SWMUs.



PHASE II ENVIRONMENTAL SITE ASSESSMENT

4301 W. Chicago Avenue

Chicago, Illinois

Property Index Number: 16-10-200-061-0000

Prepared for:

City of Chicago Department of Fleet and Facility Management

30 North LaSalle, Suite 300

Chicago, Illinois 60602-2575

Prepared by:

Amec Foster Wheeler Environment & Infrastructure, Inc.

8745 West Higgins Road, Suite 300

Chicago, Illinois 60631

January 12, 2018

Project No. 3205171606



amec
foster
wheeler

January 12, 2018

Ms. Abby Mazza, P.E.
City of Chicago Department of Fleet and Facility Management
30 North LaSalle Street, Suite 300
Chicago, Illinois 60602-2575

Subject: Phase II Environmental Site Assessment
4301 West Chicago Avenue
Chicago, Illinois
Project No. 3205171606

Dear Ms. Mazza:

Amec Foster Wheeler Environment & Infrastructure, Inc., is pleased to present this Phase II Environmental Site Assessment report for the above-referenced site in Chicago, Illinois. We appreciate the opportunity to serve you on this project. If you have any questions or desire further information, please feel free to contact us at 773-693-6030.

Sincerely,

Amec Foster Wheeler Environment & Infrastructure, Inc.

Mary E. Jank, PG
Sr. Associate

Eric J. Walkowiak, PE
Senior Engineer

Attachments



TABLE OF CONTENTS

	Page
EXECUTIVE SUMMARY.....	IV
1.0 INTRODUCTION.....	1
1.1 Property Location.....	1
1.2 Property Description	1
1.3 Recognized Environmental Conditions.....	2
1.4 Documents Reviewed.....	3
1.5 Work Completed.....	3
1.6 Limitations and Exceptions.....	3
1.7 Report Organization.....	4
2.0 SITE CHARACTERIZATION.....	6
2.1 Physical Setting	6
2.1.1 Site Topography.....	6
2.1.2 Geology/Hydrogeology	6
2.1.3 Groundwater Classification.....	8
2.1.4 Surface Water Bodies.....	10
2.1.5 Wetlands.....	10
2.1.6 Flood Maps	10
2.2 Site History	10
2.2.1 Previous Assessments and Investigations.....	10
3.0 SITE INVESTIGATION.....	12
3.1 Site-specific Sampling Plan	12
3.1.1 Soil Borings.....	12
3.1.2 Temporary Monitoring Wells.....	13
3.1.3 Soil Samples.....	13
3.1.4 Groundwater Samples	13
3.1.5 Ground Penetrating Radar Survey.....	14
4.0 ANALYTICAL RESULTS	15
4.1 Soil Results.....	16
4.2 Groundwater Results	19
4.3 GPR Survey Results.....	20
5.0 ENDANGERMENT ASSESSMENT	21
5.1 Nature and Extent of Contamination.....	21
5.2 Contaminant Fate and Transport.....	23
5.2.1 Inorganic Compounds (Arsenic, Antimony and Chromium).....	23
5.2.2 Polynuclear Aromatic Hydrocarbons.....	24
5.3 Exposure Route Evaluation	25

	5.3.1	Receptors.....	25
	5.3.2	Exposure Pathways	25
6.0		REMEDATION OBJECTIVES	28
	6.1	Tier 1 Industrial/Commercial Comparison	28
	6.2	Construction Worker Comparison.....	29
	6.3	Averaging of Shallow PNA and Arsenic Impacted Soil Concentrations.....	29
	6.4	Exclusion of the Groundwater Ingestion Pathway	30
7.0		SUMMARY AND CONCLUSIONS	34
	7.1	Site History	34
	7.2	Property Description	34
	7.3	Recognized Environmental Conditions.....	34
	7.4	Investigation and Results.....	35
	7.5	Remediation Objectives.....	36
	7.6	Construction Considerations.....	37
	7.7	Conclusions	38

TABLES

Table 1	Groundwater Level Data Summary (August 2017)
Table 2	Summary of Warzyn Soil Analytical Results
Table 3	Summary of Carlson Soil Analytical Results
Table 4	Planned Soil Borings and Sampling
Table 5	Summary of Phase II Site Investigation Soil Analytical Results
Table 6	Summary of Phase II Site Investigation Groundwater Analytical Results
Table 7	Summary of Results Exceeding Tier 1 Objectives

FIGURES

Figure 1	Property Location Map
Figure 2	Map Showing RECs
Figure 3	Map Showing Planned Land Development & Boring Locations
Figure 4	Shallow Groundwater Contour
Figure 5	Deep Groundwater Contour
Figure 6	Soil Ingestion Pathway Exceedances
Figure 7	Soil Component of Groundwater Ingestion Pathway Exceedances
Figure 8	Construction Worker Inhalation Exceedances
Figure 9	Areas for Barrier or Removal

APPENDICES

Appendix A	Boring Logs
Appendix B	Monitoring Well Construction Diagrams
Appendix C	Analytical Data
Appendix D	Field Logs
Appendix E	Averaging Input and Results
Appendix F	R-26 Calculations
Appendix G	Soil Exploration and Analysis for Preliminary Site Development (Geotechnical Report)

EXECUTIVE SUMMARY

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), was retained by the City of Chicago Department of Fleet and Facility Management (2FM) to complete a Phase II Environmental Site Assessment (ESA) for the site located at 4301 West Chicago Avenue in Chicago, Cook County, Illinois (the site). The site is a 30.4-acre parcel that is currently vacant. Development of the site as a Joint Public Safety Training Academy (JPSTA) is planned. The JPSTA campus will provide the Chicago Police Department (CPD) and the Chicago Fire Department (CFD) with a central location, replacing training facilities located throughout the City.

Site History

The site was developed as a rail yard by 1900 according to historic topographic maps. Previous environmental reports for the site indicate that the rail yard was constructed in 1896 by the Chicago and Northwestern Transportation Company on previously undeveloped land. By 1978-1980, most of the rail yard tracks were gone, and by at most 2002, the parcel was totally vacant.

Property Description

The site consists of 30.4 acres located on the southeast corner of the intersection of Kilbourn and West Chicago Avenue. The Parcel ID (Tax ID) number for the site is 16-10-200-061-0000. The site is located in a mixed land use area. At the time of the site reconnaissance, the site was vacant. The site is partially fenced and no buildings or other improvements are present on the site.

The site is situated at an elevation of approximately 610 feet above mean sea level (msl). Based on our review of the local topography, it appears that groundwater would generally flow toward the east to Lake Michigan.

Adjacent to the east is N. Kostner Avenue, beyond which is Falcon Transportation to the north and Chicago Transit Authority (CTA) to the south, to the north is W Chicago Avenue with commercial buildings lining the street and residences behind them, to the west is N. Kilbourn Avenue, beyond which is a City of Chicago Transfer Station, and to the south is a remaining railroad spur and some industrial and warehouse properties.

Recognized Environmental Conditions

Amec Foster Wheeler performed a Phase I ESA as outlined in ASTM E 1527-13 in June 2017. Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition of the property is expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase were updated in November 2017 and a final Phase I report was issued on December 11, 2017. The following recognized environmental conditions (REC) were determined to be associated with the property:

- On the property, a potential underground storage tank (UST) installed in 1959 with no record of it having been removed, its use as a former rail yard and the fill materials present on the site, various debris piles and rail ties present on the site and contaminants identified during previous investigations at the property.

- CTA at 4401 West Chicago Avenue, due to USTs installed in 1992, and because it is a former rail yard and may have fill similar to the site.
- Rail IT Property, 733 North Kilbourn Avenue, due to an UST that was not closed. It is unclear if this is the site or adjacent, as Rail IT at one time owned the site and the street number identified in the EDR report could potentially put it near the southeast corner of Chicago and Kilbourn Avenues, which would be the site.
- Department of Streets and Sanitation, 750 North Kilbourn Avenue, adjacent across North Kilbourn Avenue, due to USTs removed but not closed and since it is a transfer station and incinerator which may have resulted in airborne particulates reaching the site.
- City of Chicago, 715 North Kilbourn Avenue, due to an UST that was not closed. The initial incident report for #940242 lists 715 N. Kilbourn Avenue and then subsequent documentation on the Illinois EPA website for this incident changed to 750 N. Kilbourn Avenue. Amec Foster Wheeler believes the address was mis-identified in the original report and subsequently corrected. Although an incident was reported, a subsequent Illinois EPA letter indicates the site is a non-LUST site, which could indicate there was no confirmed release, or that the incident was from a non-regulated tank.

Investigation and Results

A previous investigation by Warzyn in 1991 consisted of the installation of ten (10) soil borings and three (3) temporary wells in three (3) of the borings. Twenty (20) soil samples were collected and analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) and total cyanides. Comparison of Warzyn results to Tiered Approach to Corrective Action Objectives (TACO, 35 IAC 742) Tier 1 current objectives showed that only one sample, SB10-4, taken at 8.5 to 10.5 feet below ground surface, had a concentration which exceeded the soil remediation objectives (SROs) to which it was compared. Arsenic was detected at 13.8 mg/kg, and its soil ingestion objective (which is the same as its background concentration) is 13 mg/kg.

A 2007 Phase II by Carlson included nineteen (19) soil borings. Twenty-four soil samples were analyzed. Analyses included VOCs, semivolatile organic compounds (SVOCs), priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc), pH, pesticides, polychlorinated biphenyls (PBCs) and chlorinated herbicides. Comparison of Carlson results to TACO Tier 1 current objectives showed that eight (8) samples, taken at seven (7) locations had concentrations which exceeded the SROs to which the samples were compared. Five (5) samples had PNA concentrations above their objectives, and three samples had inorganic concentrations (arsenic, antimony and chromium) above SROs.

This Phase II ESA consisted of the installation of twenty-four (24) soil borings, collection of twenty-six (26) soil samples for analytical testing, the installation and sampling of two (2) temporary monitoring wells, sampling of two (2) existing monitoring wells, level survey of some existing and the newly installed wells, and a limited ground penetrating radar survey. Soil samples were generally analyzed for PNAs and Priority Pollutant metals, with select samples analyzed for the Target Compound List (TCL) from the Site Remediation Program (35 IAC 740 Appendix A) and herbicides.

Groundwater samples were analyzed variously for the TCL, PNAs, metals and VOCs. three soil samples had concentrations of PNAs which exceeded objectives and four soil samples had arsenic concentrations above its soil ingestion objective.

Remediation Objectives

Based on comparison of the results of all of these investigations to TACO Tier 1 objectives for industrial/commercial sites with Class II groundwater, soils at the site have been identified as impacted by benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic at concentrations above their soil ingestion objectives. Three chemicals at three locations exceeded their soil component of groundwater ingestion objectives: benzo(a)anthracene, antimony and chromium.

TACO allows for the averaging of results with the approval of the planned or completed sampling by Illinois EPA. Based on the Illinois EPA's approach to other sites in the Site Remediation Program (SRP), concentrations of PNAs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene) and arsenic in shallow (above 3 feet in depth) soil were averaged to represent current exposure which would be only to shallow soils. All concentrations of the listed PNAs and arsenic in soils were averaged to represent future exposures, which could be to any of the soils at the site from any depth or location. PNA and arsenic concentration were averaged in accordance with Section 742.225 of TACO to demonstrate that they would be in compliance with objectives.

Results were averaged using ProUCL Version 5.1.02. Within the PNAs' current (shallow soils) data set, one sample (GP3A at 0 to 2 feet) had elevated concentrations of PNAs and will need to be remediated or have an engineered barrier, consistent with Illinois EPA SRP requirements, to prevent access. With this concentration removed, the averages for current users for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic are below their objectives.

Within the PNAs' future (all soils) data set, two samples (GP3A at 0 to 2 feet and GP-7D at 6 to 8 feet) had elevated concentrations of PNAs and will need to be remediated or have an engineered barrier, consistent with Illinois EPA SRP requirements, to prevent access. With these concentrations removed, the averages for future site use for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic are below their objectives.

The soil component of groundwater ingestion pathway can be addressed by exclusion of the groundwater pathway in accordance with 35 IAC 742.320. The City of Chicago has an ordinance which prohibits the installation of or use of potable water wells. The TACO calculations indicate that at the concentrations detected, groundwater at 10 to 1000 feet beyond any of the concentrations exceeding TACO Tier 1 Class II groundwater ingestion objectives would have no concentrations exceeding the applicable TACO Tier 1 objectives for sites with Class II groundwater. Site conditions and concentrations of chemicals of concern which exceeded the soil component of groundwater ingestion pathway were determined to be appropriate for pathway exclusion. The evaluation showed that the pathway could be excluded.

No chemicals were of concern (above objectives) for the construction worker ingestion and inhalation routes, except possibly mercury. The site was a rail yard previously, and elemental mercury is not known to be associated with rail yards. However, given the widespread detection of mercury and

the significant concentration of mercury in one 2007 Carlson investigation sample (GP-17A, 0 to 2 feet below ground surface) of 7.5 mg/kg, Amec Foster Wheeler recommends a construction worker warning for mercury be placed on the site.

Construction Considerations

During design and construction of the JPTSA, it is recommended that the following be taken into consideration:

- Future site buildings should be constructed with a full concrete slab-on-grade foundation or with a full concrete basement floor and walls. Future site buildings should not be constructed with earthen crawl spaces, earthen floors, stone foundations, partial concrete floors, or sumps.
- Unless additional testing is performed to determine compliance with Illinois EPA's Clean Construction and Demolition Debris (CCDD) regulations, all soil being removed from the site must be disposed of in accordance with applicable regulations to a Subtitle D landfill.
- Areas depicted on Figure 9 must be covered with an Illinois EPA TACO-compliant engineered barrier such as asphalt, concrete, 3 ft of clean fill, or other Illinois EPA-approved barrier.
- Imported fill material must be certified virgin stone or other soil or earthen material, which has been tested for Target Compound List parameters (35 IAC 740 Appendix A) and found to meet the most stringent objectives for residential land use included in Appendix B of TACO.
- Construction workers who will encounter site soils should be informed of the mercury detections at the site so that they may take appropriate precautions as determined by their evaluation of the data.
- Although a GPR survey for underground tanks, utilities and foundations was performed in a limited area of the site, this does not guarantee that such underground tanks, utilities and foundations are not present in these areas, or other areas where such survey was not completed.
- A Soil Management Plan should be prepared and implemented during construction to document, at a minimum: the site specific soil excavation, disposal, storage and reuse procedures, imported material testing requirements, and environmental oversight requirements.

Conclusions

A Phase II Environmental Site Assessment has been completed for the property at 4301 W Chicago Avenue in Chicago, Illinois. This investigation and previous sampling indicated that soils at the site have been impacted by benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic at concentrations above their soil ingestion objectives. Three chemicals at three locations exceeded their soil component of groundwater ingestion objectives: benzo(a)anthracene, antimony and chromium. Mercury was detected above construction worker inhalation objectives at the site. The construction worker inhalation objective is only valid if elemental mercury is a contaminant of concern. A high (7.5 mg/kg) concentration of mercury in one sample (GP-17A, 0 to 2 feet) and widespread detections of mercury above the construction worker objective, combined with limited site history has resulted in the determination that a construction worker caution should be required for the site.

4301 West Chicago Ave, Chicago, Illinois
Phase II Environmental Site Assessment

Averaging of soils above soil ingestion objectives, as allowed in TACO, has resulted in a determination that two locations should be remediated or barriered to prevent exposure. The use of the City of Chicago groundwater ordinance has allowed for exclusion of the groundwater pathway. A construction worker caution for exposure to mercury by the inhalation pathway is recommended for the site.



PHASE II ENVIRONMENTAL SITE ASSESSMENT

4301 West Chicago Avenue
Chicago, Illinois

1.0 INTRODUCTION

Amec Foster Wheeler Environment & Infrastructure, Inc. (Amec Foster Wheeler), was retained by the City of Chicago Department of Fleet and Facility Management (2FM) to conduct a Phase II Environmental Site Assessment (ESA) for the site located at 4301 West Chicago Avenue in Chicago, Cook County, Illinois (the site). Development of the site as a Joint Public Safety Training Academy (JPSTA) is planned. The JPSTA campus will provide the Chicago Police Department (CPD) and the Chicago Fire Department (CFD) with a central location, replacing training facilities located throughout the City.

Although the site has not been enrolled in the Illinois EPA's Site Remediation Program, this Phase II ESA was conducted in accordance with all applicable subsections of Illinois Environmental Protection Agency, Title 35: Environmental Protection, Subtitle G: Waste Disposal, Chapter I: Pollution Control Board, Parts 740 (Site Remediation Program) and 742 (Tiered Approach to Corrective Action Objectives). This Phase II also identifies remedial actions that would be necessary to obtain an industrial/commercial comprehensive No Further Remediation Letter for the site.

1.1 PROPERTY LOCATION

The current site address is 4301 West Chicago Avenue, Chicago, Illinois. The site is located in Chicago, Cook County, Illinois. The site location is shown on Figure 1. The site is located in Township 39N, Range 13E, Section 10 at latitude 41° 53' 38" North and longitude -87° 44' 10" West. The property is currently vacant and is located in a mixed-use area.

1.2 PROPERTY DESCRIPTION

The site consists of 30.4 acres located on the southeast corner of the intersection of Kilbourn and West Chicago Avenue. The Property Index Number (PIN) for the site is 16-10-200-061-0000. The site is located in a mixed land use area. At the time of the site reconnaissance, the site was vacant. The site is partially fenced and no buildings or other improvements are present on the site.

The site is situated at an elevation of approximately 610 feet above mean sea level (msl). Based on our review of the local topography, it appears that groundwater would generally flow toward the east to Lake Michigan.

Adjacent to the east is N. Kostner Avenue, beyond which is Falcon Transportation to the north and Chicago Transit Authority (CTA) to the south, to the north is W Chicago Avenue with commercial buildings lining the street and residences behind them, to the west is N. Kilbourn Avenue, beyond which is a City of Chicago Transfer Station, and to the south is a remaining railroad spur and some industrial and warehouse properties.

1.3 RECOGNIZED ENVIRONMENTAL CONDITIONS

Amec Foster Wheeler performed a Phase I ESA as outlined in ASTM E 1527-13 in June 2017. Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition of the property is expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase were updated in November 2017 and a final Phase I report was issued on December 11, 2017. The following recognized environmental conditions (REC) (see Figure 2 for locations) were determined to be associated with the property:

- On the property, a potential underground storage tank (UST) installed in 1959 with no record of it having been removed, its use as a former rail yard and the fill materials present on the site, various debris piles and rail ties present on the site and contaminants identified during previous investigations at the property.
- CTA at 4401 West Chicago Avenue, due to USTs installed in 1992, and because it is a former rail yard and may have fill similar to the site.
- Rail IT Property, 733 North Kilbourn Avenue, due to an UST that was not closed. It is unclear if this is the site or adjacent, as Rail IT at one time owned the site and the street number identified in the EDR report could potentially put it near the southeast corner of Chicago and Kilbourn Avenues, which would be the site.
- Department of Streets and Sanitation, 750 North Kilbourn Avenue, adjacent across North Kilbourn Avenue, due to USTs removed but not closed and since it is a transfer station and incinerator which may have resulted in airborne particulates reaching the site.
- City of Chicago, 715 North Kilbourn Avenue, due to an UST that was not closed. The initial incident report for #940242 lists 715 N. Kilbourn Avenue and then subsequent documentation on the Illinois EPA website for this incident changed to 750 N. Kilbourn Avenue. Amec Foster Wheeler believes the address was mis-identified in the original report and subsequently corrected. Although an incident was reported, a subsequent Illinois EPA letter indicates the

site is a non-LUST site, which could indicate there was no confirmed release, or that the incident was from a non-regulated tank.

1.4 DOCUMENTS REVIEWED

The following reports were provided for Amec Foster Wheeler review:

- Phase II ESA, prepared by Warzyn Inc., dated August 1991 – this was a separate report, but was also in Appendix A of the Carlson Phase I ESA
- Preliminary Report of Soils Exploration, prepared by Testing Service Corporation, April 29, 1998 - this was in Appendix A to the Carlson Phase I
- Phase I ESA, prepared by Carlson Environmental, dated May 11, 1998
- Limited Phase II, prepared by Carlson Environmental, dated October 17, 2007
- Property Screen Summary Report, prepared by 2FM, dated April 10, 2017

1.5 WORK COMPLETED

This Phase II ESA consisted of the installation of twenty-four (24) soil borings, collection of twenty-six (26) soil samples for analytical testing, the installation and sampling of two (2) temporary monitoring wells, sampling of two (2) existing monitoring wells, level survey of some existing and the newly installed wells, and a limited ground penetrating radar survey. See Figure 3 for boring and well locations.

1.6 LIMITATIONS AND EXCEPTIONS

This report was prepared by Amec Foster Wheeler exclusively for the City of Chicago Department of Fleet and Facility Management. The quality of information, conclusions, and opinions contained herein is consistent with the level of effort involved in Amec Foster Wheeler services and based on: (1) information available at the time of preparation, (2) data supplied by outside sources, and (3) the assumptions, conditions, and qualifications set forth in this report.

This Phase II Environmental Site Assessment is intended to be used by the City of Chicago Department of Fleet and Facility Management for the 4301 West Chicago Avenue, Chicago, Illinois site only, subject to the terms and conditions of its contract with Amec Foster Wheeler. Any other use of, or reliance on, this report by any third party is at that party's sole risk.

Environmental impairment of a property may result from many activities, such as illegal or unreported dumping, or the spilling of hazardous wastes or materials. The presence of contaminants at a

particular property may not always be apparent, and the completion of a Phase II ESA cannot provide a guarantee that hazardous wastes or materials not discovered during this investigation do not exist. The scope of services executed for this project does not include an audit for regulatory compliance, ecological resources, endangered species, cultural and historic resources, indoor air quality, industrial hygiene, health and safety, or high-voltage power lines. It also does not include a detailed condition survey for asbestos, lead, radon, lead in drinking water, or other potential hazards or for wetlands, naturally occurring materials, or other items not outlined in Amec Foster Wheeler's scope of services.

The findings contained herein are relevant to the dates of Amec Foster Wheeler's investigation and should not be relied upon to represent conditions at later dates. If additional information becomes available, it should be provided to Amec Foster Wheeler so the original conclusions and recommendations can be modified as necessary.

1.7 REPORT ORGANIZATION

This document is the Phase II Environmental Site Assessment for 4301 West Chicago Avenue, Chicago, Illinois. A description of the contents of the document is presented below:

- Section 1.0, Introduction: provides background information regarding the purpose of this report; identifies the objectives of the investigation and the technical approach used to meet the objectives; and outlines the contents of this report.
- Section 2.0, Site Characterization: provides relevant background information regarding the site such as the site history, and the geology and physiographic setting of the site.
- Section 3.0, Site Investigation: details site-specific sampling strategies; procedures; chain-of-custody procedures and other information which assured that accurate information was gathered regarding chemical contamination at the site.
- Section 4.0, Analytical Results: presents and discusses the results obtained from the investigation.
- Section 5.0, Endangerment Assessment: details the nature and extent of contamination; presents details on potential contaminant migration pathways and contaminant fate and transport mechanisms; and evaluates exposure routes for completeness.
- Section 6.0, Remediation Objectives: compares the contaminant concentrations with Tier 1 residential criteria, construction worker objectives and soil component of groundwater

ingestion pathway objectives presented in the Tiered Approach to Corrective Action Objectives (TACO) and provides the proposed remediation objectives for the site.

- Section 7.0, Summary and Conclusions: summarizes the information presented in this document and presents conclusions.

2.0 SITE CHARACTERIZATION

The following is a description of the general setting, and previous usage of the site. Information on previous site assessment and investigation is included in this section.

2.1 PHYSICAL SETTING

2.1.1 Site Topography

The 7.5-minute Chicago Loop, Illinois, United States Geological Survey (USGS) quadrangle, published in 2012, was examined. Review of the topographic map indicates that the site is located between 600 and 610 feet above mean sea level (msl). The topography of the area is generally flat with a slight slope to the east. Based on our review of the local topography, it appears that groundwater would generally flow toward the east to Lake Michigan.

The site itself is generally bermed on the north and the southeast and southwest and fairly flat and lower in the central portion.

2.1.2 Geology/Hydrogeology

Site soils consist primarily of the Urbanland soil type, and are comprised of fine sand, sandy loam or clay loam.

The region is located in the central portion of the Central Lowlands Physiographic Province, a broad, relatively low area that roughly outlines the glaciated area and extends from the Appalachian Plateaus on the east to the Great Plains on the west, and from the Superior Upland on the north to the Interior Low Plateaus and the Ozark Plateaus on the south. The local relief in the Central Lowlands seldom exceeds a few hundred feet. The Central Lowland Province is divided into two sections, the Till Plains Section and the Great Lakes Section. The Great Lakes Section, which includes the site, contains surficial features of the youngest part of the Wisconsin Stage glacial drift, and is characterized by its many lakes, and rough surfaced moraines.

Near surface geology in the southeastern Chicago area consists primarily of glacially derived fluvial, lacustrine, and ice-contact sediments. The property is underlain by these glacial deposits which overlie Silurian Dolomite bedrock. The underlying glacial deposits in the area are predominantly the Pleistocene-aged Wadsworth Till Member of the Wedron Formation. Overlying the till in parts of the area is the Carmi Member of the Equality Formation, which is composed primarily of quiet-water, well-bedded silts. In northeastern Illinois, the Wadsworth Till ranges from clay to clayey silt to sandy, clayey silt. All tills of the Wadsworth are characterized by their high clay content and abundance of

black shale fragments. The high clay content produces medium to high plasticity and low hydraulic conductivity in the till unit.

The geologic rock stratigraphic unit underlying the site is a Paleozoic Middle Silurian (Niagoaran) dolomite.

Four regional aquifers are present within the Chicago area. The first two are shallow aquifer systems that provide groundwater for domestic and municipal use. The first of these is the sand and gravel located within glacial deposits. These deposits of sand and gravel may occur as shallow, unconfined surficial aquifers or as confined aquifers buried beneath clay till. Groundwater flow within the clay till is expected to be downward toward underlying aquifers.

The upper 50 feet of bedrock forms the second shallow aquifer system in northeastern Illinois. Prior to glaciation, the bedrock was at or near the ground surface and was subject to chemical and physical weathering processes. As a result, the shallow weathered bedrock is generally more permeable and water-bearing than deeper sections of bedrock. The Silurian Dolomite, which is the upper bedrock in much of northeastern Illinois, has historically been used as a water source for municipalities. However, most municipalities in northeastern Illinois, including Chicago, now obtain water from Lake Michigan.

The Silurian Dolomite is underlain by the Maquoketa Shale which is approximately 170 feet thick and is a regional aquitard. An aquitard may be defined as any saturated geologic formation not capable of yielding useable quantities of groundwater to a well. Sandstone and dolomite formations beneath the Maquoketa Shale form two deep regional aquifer systems capable of yielding large groundwater supplies.

In general, soils throughout the site encountered during this investigation consisted of fill material to varying depths, from 5.5 feet to as deep as 17.5 feet below ground surface (bgs), under which was a stiff gray to brown clay. With greater depth, the clay and silty clay becomes very stiff and then overlies hard, and in some cases very hard grey silty clay to clayey silt.

Groundwater was encountered at 5 feet to 30 feet bgs and the occurrence of groundwater coincided with more permeable sand or gravel in the fill materials or the zone just above the stiff, native glacial clay.

Groundwater levels in newly installed wells and previously installed wells that had been found by Amec Foster Wheeler were measured in August 2017. A level survey, with a benchmark of 100 feet for the previous well identified by Amec Foster Wheeler as Well E, was performed to aid in the

determination of the groundwater flow direction. See Table 1 for depth to groundwater and water level elevations. Two groundwater contour maps were developed: Figure 4 is a map of the shallow groundwater elevations (wells set at about 15 to 20 feet in depth) and Figure 5 is a map of deeper groundwater elevations (wells set at about 38 to 51 feet below surface). Note that Well E was excluded from the deep map as its water level was anomalous; it was about 11 feet higher than the next closest deep well. The shallow groundwater contours indicate groundwater flow is to the southeast toward the CTA facility. The deeper groundwater contours indicate that the site is a groundwater high with offsite flow in all directions from the site.

2.1.3 Groundwater Classification

Results of soil borings at the site were evaluated to determine the proper classification of the shallow groundwater at the site. Per 35 IAC Section 620.201, all groundwaters of the State are designated as either:

- Class I: Potable Resource Groundwater;
- Class II: General Resource Groundwater;
- Class III: Special Resource Groundwater; or
- Class IV: Other Groundwater.

As defined in 35 IAC Section 620.230, Class III Special Resource Groundwater is groundwater that is demonstrably unique or vital for a particularly sensitive ecological system. Since the shallow groundwater at the site is not unique or vital to a sensitive ecological system, this classification is not appropriate for the site.

According to 35 IAC Section 620.240, Class IV Other Groundwater refers to groundwater that is within the zone of attenuation of non-hazardous waste landfills, within the point of compliance of a RCRA permitted unit, groundwater designated as exempt pursuant to the UIC regulations (35 IAC 704), groundwater that naturally contains total dissolved solid concentrations in excess of 10,000 mg/L, groundwater with contaminants present no farther than 25 feet from a non-regulated source, and groundwater within a previously mined area or which underlies a coal mine refuse disposal area. Since the groundwater at the site does not satisfy any of these requirements, this groundwater classification is also not appropriate.

Therefore, the groundwater at the site would be classified as either Class I Potable Resource or Class II General Resource Groundwater. Among other requirements, 35 IAC Section 620.210 specifies that Class I groundwater is:

- a) Groundwater located 10 feet or more below the land surface and within:

- 1) The minimum setback zone of a well which serves as a potable water supply and to the bottom of such well.
- 2) Unconsolidated sand, gravel or sand and gravel which is five feet or more in thickness and that contains 12% or less of fines.
- 3) Sandstone which is 10 feet or more in thickness, or fractured carbonate which is 15 feet or more in thickness.
- 4) Any geologic material which is capable of a:
 - A) Sustained groundwater yield, from up to a 12-inch diameter borehole, of 150 gallons per day or more from a thickness of 15 feet or less; or
 - B) Hydraulic conductivity of 1×10^{-4} cm/sec or greater using one of the following test methods or its equivalent:
 - i) Permeameter;
 - ii) Slug test; or
 - iii) Pump test.

Groundwater at the site was encountered at eight (8) feet and deeper below surface, based on Amec Foster Wheeler measurements (see Table 1) and a geotechnical report prepared by Midland Standard Engineering and Testing, Inc. (MSET) (see Appendix G). Near surface soil at the site consists of sandy fill to up to about 17.5 feet below the ground surface. Grain size analysis of this fill material performed by MSET indicates that, below 6 feet in depth (B-7, 6-8 feet) the sand contains 13% fines (exceeding 12% or less). The sample (B-11) at 4 to 6 feet had only 8% fines, but the remaining clay samples (B-9, 21-22.5 feet, 61% fines; and B-15, 14 to 15.5 feet, 89% fines) had greater concentrations of fines. Below the fill is glacial till consisting of silty clay to clayey silt, which becomes stiff and hard with depth.

Soil permeability testing was conducted by MSET on the existing sandy fill and underlying silty clay. The fill was tested for hydraulic conductivity in place at boring location ESB-4. At ESB-4, a falling head permeability test was conducted to determine the soil permeability. At this location, 15.5 feet of well pipe was installed to a depth of 13 feet below the ground surface with 2.5 feet of stick up. The screened interval was at roughly a depth of 2.75 feet to 12.75 feet. Clay at this location started at a depth of 9 feet. The permeability test consisted of filling the well pipe and timing the drop of the water level for several time intervals (falling head test). A total of 4 trials were conducted.

The permeability of the silty clay at boring B-10 from a depth of 11 to 13 feet was determined by performing a laboratory hydraulic conductivity test. A Shelby tube sample was collected and

laboratory permeability testing was conducted per ASTM 5084-90. Geotechnical hydraulic conductivity testing at the site found that the sandy granular fill had a hydraulic conductivity of 8.8×10^{-4} cm/sec (just above the 1×10^{-4} cm/sec required for the Class II groundwater designation by hydraulic conductivity) and the underlying clay till had a hydraulic conductivity of 4.2×10^{-7} cm/sec. Based on the concentration of fines in the fill materials below 6 feet and the hydraulic conductivity of the underlying clay till, the groundwater classification at the site is Class II groundwater.

2.1.4 Surface Water Bodies

Surface water at the site discharges into storm sewers, and thence into the Metropolitan Water Reclamation District of Greater Chicago (MWRDGC) combined sewer system, by overland flow to other properties, or through infiltration, into the site soils. The closest apparent surface water bodies are small ponds in Garfield Park about 1 mile southeast of the site. Lake Michigan is about 6 miles to the east and the DesPlaines River is about 5 miles west of the site.

2.1.5 Wetlands

A detailed wetland evaluation is beyond the scope of this investigation. Areas that may be wetlands or nearby surface water bodies were not observed on the site. The closest wetlands appear to be small areas near the ponds in Garfield Park, about 1 mile southeast of the site.

2.1.6 Flood Maps

The property and surrounding properties are not within 100-year and 500-year flood zones as defined by the Federal Emergency Management Agency (FEMA). The information includes the National Flood Hazard Layer (NFHL) which incorporates Flood Insurance Rate Map (FIRM) data and Q3 data from FEMA in areas not covered by NFHL.

2.2 SITE HISTORY

Before its first development in about 1896, the property was vacant and undeveloped. The site was first developed as a rail yard by 1900 according to historic topographic maps. Previous environmental reports for the site indicate that the rail yard was constructed in 1896 by the Chicago and Northwestern Transportation Company on previously undeveloped land. By 1978-1980, most of the rail yard tracks were gone, and by at most 2002, the parcel was totally vacant.

2.2.1 Previous Assessments and Investigations

A previous investigation by Warzyn in 1991 consisted of the installation of ten (10) soil borings and three (3) temporary wells in three (3) of the borings. Twenty (20) soil samples were collected and analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs),

Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) and total cyanides. Total xylene was detected in two (2) samples from one (1) boring and trichlorofluoromethane was detected in samples from two (2) other borings. PNAs were widespread, but generally below 1 mg/kg concentration, although some locations were higher. Metals were detected but at concentrations considered to be background or naturally occurring. Cyanides were not detected. Groundwater flow in the shallow soils was thought to be to the north, but could not be determined based on the temporary wells. No VOCs were detected and low concentrations of PNAs, metals and cyanide (one sample) were detected in the water samples. See Table 2 for a summary of the Warzyn investigation soil sample results and comparison of these results to the Tiered Approach to Corrective Action Objectives (TACO, 35 IAC 742) Tier 1 objectives for industrial/commercial sites with Class II groundwater.

A 2007 Phase II by Carlson included nineteen (19) soil borings. Twenty-four soil samples were analyzed. Analyses included VOCs, semivolatile organic compounds (SVOCs), priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc), pH, pesticides, polychlorinated biphenyls (PBCs) and chlorinated herbicides. No VOCs were detected at concentrations exceeding the TACO objectives; although VOCs were detected at some locations. PNAs and carbazole were detected at concentrations that exceeded the TACO Tier 1 screening objectives. Antimony, arsenic, chromium, lead and mercury were detected at concentrations above their TACO Tier 1 objectives. PCBs, pesticides and herbicides were not detected in the two (2) samples analyzed for these parameters. The report concluded that concentrations of five (5) PNAs, one (1) SVOC and five (5) metals were present at concentrations exceeding the most stringent TACO Tier 1 residential screening levels. See Table 3 for a summary of the Carlson investigation soil sample results and comparison of these results to the TACO Tier 1 objectives for industrial/commercial sites with Class II groundwater.

3.0 SITE INVESTIGATION

3.1 SITE-SPECIFIC SAMPLING PLAN

Prior to completing this Phase II ESA, Amec Foster Wheeler prepared a site-specific sampling plan consisting of a figure showing planned sampling locations (Figures 2 through 8) and a table (Table 4) showing planned samples and analytical testing to be performed. After revisions and discussion with the 2FM representative, the plan was implemented substantially per the revised planning documents.

3.1.1 Soil Borings

Twenty-four (24) soil borings were installed at the property. Six (6) borings (ESB-1 to ESB-6) were environmental borings drilled to about 16 feet bgs. Eighteen (18) borings (B-1 to B-18) were geotechnical borings which were drilled to depths of 16 feet to 40 feet bgs. Soil samples for environmental testing were obtained from fifteen (15) of the geotechnical borings. No environmental samples were taken from borings B-5, B-8 and B-13.

Drilling was performed by Groff Testing Corporation using a CME 75 ATV to drive 2.25 inch or 4.25-inch hollow stem augers. Soil sampling conducted through the hollow stem augers involved the use of a 1-3/8 inch, 24-inch long split-barrel sampler. The split-barrel sampler was advanced in substantial accordance with American Society for Testing Materials ("ASTM") methods, which involves driving the sampler into the soil with a 140-pound hammer, falling 30-inches. The number of blows required to drive the sampler each 6-inch interval was recorded and used as a qualitative measure of soil density. An Amec Foster Wheeler field person logged soil in general accordance with the Unified Soil Classification System. The boring logs are included in Appendix A.

After the split-barrel sampler was driven 24-inches, the sampler was extracted from the borehole, opened and screened for volatile organic vapors using a photoionization detector (PID). Headspace analysis was conducted on soil samples from each boring. Headspace analysis was completed by first placing a small portion of soil into a zip lock bag which was then sealed. The bagged samples were left undisturbed for a period of not less than ten minutes to allow any organic compounds to come to equilibrium within the bag. The tip of a Minibreak 3000 PID was then inserted into the bag. The PID utilizes a lamp with an ionization potential of 10.6 electron volts. The maximum PID response for each sample in parts per million (ppm) was recorded on the field boring logs in Appendix A.

The split-barrel sampler was decontaminated between each sample using an Alconox wash and clean water rinse. Decontamination water was discharged to the land surface away from boring and well locations. Boreholes were subsequently filled with soil cuttings and/or bentonite chips to complete boring backfilling.

3.1.2 Temporary Monitoring Wells

Two temporary wells were installed at the site in borings ESB-5 and ESB-6. The temporary wells were installed through the 4.25-inch hollow stem augers. Each well was constructed of a 2-inch ID 10-foot long PVC well screen with 0.010-inch continuous slots at an approximate depth of 6 to 16 ft. bgs. A 2-inch inner diameter (I.D.) PVC well casing was used to bring the well to land surface. The annular space surrounding the well screen was backfilled with #5 filter sand to a level approximately 2.0 foot above the well screen. The remaining annular space was backfilled with bentonite chips. Wells were level surveyed with regard to a site-specific datum. Wells were removed immediately after sampling and their boreholes backfilled with soil cuttings or bentonite chips. Temporary well installation diagrams are presented in Appendix B.

3.1.3 Soil Samples

Soil samples for all testing except volatile organic analysis were collected in laboratory-supplied, USEPA-approved eight-ounce glass sample jars. For boring locations requiring volatile organic analysis, samples were collected in laboratory-supplied USEPA-approved 40 milliliter vials with sample collection procedures conforming to SW-846 Method 5035. Prior to each sampling interval and between each boring location, the sampling equipment, were decontaminated by using an Alconox wash followed by a tap water rinse. To reduce the possibility of cross contamination between samples, a new pair of disposable latex gloves was donned by the sampler for each sample collected. Upon collection, the sample jars were labeled with the site name, sample number, date, time, and sampler initials, and were placed in a cooler containing ice. Samples were submitted to STAT Analysis Corporation of Chicago, Illinois, an Illinois EPA-accredited testing laboratory (accreditation number 100445), using proper chain of custody procedures.

3.1.4 Groundwater Samples

The wells were sampled utilizing a peristaltic pump with dedicated tubing. The well was purged prior to sampling using low flow sampling techniques until the water became visually clearer and pH, temperature and specific conductivity had stabilized. Groundwater samples were collected in laboratory-supplied, USEPA-approved, sample containers with the sampler donning a new pair of disposable nitrile gloves. Upon collection, the sample jars were labeled with the site name, sample number, date, time, and sampler initials, and were placed in a cooler containing ice. The samples

were submitted to STAT Analysis Corporation of Chicago, Illinois, an Illinois EPA-accredited testing laboratory (accreditation number 100445), using proper chain of custody procedures.

3.1.5 Ground Penetrating Radar Survey

The objective of the Ground Penetrating Radar Survey was to detect and identify potential buried metallic objects that may represent USTs, piping, buried drums or other similar objects that could be characterized as an REC and adversely affect redevelopment. Specifically, the survey was performed around an area with debris in the northwest of the site that appeared for have formerly been a structure based on the assumption that any previous tanks would have been associated with a structure. On August 7, 2017, Mr. Michael McGarry of Worksmart, Inc. (Worksmart), subcontracted by Amec Foster Wheeler, performed a GPR Survey of approximately 10,000 square feet around the structure debris pile. The area was delineated using a one meter interval grid pattern. This grid pattern should allow for objects consistent with an underground storage tank to be scanned. Multiple scans in a North – South and East – West direction were performed using a trolley-mounted USRADAR SPR unit with a 500 MHz antenna, and a 500 MHz GPR system mounted on an all-terrain rover, providing imaging to an anticipated depth of 8.5 feet.

4.0 ANALYTICAL RESULTS

This Phase II ESA consisted of the installation of twenty-four (24) soil borings, collection of twenty-six (26) soil samples for analytical testing, the installation and sampling of two (2) temporary monitoring wells, sampling of two (2) existing monitoring wells, level survey of some existing and the newly installed wells, and a limited ground penetrating radar survey. Soil samples were generally analyzed for PNAs and Priority Pollutant metals, with select samples analyzed for the Target Compound List (TCL) from the Site Remediation Program (35 IAC 740 Appendix A) and herbicides. Groundwater samples were analyzed variously for the TCL, PNAs, metals and VOCs.

Analytical testing was performed by STAT Analysis Corporation of Chicago, Illinois, an accredited Illinois EPA Environmental Laboratory Program (ELAP) laboratory (IEPA ELAP 100445). All analyses were performed in accordance with the requirements of 35 Illinois Administrative Code (IAC) Part 186 National Environmental Laboratory Accreditation Conference (NELAC) standards.

All analytical results were compared to the current Illinois EPA Tier 1 Tiered Approach to Corrective Action Objectives (TACO) Tier 1 Soil Remediation Objectives (SROs) for Industrial/Commercial sites with Class II groundwater. Soil results were compared to the Illinois TACO Soil Remediation Objectives for Industrial/Commercial land use (35 IAC 742 Appendix B Table A); for Construction Workers (35 IAC 742 Appendix B Table B); and to pH-specific objectives for sites with Class II groundwater (35 IAC 742 Appendix B Tables C and D). Background values as provided in TACO (35 IAC 742, Appendix A Tables G and H) were also used for comparison. If concentrations did not exceed background values, they were not compared to SROs. In some cases, results could not be compared to objectives (metals) but were above background, or were above pH-specific objectives. In these cases, Toxicity Characteristic Leaching Procedure (TCLP) or Synthetic Precipitation Leaching Procedure (SPLP) testing was requested from the laboratory.

Groundwater results were compared to Groundwater Remediation objectives for sites with Class II groundwater (35 IAC 742 Appendix B Table E) and to Groundwater Remediation objectives for the Indoor Inhalation Exposure Route – Diffusion and Advection (35 IAC Appendix B, Table H). Use of the objectives in 35 IAC 742 Appendix B Table H is only allowed if institutional controls are in place which ensure that any existing or potential building has a full concrete slab-on-grade or a full concrete basement floor and walls.

The current analytical results and previous results are summarized and compared to the SROs and GROs in Tables 2, 3, 5 and 6. Those results that exceed the applicable SROs and GROs are discussed in the following sections. The laboratory analytical reports are provided in Appendix C.

4.1 SOIL RESULTS

Warzyn Investigation

Comparison of Warzyn results to TACO Tier 1 current objectives showed that three samples had concentrations which exceeded the SROs to which they were compared. SB10-4, taken at 8.5 to 10.5 feet bgs, had arsenic and mercury above objectives. Arsenic was detected at 13.8 mg/kg, and its soil ingestion objective (which is the same as its background concentration) is 13 mg/kg. In addition, the same sample had mercury at a concentration above its construction worker inhalation objective. The sample concentration was 0.14 mg/kg and the construction worker inhalation objective is 0.1 mg/kg. Mercury was detected above its construction worker inhalation objective in two other samples: SB2-1 at 1 to 3 feet bgs, concentration 0.31 mg/kg (qualified by the laboratory as estimated due to a matrix issue) and SB2-1 at 1 to 3 feet bgs, concentration 0.17 mg/kg. Note that this mercury objective is only valid where elemental mercury is a contaminant of concern.

Carlson Investigation

Comparison of Carlson results to TACO Tier 1 current objectives showed that ten (10) samples, taken at nine (9) locations had concentrations which exceeded the SROs to which the samples were compared. Five (5) samples had PNA concentrations above their objectives, as summarized below.

Sample Number and Depth	Chemical	Concentration mg/kg	Soil Ingestion Objective mg/kg	Soil Component of Class II Groundwater Ingestion Objective mg/kg
GP-3A (0-2.0 ft)	Benzo(a)pyrene	6.3 E	1.3 (ingestion)	
	Benzo(b)fluoranthene	8.7E	8 (ingestion)	
	Dibenzo(a,h)anthracene	1.7	0.8 (ingestion)	
GP-6C (4-6 ft)	Benzo(a)pyrene	3.8	1.3 (ingestion)	
	Dibenzo(a,h)anthracene	0.82	0.8 (ingestion)	
GP-7D (6-8 ft)	Benzo(a)anthracene	12	8 (ingestion)	8
	Benzo(a)pyrene	13	1.3 (ingestion)	
	Benzo(b)fluoranthene	12	8 (ingestion)	
	Dibenzo(a,h)anthracene	1.0	0.8 (ingestion)	
GP-7F	Benzo(a)pyrene	2.3 E	1.3 (ingestion)	

Sample Number and Depth	Chemical	Concentration mg/kg	Soil Ingestion Objective mg/kg	Soil Component of Class II Groundwater Ingestion Objective mg/kg
(10-12 ft)				
GP-11D (1.0-3.0 ft)	Benzo(a)pyrene	3.1	1.3 (ingestion)	

mg/kg: milligrams per kilogram ft – feet below ground surface

E – laboratory qualifier – value above quantitation range

Eight (8) samples had inorganic concentrations above SROs. Arsenic and mercury in sample GP-17A at 0 to 2 feet bgs were detected at concentrations above their objectives. Arsenic was detected at a concentration of 18 mg/kg, above its soil ingestion objective of 13 mg/kg. Mercury was detected at a concentration of 7.5 mg/kg, above its construction worker inhalation objective of 0.1 mg/kg. Note that this mercury objective is only valid where elemental mercury is a contaminant of concern.

Antimony in sample GP-4E at 8 to 10 feet bgs was detected at a concentration of 23 mg/kg, which is above its pH-specific soil component of groundwater ingestion objective for Class II groundwater of 20 mg/kg. Mercury in this same sample was detected at a concentration of 0.16 mg/kg, above its construction worker inhalation objective of 0.1 mg/kg. Leaching procedure testing by the Toxicity Characteristic Leaching Procedure (TCLP) or Synthetic Precipitation Leaching Procedure (SPLP), another method accepted by the Illinois EPA to determine compliance with the soil component of groundwater ingestion objective for Class II groundwater, could not be performed as the sample was taken in 2007 and was no longer within holding times or available for testing.

For five (5) samples, mercury was the only inorganic detected above an objective. Mercury was detected above its construction worker inhalation objective (0.1 mg/kg) in the following samples: GP-6C 4 to 6 feet bgs at a concentration of 0.16 mg/kg, GP-7D 6 to 8 feet bgs at a concentration of 0.76 mg/kg, GP-7F 10 to 12 feet bgs at a concentration of 0.16 mg/kg, GP-13A 0 to 2 feet bgs at a concentration of 0.12 mg/kg and GP-15A 0 to 2 feet bgs at a concentration of 0.28 mg/kg. Note that this mercury objective is only valid where elemental mercury is a contaminant of concern.

Chromium in sample GP-19A, at 0 to 2 feet bgs, was detected at a concentration of 35 mg/kg, which is above its pH-specific soil component of groundwater ingestion objective of 28 mg/kg. The chromium pH-specific objective is for Class I groundwater as there is no chromium pH-specific objective for Class II groundwater and it is an objective for hexavalent chromium, which is not as

abundant naturally in soils as trivalent chromium. Hexavalent chromium is more toxic than trivalent chromium so it would have a lower objective. Leaching procedure testing by TCLP or SPLP could not be performed as the sample was taken in 2007 and was no longer within holding times or available for testing.

Note that had samples still been available from the Carlson sampling, it may have been possible to eliminate both chromium and antimony as chemicals of concern for the soil component of groundwater ingestion pathway by performing leaching procedure, TCLP or SPLP testing, and comparison to the appropriate objectives.

Amec Foster Wheeler Investigation

For this Phase II investigation, three (3) soil samples had concentrations of PNAs which exceeded objectives, as shown below.

Sample Number and Depth	Chemical	Concentration mg/kg	Soil Ingestion Objective mg/kg
ESB-3B (5.5-6.5 ft)	Benzo(a)pyrene	3.0	1.3 (ingestion)
	Dibenzo(a,h)anthracene	0.87	0.8 (ingestion)
ESB-4A (0.5-1.5 ft)	Benzo(a)pyrene	3.2	1.3 (ingestion)
	Dibenzo(a,h)anthracene	0.81	0.8 (ingestion)
B-6A (1-3 ft)	Benzo(a)pyrene	3.9	1.3 (ingestion)
	Dibenzo(a,h)anthracene	1.1	0.8 (ingestion)

mg/kg: milligrams per kilogram ft – feet below ground surface

Four (4) samples had arsenic concentrations above its soil ingestion objective of 13 mg/kg: ESB-6A (2-4 ft bgs) at 18 mg/kg, B-9A (1-3 ft bgs) at 14 mg/kg, B-17A (0-2 ft bgs) at 34 mg/kg and B-18A (0-2 ft bgs) at 20 mg/kg.

Two (2) soil samples had concentrations of chromium which exceeded the pH-specific soil component of groundwater ingestion objective for chromium. At sample location B-6B, 8 to 10 feet bgs, chromium was detected at 29 mg/kg and the pH-specific is 28 mg/kg. At sample location-18A, 0 to 2 feet bgs, the detected concentration was 61 mg/kg and the pH-specific chromium objective for this location is 32 mg/kg. The chromium pH-specific objective is for Class I groundwater as there is no chromium pH-specific objective for Class II groundwater and it is an objective for hexavalent

chromium, which is not as abundant naturally in soils as trivalent chromium. Hexavalent chromium is more toxic than trivalent chromium so it would have a lower objective.

Mercury was detected at nine (9) locations at concentrations which exceeded its construction worker inhalation objective. The following locations had detected concentrations of mercury that exceeded the construction worker inhalation objective (0.1 mg/kg): ESB-4A, 0.5 to 1.5 feet bgs, 0.14 mg/kg; ESB-5A, 0 to 1 feet bgs, 0.15 mg/kg; ESB-6A, 2 to 4 feet bgs, 0.15 mg/kg; B-6B, 8 to 10 feet bgs, 0.24 mg/kg; B-7A, 0 to 2 feet bgs, 0.23 mg/kg; B-9A, 1 to 3 feet bgs, 0.22 mg/kg; B-10A, 0 to 1 feet bgs, 0.20 mg/kg; B-12A, 0 to 2 feet bgs, 0.32 mg/kg and B-18A, 0 to 2 feet bgs, 0.25 mg/kg. This objective is only valid if elemental mercury is a chemical of concern for the site. The site was a former railyard and elemental mercury is not known to have been used at the site.

Some concentrations of chromium, manganese, iron and cobalt were above background, or for two (2) samples for chromium (see above), above the pH-specific objective for the soil component of groundwater ingestion pathway. Leaching procedure testing (TCLP or SPLP) was performed on these samples and the results were below the soil component of ingestion pathway objectives for Class II groundwater. The detected chromium concentration for B-6B, 8 to 10 feet bgs, was <0.0040 mg/L (non-detect) and for B-18A, 0 to 2 feet bgs, the detected chromium concentration was 0.008 mg/L. The chromium objective for the soil component of groundwater ingestion for Class II groundwater is 1.0 mg/L.

See Figure 6 for soil ingestion pathway exceedances, Figure 7 for soil component of groundwater ingestion pathway exceedances and Figure 8 for construction worker inhalation pathway exceedances. See Table 7 for a summary of all results above objectives.

4.2 GROUNDWATER RESULTS

Two temporary wells were installed and sampled. The sample from ESB-5 was analyzed for the entire Target Compound List from the Site Remediation Program (35 IAC 740 Appendix A). The sample from ESB-6 was analyzed for PNAs and metals, as they were the chemicals of concern for previous soil sampling at the site. The sample from ESB-6 was also later sampled for VOCs, using the unpreserved sample from the amber jar used for PNAs and metals. Since the sample was unpreserved, it was also past the sample's holding time.

Due to concerns about volatile compounds at the site, two of the previously installed wells at the site were sampled for volatile organic compounds (VOCs). Well I with a measured depth of 47 feet and Well C with a measured depth of 15 feet were sampled and the samples were analyzed only for VOCs. No VOCs were detected in any of the groundwater samples (1 temporary well, ESB-5 and

two previous wells, Well I and Well C). For ESB-6, methylene chloride was detected at a low level in the well; but the laboratory indicated that this detection was most probably a laboratory artifact due to the sample having been obtained from a jar that had already been opened at least twice in the laboratory.

4.3 GPR SURVEY RESULTS

During the GPR Survey, no anomalies consistent with buried debris, tanks or other metal objects were identified. There are limitations to this survey. It covered only a small area of the site, near what appeared to be a demolished building. Also, GPR, which sends an electromagnetic pulse into the subsurface, and then measures the return signal, is affected by many factors: moisture, the soil type, nearby metallic objects or electrical sources (such as power lines). Therefore, although Amec Foster Wheeler and its subcontractor, Worksmart, Inc. have performed this survey with care and as skilled professionals, no survey can completely evaluate for the presence of USTs or other underground obstructions, or eliminate the risk of encountering them during construction.

5.0 ENDANGERMENT ASSESSMENT

5.1 NATURE AND EXTENT OF CONTAMINATION

The site was vacant prior to its first developed usage. The site was developed as a rail yard by 1900 according to historic topographic maps. Previous environmental reports for the site indicate that the rail yard was constructed in 1896 by the Chicago and Northwestern Transportation Company on previously undeveloped land. By 1978-1980, most of the rail yard tracks were gone, and by at most 2002, the parcel was totally vacant.

A previous investigation by Warzyn in 1991 consisted of the installation of ten (10) soil borings and three (3) temporary wells in three (3) of the borings. Twenty (20) soil samples were collected and analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) and total cyanides. Total xylene was detected in two (2) samples from one (1) boring and trichlorofluoromethane was detected in samples from two (2) other borings. PNAs were widespread, but generally below 1 mg/kg concentration, although some locations were higher. Metals were detected but at concentrations considered to be background or naturally occurring. Cyanides were not detected. Groundwater flow in the shallow soils was thought to be to the north, but could not be determined based on the temporary wells. No VOCs were detected and low concentrations of PNAs, metals and cyanide (one sample) were detected in the water samples.

A 2007 Phase II by Carlson included nineteen (19) soil borings. Twenty-four soil samples were analyzed. Analyses included VOCs, semivolatile organic compounds (SVOCs), priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc), pH, pesticides, polychlorinated biphenyls (PBCs) and chlorinated herbicides. No VOCs were detected at concentrations exceeding the TACO objectives; although VOCs were detected at some locations. PNAs and carbazole were detected at concentrations that exceeded the TACO Tier 1 screening objectives. Antimony, arsenic, chromium, lead and mercury were detected at concentrations above their TACO Tier 1 objectives. PCBs, pesticides and herbicides were not detected in the two (2) samples analyzed for these parameters. The report concluded that concentrations of five (5) PNAs, one (1) SVOC and five (5) metals were present at concentrations exceeding the most stringent TACO Tier 1 residential screening levels.

The current investigation included the installation of twenty-four (24) soil borings and two (2) temporary wells. Twenty-six (26) soil samples were obtained and four (4) groundwater samples (2 groundwater samples were from wells already present on the site). Samples were compared to current TACO Tier 1 objectives for industrial/commercial sites with Class II groundwater.

Concentrations of PNAs, arsenic, antimony and chromium were detected in soils at concentrations above those objectives. No detected concentrations in groundwater exceeded the objectives.

Based on comparison of the results of all of these investigations to TACO Tier 1 objectives for industrial/commercial sites with Class II groundwater, soils at the site have been identified as impacted by benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic at concentrations above their soil ingestion objectives.

Groundwater at the site was tested and only low levels of inorganic and organic chemicals were detected. Soils at the site were tested and compared to soil component of groundwater ingestion objectives (soil migration to groundwater). One organic contaminant, benzo(a)anthracene, was detected at one location at a concentration which exceeded its soil component of groundwater ingestion pathway objective for sites with Class II groundwater. One contaminant, antimony, was detected at one location at a concentration above its TACO Tier 1 pH-specific soil component of groundwater ingestion objective for sites with Class II groundwater. For another contaminant, chromium, there is no pH-specific objective for sites with Class II groundwater. There are pH-specific objectives for Class I groundwater and site chromium concentrations were compared to these objectives and were below the objectives, or were analyzed again by a leaching procedure and were below the objective. However, at one location, the chromium concentration was above the Class I objective to which it was compared and the sample was from the Carlson investigation so re-analysis by a leaching procedure was not possible. Three chemicals at three locations therefore exceeded their soil component of groundwater ingestion objectives: benzo(a)anthracene, antimony and chromium.

No contaminant concentrations exceeded construction worker objectives. The mercury inhalation construction worker objective was exceeded at many locations; but, this objective is only valid if elemental mercury is a contaminant of concern at the site. No previous site use would have resulted in the use of elemental mercury at the site.

Arsenic and PNA detections above objectives were scattered throughout the site, with localized hot spots at various locations indicative of concentrations in non-native fill materials.

Investigations to-date have identified, characterized and quantified the extent of impacted soils at the site sufficiently to determine appropriate remediation objectives for soil pathways, to allow determination of the need for remediation, and to evaluate remedial options.

5.2 CONTAMINANT FATE AND TRANSPORT

The term “Fate and Transport” refers to the process that a contaminant encounters in the environment as a result of its potential to be transported, transformed (physically, chemically, or biologically), or accumulated in soil, groundwater or surface water. The following sections briefly summarize the fate and transport properties of the constituents detected above TACO Tier 1 industrial/commercial objectives for sites with Class II groundwater.

5.2.1 Inorganic Compounds (Arsenic, Antimony and Chromium)

Generally, metals (arsenic, antimony and chromium) tend to be immobile in soils, and the extent of transport and migration is dependent on environmental conditions at the site. While the pure metallic forms of these compounds are insoluble in water, many of their salts are soluble in varying degrees. The primary fate process for all of the metals in relation to groundwater and surface water transport is adsorption. These constituents may be released into solution depending on pH, the particular chemical state present, and the presence of aerobic or anaerobic conditions at the site.

Arsenic, because of its complex chemistry, exists in the environment in many different inorganic and organic forms, which have different toxicological and physicochemical properties. Inorganic arsenic exists as either the trivalent (3+) form or the pentavalent (5+) form. The inorganic trivalent arsenic forms are more toxic than the pentavalent forms. Elemental arsenic (the metalloid -0+) is essentially nontoxic even at high intakes. The dominant form of arsenic in soil and its transport are largely dependent on the physical characteristics of the soil matrix. Insoluble arsenic compounds, such as arsenic trioxide, bind tightly to organic matter in soil or sediment in surface water, soluble inorganic arsenate (As5+) predominates under normal conditions and is more stable than arsenite (EPA 1980a). Movement and partitioning of arsenic in water depends on the chemical form of arsenic and on interactions with other materials present (Callahan et al. 1979). Soluble forms of arsenic remain dissolved in the water column or adsorb onto sediments or soils, especially those containing clays, iron oxides, aluminum hydroxides, manganese compounds, and organic matter (Callahan et al. 1979; Welch et al. 1988). Sediment bound arsenic is released back into the water by chemical or biological interconversions. This interconversion is influenced by the Eh (the oxidation-reduction potential), pH, temperature, other metals, salinity, and biota (Callahan et al. 1979) (U.S. EPA Office of Solid Waste, U.S. EPA Region 6 Multimedia Planning and Permitting Division Center for Combustion Science and Engineering, Protocol for Screening Level Ecological Risk Assessment, Appendix H, August 1999).

Antimony is found naturally in the environment and the general population is exposed to low levels of it every day, primarily in food, drinking water, and air. It may be found in air near industries that process or release it, such as smelters, coal-fired plants, and refuse incinerators. In polluted areas

containing high levels of antimony, it may be found in the air, water, and soil. In the air, antimony is attached to very small particles that may stay in the air for many days. Oxidation states, speciation and redox transformation generally determine the geochemical characteristics of antimony. Oxidative dissolution of sulfide minerals and aqueous dissolution are the most prevalent geochemical mechanisms for the release of antimony to the environment. Transformation of mobile forms of antimony is predominantly controlled by naturally occurring precipitation and adsorption processes. Most antimony ends up in soil, where it attaches strongly to particles that contain iron, manganese, or aluminum. Antimony is also immobilized in the natural environment via precipitation with alkali and heavy metals resulting in extremely stable mineral phases.

Human exposure to chromium occurs from both natural and anthropogenic sources. Chromium is present naturally in soil. The mobility of chromium in soil is dependent upon the speciation of chromium, which is a function of redox potential and the pH of the soil. In most soils, chromium will be present predominantly in the chromium(III) oxidation state. This form has very low solubility and low reactivity, resulting in low mobility in the environment (Barnhart 1997; Jardine et al. 1999; Robson 2003). Under oxidizing conditions, chromium(VI) may be present in soil as CrO_4^{2-} and HCrO_4^- (James et al. 1997). In this form, chromium is relatively soluble and mobile. A leachability study comparing the mobility of several metals, including chromium, in soil demonstrated that chromium had the least mobility of all of the metals studied (Sahuquillo et al. 2003). These results support previous data finding that chromium is not very mobile in soil, especially in the trivalent oxidation state (Balasoiu et al. 2001; Jardine et al. 1999; Lin et al. 1996; Robson 2003). These results are further supported by a leachability investigation in which chromium mobility was studied for a period of 4 years in a sandy loam (Sheppard and Thibault 1991). The vertical migration pattern of chromium in this soil indicated that after an initial period of mobility, chromium forms insoluble complexes and little leaching is observed. Chromium present as insoluble oxide, $\text{Cr}_2\text{O}_3 \cdot n\text{H}_2\text{O}$, exhibited limited mobility in soil (Rifkin et al. 2004). Organic matter in soil is expected to convert soluble chromate, chromium(VI), to insoluble chromium(III) oxide, Cr_2O_3 (Calder 1988). Surface runoff from soil can transport both soluble and bulk precipitate of chromium to surface water. Soluble and unadsorbed chromium(VI) and chromium(III) complexes in soil may leach into groundwater. The leachability of chromium(VI) in the soil increases as the pH of the soil increases. On the other hand, lower pH present in acid rain may facilitate leaching of acid-soluble chromium(III) complexes and chromium(VI) compounds in soil (from ATSDR, Toxicological Profile, Chromium).

5.2.2 Polynuclear Aromatic Hydrocarbons

Most PNAs such as those found at the site (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene and dibenzo(a,h)anthracene), because of their low volatility, are classified as semivolatile organic compounds. In general, PNAs do not easily dissolve in water and are more likely to partition into sediments and soils rather than into groundwater because of their low solubilities and

high soil organic carbon-water partitioning coefficients (Koc's). As a result, transport of PNAs tends to be associated primarily with erosion of contaminated soils and sediments. PNAs sorbed to sediments may potentially affect aquatic communities downstream of contaminated sites (Irwin and others, 1998). The potential for colloid-facilitated transport of PNAs in groundwater also has been documented. PNAs possess a wide range of physicochemical properties, but generally PNAs have low vapor pressures and water solubilities, and high Koc. PNAs if released to soil will be expected to adsorb very strongly and will not be expected to leach to the groundwater. Adsorption onto suspended solids and particulate matter and complexation with natural organic substances are probably the most important environmental transport processes for these compounds. They also migrate to ground or surface waters by leaching from soil, but this is generally a slow process. Volatilization of these compounds from the aqueous phase is generally not expected to be a major fate process. PNAs may be bioaccumulated; however, some are also quickly metabolized and eliminated by most organisms. Biodegradation and biotransformation are probably an important fate process for this group of constituents, although because of their high molecular weights, degradation of these compounds is expected to be slow.

5.3 EXPOSURE ROUTE EVALUATION

5.3.1 Receptors

There are no current potential receptors. Future receptors will be personnel accessing the training facility (trainees, instructors and visitors). The City of Chicago has a groundwater ordinance which prohibits use of groundwater as a potable water source so no groundwater receptors should be present.

5.3.2 Exposure Pathways

In accordance with TACO guidance, four exposure pathways (i.e., soil ingestion, outdoor soil inhalation, protection from groundwater/surface water ingestion, and indoor inhalation) must be addressed during site closure.

5.3.2.1 Soil Ingestion Pathway

For the current and future personnel at the site, compounds above the industrial/commercial soil ingestion objectives could be accessed and ingested at concentrations above objectives at any Site areas where impacted soils are present in a contiguous area and where no natural and man-made barriers (i.e. clean soil at shallower depths, buildings, concrete pavement) are present or will be in-place in the future to prevent such ingestion.

Benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic are present at the site at concentrations which exceed the TACO Tier 1 industrial/commercial soil

ingestion objective. Eight (8) of the samples had measured concentrations of PNAs which exceed the soil ingestion objective. Five (5) of the samples had measured concentrations of arsenic which exceed the soil ingestion objective

5.3.2.2 Outdoor Inhalation Exposure Pathway

Constituents bound to soils may be transported as suspended particulates (dust) or may be volatilized. Transport on dust poses less risk for the compounds detected than does soil ingestion or inhalation of volatiles.

No site soil samples had concentrations which exceeded outdoor inhalation pathway objectives, except mercury which may exceed construction worker inhalation pathway objectives if elemental mercury is a contaminant of concern for the site (see discussion in Section 6.0).

5.3.2.3 Soil and Groundwater Components of the Groundwater Ingestion Pathway

Constituents present in soil may leach to groundwater. There are no known current receptors. The City of Chicago has a groundwater ordinance which prohibits use of groundwater as a potable water source so no groundwater receptors should be present. Groundwater discharging to surface water could result in other receptors, but the concentrations, and distance to surface water should result in no effect on surface water.

No contaminants are present at the site at concentrations which exceed their TACO Tier 1 Class II groundwater ingestion objectives.

One (1) organic contaminant, benzo(a)anthracene, was detected at one location at a concentration which exceeded its soil component of groundwater ingestion pathway objective for sites with Class II groundwater. Antimony, an inorganic contaminant, was detected at one (1) location at a concentration above its TACO Tier 1 pH-specific soil component of groundwater ingestion objective for sites with Class II groundwater. The sample was from the Carlson investigation so re-analysis by a leaching procedure was not possible. For another inorganic contaminant, chromium, there is no pH-specific objective for sites with Class II groundwater. There are pH-specific objectives for Class I groundwater and site chromium concentrations from the recent investigation were compared to these objectives and were below the objectives, or were analyzed again by a leaching procedure and were below the objective. However, at one (1) location, the chromium concentration was above the Class I objective to which it was compared and the sample was from the Carlson investigation so re-analysis by a leaching procedure was not possible. Three (3) chemicals at three (3) locations therefore exceeded their soil component of groundwater ingestion objectives: benzo(a)anthracene, antimony and chromium.

5.3.2.4 Indoor Inhalation Exposure Pathway

The indoor inhalation exposure pathway refers to the migration of volatile chemicals from subsurface contaminated soils and groundwater into the indoor air spaces of overlying buildings through openings in the building foundation (for example, cracks and utility openings). Any volatile chemical may migrate in this manner. The Illinois EPA in the TACO guidance (35 IAC 742 Appendix A, Table J) provides a list of TACO volatile chemicals for the indoor inhalation route.

Acetone, benzene, carbon disulfide, carbon tetrachloride, chloroform, tetrachloroethene, toluene, trichlorofluoromethane, xylenes, 2-methyl naphthalene and naphthalene were detected at the site and are listed as volatile chemicals on 35 IAC 742 Table J in TACO. Other detected chemicals and metals are not volatile, except mercury, which was also detected and is considered a volatile chemical. Generally, these compounds and metal are present at low levels at scattered locations. Since the compounds and metal are not present in groundwater, which was sampled at three locations for VOCs and two locations for mercury, they are not a concern for the indoor inhalation pathway.

6.0 REMEDIATION OBJECTIVES

A comparison of the results with Tier 1 industrial/commercial objectives (for ingestion, for indoor and outdoor inhalation and for the soil component of groundwater ingestion for Class II groundwater) was conducted to determine the chemicals of concern for the site. Soils with PNAs, and arsenic results above the soil ingestion pathway objectives were considered for averaging (95% Upper Confidence Limit) and two (2) locations will need to be remediated or have an engineered barrier to prevent access.

Benzo(a)anthracene is present at one (1) location at a concentration which exceeds its TACO Tier 1 Class II groundwater ingestion objective. Antimony was detected at one (1) location at a concentration above its TACO Tier 1 pH-specific objective for sites with Class II groundwater and chromium, detected above its pH-specific Class I objective at one (1) location, has no pH-specific objective for sites with Class II groundwater. Groundwater pathway exclusion was evaluated for these sample results.

6.1 TIER 1 INDUSTRIAL/COMMERCIAL COMPARISON

Site investigation soil sample results have been compared to TACO Tier 1 industrial/commercial objectives for sites with Class II groundwater (35 IAC 742 Appendix B, Table B, and Table D). Soil Remediation Objectives (SROs) were determined from TACO Tier 1 industrial/commercial soil remediation objectives in 35 IAC 742 Appendix B Table B and Appendix B Table D; and background concentrations found in 35 IAC 742 Appendix A, Table H. Groundwater sample analytical results were compared to the Illinois EPA TACO Tier 1 groundwater remediation objectives (GROs) for Class II groundwater (35 IAC 742 Appendix B Table E) and to the Tier 1 Groundwater Remediation objectives (GROs) for the Indoor Inhalation Route – Diffusion and Advection (35 IAC 742, Appendix B, Table H). This comparison has resulted in the identification of samples with concentrations which exceed the Tier 1 objectives or background concentrations. Results which exceed these objectives are summarized in Table 7.

The chemicals of concern for the soil ingestion pathway are: benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic. There are no chemicals of concern for the outdoor or indoor soil inhalation pathways.

Benzo(a)anthracene is present at one (1) location at a concentration which exceeds its TACO Tier 1 Class II soil component of groundwater ingestion objective. Antimony was detected at one (1) location at a concentration above its TACO Tier 1 pH-specific soil component of groundwater objective for sites with Class II groundwater. Chromium has no pH-specific soil component of

groundwater objective for sites with Class II groundwater. At one (1) location, the chromium concentration was above the Class I objectives to which it was compared.

The pathways of concern for industrial/commercial use of the site are therefore the soil ingestion pathway and the soil component of groundwater ingestion pathway.

6.2 CONSTRUCTION WORKER COMPARISON

Soil chemical concentrations were compared to the construction worker objectives provided in TACO (35 IAC 742 Appendix B, Table B). No chemicals were of concern (above objectives) for the construction worker ingestion and inhalation routes, except possibly mercury. The site was a rail yard previously, and elemental mercury is not known to be associated with rail yards. However, given the widespread detection of mercury (see Figure 8) and the significant concentration of mercury in one 2007 Carlson investigation sample (GP-17A, 0 to 2 feet bgs) of 7.5 mg/kg, Amec Foster Wheeler recommends a construction worker warning for mercury be placed on the site.

6.3 AVERAGING OF SHALLOW PNA AND ARSENIC IMPACTED SOIL CONCENTRATIONS

TACO allows for the averaging of results with the approval of the planned or completed sampling by Illinois EPA. Based on the Illinois EPA's approach to other sites in the SRP, concentrations of PNAs (benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene) and arsenic in shallow (above 3 feet in depth) soil were averaged to represent current exposure which would be only to shallow soils. All concentrations of the listed PNAs and arsenic in soils were averaged to represent future exposures, which could be to any of the soils at the site from any depth or location.. PNA and arsenic concentration were averaged in accordance with Section 742.225 of TACO to demonstrate that they would be in compliance with objectives.

Results were averaged using ProUCL Version 5.1.02 Statistical Software for Environmental Applications for Data Sets with and without Nondetect Observations (ProUCL software was developed by Lockheed Martin under a contract with the EPA and is made available through the EPA Technical Support Center in Atlanta, Georgia, EPA/600/R-07/041 October 2015). The software is used to calculate a 95% upper confidence limit (UCL95) of the arithmetic mean of the concentrations of compounds detected at a site. Concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic, at above 3 feet in depth, were included in the current soil calculations. Concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic at all depths were included in the future site use calculations. Input data and calculation results are provided in Appendix E.

Within the PNAs current (shallow soils) data set, one sample (GP3A at 0 to 2 feet bgs) had elevated concentrations of PNAs and will need to be remediated or have an engineered barrier to prevent access. With this concentration removed, the average for current users for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic is below their objectives.

Within the PNAs future (all soils) data set, two samples (GP3A at 0 to 2 feet bgs and GP-7D at 6 to 8 feet bgs) had elevated concentrations of PNAs and will need to be remediated or have an engineered barrier to prevent exposure to the soils. With these concentrations removed, the average for future site use for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic is below their objectives.

Areas around GP3A at 0 to 2 feet bgs and GP-7D at 6 to 8 feet bgs which would require soil removal or engineered barriers based on the above averaging are shown on Figure 9. The extent of these areas was based on detected concentrations and depths of PNAs in the borings around GP3A at 0 to 2 feet bgs and GP-7D at 6 to 8 feet bgs.

Engineered barriers should be consistent with the Illinois EPA's TACO requirements (35 IAC 742). Barriers cited in TACO and approved by the Illinois EPA include concrete, asphalt, or three feet of clean soil or fill. The Illinois EPA also approves alternative barriers of less than three feet of clean fill, such as 18" of clean fill with geotextile fabric. Clean fill can be certified virgin stone or other soil or earthen material, which has been tested for Target Compound List parameters (35 IAC 740 Appendix A) and found to meet the most stringent objectives for residential land use included in Appendix B of TACO.

6.4 EXCLUSION OF THE GROUNDWATER INGESTION PATHWAY

The chemicals of concern for the soil component of groundwater ingestion pathway at the site are benzo(a)anthracene, antimony and chromium. None of these chemicals were detected in the groundwater in two samples tested for metals and PNAs. The TACO regulations under 35 IAC 742.320 allow for the exclusion of the groundwater ingestion pathway from consideration if certain conditions are met. The site is evaluated for compliance with these conditions in the following paragraphs.

- A.) Requirements under Sections 742.300 and 742.305 of the regulation must be met.
35 IAC 742.300 addresses the following procedures for exclusion of an exposure route, requires that the site be fully characterized, and refers to the requirements for Tier 3 evaluation as an alternative for pathway exclusion.

35 IAC 742.305 requires that:

- (1) The sum of the concentrations of all of the organic contaminants of concern cannot exceed the attenuation capacity of the soil as determined under Section 742.215. Section 742.215 states that at each discrete sampling point, the sum of all of the organic compounds detected cannot exceed the natural organic carbon fraction of the soil. A default value of 6000 mg/kg can be used for soils within one meter of the surface and 2000 mg/kg can be used for soils below one meter.

$V \times \sum C_i \leq f_{OC} \times \text{Soil Capacity}$

- (2) The concentrations of any organic contaminant remaining in the soil shall not exceed the soil saturation limit as determined under Section 742.220. Section 742.220 states that the soil saturation limit shall be: the default value listed in Appendix A, Table A of TACO, a value derived from Equation S29 in Appendix C, Table A, or a value derived from another method approved by the Agency.

$C_i \leq \text{Soil Saturation Limit}$

- (3) Soils which contain contaminants of concern shall not exhibit the characteristics of reactivity for hazardous waste as determined under 35 IAC 721.123.

$pH \geq 2 \text{ and } pH \leq 12.5$

- (4) Soils which contain contaminants of concern shall not exhibit a pH of less than or equal to 2 or greater than or equal to 12.5.

$pH \geq 2 \text{ and } pH \leq 12.5$

- (5) Soil which contains the following inorganic contaminants of concern shall not exhibit characteristics of toxicity as determined by 35 IAC 721.124: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver.

$C_i \leq \text{Toxicity Limits}$

(6) If contaminants of concern include polychlorinated biphenyls (PCBs), the concentration of any PCBs in the soil shall not exceed 50 parts per million.

PCB concentration in soil shall not exceed 50 ppm.

(7) The concentration of any contaminant of concern in soil gas shall not exceed 10% of its Lower Explosive Limit (LEL) as measured by a hand held combustible gas indicator that has been calibrated to manufacturer specifications

Soil gas concentrations shall not exceed 10% LEL.

B.) Corrective action measures must be completed to remove any free product to the maximum extent practicable.

Remediation to maximum extent practicable.

C.) The source of the release may not be located within the minimum or designated maximum setback zone or within the regulated recharge area of a potable water supply well.

Source of release not within setback zones or recharge areas.

D.) An ordinance adopted by a unit of local government must be in place which prohibits the installation and use of potable water supply wells for an area within 2500 feet from the source of the release. This ordinance must be approved in accordance with Section 742.1015.

Local ordinance prohibiting wells within 2500 feet of release source.

E.) The concentration of any contaminant of concern in groundwater within the minimum or designated setback zone of an existing potable water supply well will meet the applicable Tier 1 groundwater remediation objective, as demonstrated using Equation R-26 in Appendix C, Table C.

Groundwater concentrations meet Tier 1 remediation objectives.

7.0 SUMMARY AND CONCLUSIONS

Amec Foster Wheeler was retained by the City of Chicago Department of Fleet and Facility Management to complete a Phase II Environmental Site Assessment for the site located at 4301 West Chicago Avenue in Chicago, Cook County, Illinois (the site). The site is a 30.4-acre parcel that is currently vacant. Development of the site as a Joint Public Safety Training Academy is planned. The JPSTA campus will provide the Chicago Police Department (CPD) and the Chicago Fire Department (CFD) with a central location, replacing training facilities located throughout the City.

7.1 SITE HISTORY

The site was developed as a rail yard by 1900 according to historic topographic maps. Previous environmental reports for the site indicate that the rail yard was constructed in 1896 by the Chicago and Northwestern Transportation Company on previously undeveloped land. By 1978-1980, most of the rail yard tracks were gone, and by at most 2002, the parcel was totally vacant.

7.2 PROPERTY DESCRIPTION

The site consists of 30.4 acres located on the southeast corner of the intersection of Kilbourn and West Chicago Avenue. The Parcel ID (Tax ID) number for the site is 16-10-200-061-0000. The site is located in a mixed land use area. At the time of the site reconnaissance, the site was vacant. The site is partially fenced and no buildings or other improvements are present on the site.

The site is situated at an elevation of approximately 610 feet above mean sea level (msl). Based on our review of the local topography, it appears that groundwater would generally flow toward the east to Lake Michigan.

Adjacent to the east is N. Kostner Avenue, beyond which is Falcon Transportation to the north and Chicago Transit Authority (CTA) to the south, to the north is W Chicago Avenue with commercial buildings lining the street and residences behind them, to the west is N. Kilbourn Avenue, beyond which is a City of Chicago Transfer Station, and to the south is a remaining railroad spur and some industrial and warehouse properties.

7.3 RECOGNIZED ENVIRONMENTAL CONDITIONS

Amec Foster Wheeler performed a Phase I ESA as outlined in ASTM E 1527-13 in June 2017. Amec Foster Wheeler issued the Draft Phase I ESA on June 26, 2017. Acquisition of the property is

expected to occur in January 2018. Components of the Phase I ESA which are required to be completed within 180 days of the expected date of purchase were updated in November 2017 and a final Phase I report was issued on December 11, 2017. The following recognized environmental conditions (REC) were determined to be associated with the property:

- On the property, a potential underground storage tank (UST) installed in 1959 with no record of it having been removed, its use as a former rail yard and the fill materials present on the site, various debris piles and rail ties present on the site and contaminants identified during previous investigations at the property.
- CTA at 4401 West Chicago Avenue, due to USTs installed in 1992, and because it is a former rail yard and may have fill similar to the site.
- Rail IT Property, 733 North Kilbourn Avenue, due to an UST that was not closed. It is unclear if this is the site or adjacent, as Rail IT at one time owned the site and the street number identified in the EDR report could potentially put it near the southeast corner of Chicago and Kilbourn Avenues, which would be the site.
- Department of Streets and Sanitation, 750 North Kilbourn Avenue, adjacent across North Kilbourn Avenue, due to USTs removed but not closed and since it is a transfer station and incinerator which may have resulted in airborne particulates reaching the site.
- City of Chicago, 715 North Kilbourn Avenue, due to an UST that was not closed. The initial incident report for #940242 lists 715 N. Kilbourn Avenue and then subsequent documentation on the Illinois EPA website for this incident changed to 750 N. Kilbourn Avenue. Amec Foster Wheeler believes the address was mis-identified in the original report and subsequently corrected. Although an incident was reported, a subsequent Illinois EPA letter indicates the site is a non-LUST site, which could indicate there was no confirmed release, or that the incident was from a non-regulated tank.

7.4 INVESTIGATION AND RESULTS

A previous investigation by Warzyn in 1991 consisted of the installation of ten (10) soil borings and three (3) temporary wells in three (3) of the borings. Twenty (20) soil samples were collected and analyzed for volatile organic compounds (VOCs), polynuclear aromatic hydrocarbons (PNAs), Resource Conservation and Recovery Act (RCRA) metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium and silver) and total cyanides. Comparison of Warzyn results to TACO Tier 1 current objectives showed that only one sample, SB10-4, taken at 8.5 to 10.5 feet below ground

surface, had a concentration which exceeded the soil remediation objectives (SROs) to which it was compared. Arsenic was detected at 13.8 mg/kg, and its soil ingestion objective (which is the same as its background concentration) is 13 mg/kg.

A 2007 Phase II by Carlson included nineteen (19) soil borings. Twenty-four (24) soil samples were analyzed. Analyses included VOCs, semivolatile organic compounds (SVOCs), priority pollutant metals (antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc), pH, pesticides, polychlorinated biphenyls (PBCs) and chlorinated herbicides. Comparison of Carlson results to TACO Tier 1 current objectives showed that eight (8) samples, taken at seven (7) locations had concentrations which exceeded the SROs to which the samples were compared. Five (5) samples had PNA concentrations above their objectives, and three samples had inorganic concentrations (arsenic, antimony and chromium) above SROs.

This Phase II ESA consisted of the installation of twenty-four (24) soil borings, collection of twenty-six (26) soil samples for analytical testing, the installation and sampling of two (2) temporary monitoring wells, sampling of two (2) existing monitoring wells, level survey of some existing and the newly installed wells, and a limited ground penetrating radar survey. Soil samples were generally analyzed for PNAs and Priority Pollutant metals, with select samples analyzed for the Target Compound List (TCL) from the Site Remediation Program (35 IAC 740 Appendix A) and herbicides. Groundwater samples were analyzed variously for the TCL, PNAs, metals and VOCs. Three (3) soil samples had concentrations of PNAs which exceeded objectives and four (4) soil samples had arsenic concentrations above its soil ingestion objective.

7.5 REMEDIATION OBJECTIVES

Based on comparison of the results of all of these investigations to TACO Tier 1 objectives for industrial/commercial sites with Class II groundwater, soils at the site have been identified as impacted by benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic at concentrations above their soil ingestion objectives. Three (3) chemicals at three (3) locations exceeded their soil component of groundwater ingestion objectives: benzo(a)anthracene, antimony and chromium.

Concentrations of benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic in shallow (above 3 feet in depth) soil, to represent current exposure, and all of the listed PNAs and arsenic in soils to represent future exposures, which exceeded soil ingestion pathway objectives were averaged in accordance with Section 742.225 of TACO to demonstrate that they would be in compliance with objectives if the use of averaging and the already completed sampling was approved by the Illinois EPA.

Results were averaged using ProUCL Version 5.1.02. Within the PNAs current (shallow soils) data set, one sample (GP3A at 0 to 2 feet bgs) had elevated concentrations of PNAs and will need to be remediated or have an engineered barrier to prevent access. With this concentration removed, the average for current users for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic is below their objectives.

Within the PNAs future (all soils) data set, two samples (GP3A at 0 to 2 feet bgs and GP-7D at 6 to 8 feet bgs) had elevated concentrations of PNAs and will need to be remediated or have an engineered barrier to prevent access. With these concentrations removed, the averages for future site use for benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic are below their objectives.

The soil component of groundwater ingestion pathway was addressed by exclusion of the groundwater pathway in accordance with 35 IAC 742.320. Site conditions and concentrations of chemicals of concern which exceeded the soil component of groundwater ingestion pathway were determined to be appropriate for pathway exclusion. The evaluation showed that the pathway could be excluded.

No chemicals were of concern (above objectives) for the construction worker ingestion and inhalation routes, except possibly mercury. The site was a rail yard previously, and elemental mercury is not known to be associated with rail yards. However, given the widespread detection of mercury and the significant concentration of mercury in one 2007 Carlson investigation sample (GP-17A, 0 to 2 feet bgs) of 7.5 mg/kg, Amec Foster Wheeler recommends a construction worker warning for mercury be placed on the site.

7.6 CONSTRUCTION CONSIDERATIONS

During design and construction of the JPTSA, it is recommended that the following be taken into consideration:

- Future site buildings should be constructed with a full concrete slab-on-grade foundation or with a full concrete basement floor and walls. Future site buildings should not be constructed with earthen crawl spaces, earthen floors, stone foundations, partial concrete floors, or sumps.
- Unless additional testing is performed to determine compliance with Illinois EPA's Clean Construction and Demolition Debris (CCDD) regulations, all soil being removed from the site must be disposed of in accordance with applicable regulations to a Subtitle D landfill.
- Areas depicted on Figure 9 must be covered with an Illinois EPA TACO-compliant engineered barrier such as asphalt, concrete, 3 ft of clean fill, or other Illinois EPA-approved barrier.

- Imported fill material must be certified virgin stone or or other soil or earthen material, which has been tested for Target Compound List parameters (35 IAC 740 Appendix A) and found to meet the most stringent objectives for residential land use included in Appendix B of TACO.
- Construction workers who will encounter site soils should be informed of the mercury detections at the site so that they may take appropriate precautions as determined by their evaluation of the data.
- Although a GPR survey for underground tanks, utilities and foundations was performed in a limited area of the site, this does not guarantee that such underground tanks, utilities and foundations are not present in these areas, or other areas where such survey was not completed.
- A Soil Management Plan should be prepared and implemented during construction to document, at a minimum: the site specific soil excavation, disposal, storage and reuse procedures, imported material testing requirements, and environmental oversight requirements.

7.7 CONCLUSIONS

A Phase II Environmental Site Assessment has been completed for the property at 4301 W Chicago Avenue in Chicago, Illinois. This investigation and previous sampling indicated that soils at the site have been impacted by benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, dibenzo(a,h)anthracene and arsenic at concentrations above their soil ingestion objectives. Three (3) chemicals at three locations exceeded their soil component of groundwater ingestion objectives: benzo(a)anthracene, antimony and chromium.

Averaging of soils above soil ingestion objectives, as allowed in TACO, has resulted in a determination that two (2) locations should be remediated or barriered to prevent exposure. The use of the City of Chicago groundwater ordinance has allowed for exclusion of the groundwater pathway.

A construction worker caution for exposure to mercury by the inhalation pathway is recommended for the site.



TABLES

Table 1. Groundwater Level Data Summary
 (August 2017)
 4301 West Chicago Avenue
 Chicago, Illinois

Well ID	Date	Depth to Bottom	Top of Well Casing Elevation ¹ (feet)	Water Depth Below TOC ¹ (feet)	Ground Water Elevation (feet)
MW A	8/11/2017	44.04	92.54	26.26	66.28
MW B	8/11/2017	51.28	95.73	29.15	66.58
MW C	8/11/2017	15.09	94.91	10.03	84.88
	8/28/2017		94.91	10.00	84.91
MW D	8/11/2017	44.27	92.89	25.96	66.93
MW E	8/11/2017	42.70	100.00	21.90	78.10
MW F (MW-25)	8/11/2017	14.90	99.29	dry	--
MW G	8/11/2017	49.32	99.13	32.23	66.90
MW-H	8/11/2017	37.87	100.67	30.42	70.25
MW I (MW-4)	8/11/2017	47.80	97.26	30.85	66.41
	8/29/2017		97.26	30.46	66.80
MW J	8/11/2017	45.30	94.07	27.60	66.47
MW K	8/11/2017	47.24	92.89	25.99	66.90
ESB-5 (temporary well)	8/9/2017 am	20.16	95.77	9.59	86.18
ESB-5 (temporary well)	8/9/2017 sampling		95.77	9.65	86.12
ESB-6 (temporary well)	8/9/2017 am	16.78	95.50	10.63	84.87
ESB-6 (temporary well)	8/9/2017 sampling		95.50	10.67	84.83

Notes:

1. TOC = Top of Casing - top of casing elevations were surveyed against an assumed elevation of 100 feet at top of casing for existing well E

Shallow Wells

Prepared by: MEJ 11/14/17
 Checked by: EJW 12/20/2017

TABLE 2
SUMMARY OF WARZYN SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet) Sample Date Parameter	Units	SB1-1	SB1-4	SB2-1	SB2-3	SB3-1	SB3-3	SB4-1	SB4-4	SB5-1	SB5-4	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		1-3	8.5-10.5	1-3	6-8	1-3	6-8	1-3	8.5-10.5	1-3	8.5-10.5	6/19/91	6/19/91	Ingestion	Inhalation	Ingestion	Inhalation
VOLATILE ORGANIC COMPOUNDS																	
Trichlorofluoromethane	mg/kg	<0.005	<0.005	0.00775	<0.005	0.0089	<0.005	<0.005	<0.005	<0.005	<0.005	NE	NE	NE	NE	NE	NE
Xylenes, m & p	mg/kg	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	410,000	420	41,000	5.9	200	NE
Xylenes, o	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	410,000	410	41,000	6.5	190	NE
POLYNUCLEAR AROMATIC HYDROCARBONS																	
Anthracene	mg/kg	<0.038	0.0019	<0.037	<0.00074	<0.075	0.0094	<0.00075	<0.00074	<0.037	<0.00074	610,000	NE	610,000	NE	59,000	0.25
Acenaphthylene	mg/kg	<0.007	<0.0014	<0.007	<0.0014	<0.140	<0.007	<0.0014	<0.0014	<0.0069	<0.0014	NE	NE	NE	NE	NE	0.03
Acenaphthene	mg/kg	<0.0063	0.0033	<0.0062	<0.0012	<0.120	<0.0063	<0.0012	<0.0012	<0.0062	<0.0012	120,000	NE	120,000	NE	2,900	0.09
Benzo(a)anthracene	mg/kg	0.140	0.002	0.093	0.002	0.470	0.026	0.004	0.00056	0.140	0.0056	8	NE	170	NE	8	1.1
Benzo(a)pyrene	mg/kg	0.250	0.0025	0.094	0.0019	0.480	0.029	0.0051	0.00071	0.140	0.0052	0.8	NE	17	NE	82	1.3
Benzo(b)fluoranthene	mg/kg	0.260	0.0049	0.130	0.0035	0.130	0.08	0.0077	0.0011	0.220	0.014	8	NE	170	NE	25	1.5
Benzo(g,h,i)perylene	mg/kg	0.260	<0.00040	0.094	<0.00039	0.330	0.032	0.0054	<0.00039	0.23	<0.00039	NE	NE	NE	NE	NE	0.68
Benzo(k)fluoranthene	mg/kg	0.140	0.0018	0.053	0.0012	0.250	0.017	0.0035	0.00045	0.100	0.01	78	NE	1,700	NE	250	0.99
Chrysene	mg/kg	0.140	<0.00045	0.120	0.0019	0.120	<0.0023	0.0068	0.00078	0.180	<0.00044	780	NE	17,000	NE	800	1.2
Dibenzo(a,h)anthracene	mg/kg	0.044	<0.00035	0.017	<0.00034	0.071	<0.0018	0.00092	<0.00035	0.023	<0.00034	0.8	NE	17	NE	7.6	0.2
Fluoranthene	mg/kg	0.210	0.006	<0.017	0.0046	0.730	0.089	0.0081	0.0015	0.310	0.013	82,000	NE	82,000	NE	21,000	2.7
Fluorene	mg/kg	<0.012	<0.0023	<0.012	<0.0023	<0.230	<0.012	<0.0023	<0.0023	<0.012	<0.0023	82,000	NE	82,000	NE	2,800	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	<0.020	<0.00040	<0.020	<0.00039	0.270	<0.002	<0.00040	<0.00039	<0.020	<0.00039	8	NE	170	NE	60	0.86
Naphthalene	mg/kg	0.096	0.0024	0.070	0.0053	0.250	0.025	<0.0014	0.0014	0.130	0.028	41,000	270	4,100	1.8	18	0.04
Phenanthrene	mg/kg	0.23	0.0052	0.240	0.006	0.240	0.15	0.0085	0.0019	0.410	0.032	NE	NE	NE	NE	NE	1.3
Pyrene	mg/kg	0.200	0.0049	0.160	0.0042	0.160	0.073	0.0072	0.0012	0.260	0.011	61,000	NE	61,000	NE	21,000	1.9
METALS, TOTAL																	
Arsenic	mg/kg	8.84	3.44	13.0	3.36	12.2	2.77	3.38	3.47	4.51	5.42	13	1,200	61	25,000	NE	13
Barium	mg/kg	21.8	53.0	47.2	25.3	52.2	12.7	10.8	55.4	10.8	42.6	140,000	910,000	14,000	870,000	NE	110
Cadmium	mg/kg	<1.00	<1.00	1.6	<1.00	2.79	<1.00	<1.00	<1.00	<1.00	<1.00	2,000	2,800	200	59,000	NE	0.6
Chromium	mg/kg	10.0	22.10	13.2	4.39	9.98	6.76	4.00	19.4	3.79	19.2	6,100	420	4,100	690	NE	16.2
Lead	mg/kg	91.9	25.9	166	<20.0	261	<20.0	<20.0	<20.0	32.5	22.3	800	NE	700	NE	NE	36.0
Mercury	mg/kg	0.10	<0.04	0.31 (5)	<0.04	0.17	<0.04	<0.04	<0.04	<0.04	<0.04	610	16 (6)	61	0.1 (6)	NE	0.06
Selenium	mg/kg	0.45	<0.40	0.90	<0.40	0.85	<0.40	<0.40	<0.40	<0.40	0.65	10,000	NE	1,000	NE	NE	0.48
Silver	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	2.00	<2.00	10,000	NE	1,000	NE	NE	0.55
CYANIDE																	
Cyanide	mg/kg	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	41,000	NE	4,100	NE	NE	0.51

TABLE 2
SUMMARY OF WARZYN SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet) Sample Date Parameter	Units	SB6-1	SB6-4	SB7-4	SB7-5	SB8-1	SB8-3	SB9-2	SB9-3	SB10-1	SB10-4	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)		
		1-3	8.5-10.5	8.5-10.5	11-13	1-3	8.5-10.5	3.5-5.5	6-8	1-3	8.5-10.5	6/19/91	6/19/91	6/19/91	6/19/91	6/19/91	6/19/91	Ingestion	Inhalation
VOLATILE ORGANIC COMPOUNDS																			
Trichlorofluoromethane	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	NE	NE	NE	NE	NE	NE		
Xylenes, m & p	mg/kg	<0.010	<0.010	<0.010	<0.010	0.023	0.015	<0.010	<0.010	<0.010	<0.010	410,000	420	41,000	5.9	200	NE		
Xylenes, o	mg/kg	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	410,000	410	41,000	6.5	190	NE		
POLYNUCLEAR AROMATIC HYDROCARBONS																			
Anthracene	mg/kg	<0.0037	<0.00075	<0.0015	<0.0015	<0.0015	0.032	<0.0015	<0.0015	<0.0015	0.091	610,000	NE	610,000	NE	59,000	0.25		
Acenaphthylene	mg/kg	<0.0069	<0.0014	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.0028	<0.055	NE	NE	NE	NE	NE	0.03		
Acenaphthene	mg/kg	<0.0062	<0.0013	<0.0025	<0.0025	0.0026	<0.0025	<0.0025	<0.0025	<0.0025	<0.049	120,000	NE	120,000	NE	2,900	0.09		
Benzo(a)anthracene	mg/kg	0.014	0.0025	<0.00060	<0.00060	0.027	0.030	0.0042	<0.00060	0.025	0.190	8	NE	170	NE	8	1.1		
Benzo(a)pyrene	mg/kg	0.016	0.0018	<0.00070	<0.00070	0.033	0.031	0.0042	<0.00070	0.026	<0.014	0.8	NE	17	NE	82	1.3		
Benzo(b)fluoranthene	mg/kg	0.034	0.0036	<0.00070	0.001	0.051	0.072	0.0089	0.00095	0.064	0.021	8	NE	170	NE	25	1.5		
Benzo(g,h,i)perylene	mg/kg	0.017	<0.00040	<0.00080	<0.00080	0.04	0.041	0.0062	0.00083	0.041	0.310	NE	NE	NE	NE	NE	0.68		
Benzo(k)fluoranthene	mg/kg	0.0093	0.0014	<0.00070	<0.00070	0.018	0.021	0.0028	<0.00070	0.016	<0.014	78	NE	1,700	NE	250	0.99		
Chrysene	mg/kg	<0.0022	<0.00045	<0.00090	<0.00090	<0.00090	0.067	<0.00090	<0.00090	<0.00090	<0.018	780	NE	17,000	NE	800	1.2		
Dibenzo(a,h)anthracene	mg/kg	<0.0017	<0.00035	<0.00070	<0.00070	0.0054	0.0074	<0.00070	<0.00070	<0.00070	<0.014	0.8	NE	17	NE	7.6	0.2		
Fluoranthene	mg/kg	0.037	0.0069	0.00089	0.0012	0.055	0.050	0.0084	0.0011	0.057	0.59	82,000	NE	82,000	NE	21,000	2.7		
Fluorene	mg/kg	<0.012	<0.0024	<0.0047	<0.0047	<0.0047	0.018	<0.0047	<0.0047	<0.0047	0.350	82,000	NE	82,000	NE	2,800	0.1		
Indeno(1,2,3-cd)pyrene	mg/kg	<0.002	<0.00040	<0.00080	<0.00080	<0.00080	0.016	<0.00080	<0.00080	<0.00080	<0.016	8	NE	170	NE	60	0.86		
Naphthalene	mg/kg	0.012	0.0042	<0.0029	<0.0029	0.022	0.0078	0.0063	<0.0029	0.018	0.110	41,000	270	4,100	1.8	18	0.04		
Phenanthrene	mg/kg	0.070	0.018	0.0021	0.0021	0.080	0.049	0.015	0.0021	0.110	0.620	NE	NE	NE	NE	NE	1.3		
Pyrene	mg/kg	0.036	0.0047	0.001	0.00081	0.059	0.055	0.0082	<0.00080	0.058	0.650	61,000	NE	61,000	NE	21,000	1.9		
METALS , TOTAL																			
Arsenic	mg/kg	3.53	2.38	2.65	2.72	2.09	3.15	3.26	2.94	5.45	13.8	13	1,200	61	25,000	NE	13		
Barium	mg/kg	9.95	6.71	6.57	8.81	5.81	39.0	26.1	19.2	13.9	38.5	140,000	910,000	14,000	870,000	NE	110		
Cadmium	mg/kg	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	<1.00	2,000	2,800	200	59,000	NE	0.6		
Chromium	mg/kg	5.81	3.20	2.38	4.96	2.17	2.37	7.22	3.95	3.98	8.03	6,100	420	4,100	690	NE	16.2		
Lead	mg/kg	22.9	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	<20.0	346	800	NE	700	NE	NE	36.0		
Mercury	mg/kg	0.06	<0.04	<0.04	<0.04	<0.04	0.06	<0.04	<0.04	<0.04	0.14	610	16 (6)	61	0.1 (6)	NE	0.06		
Selenium	mg/kg	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.66	10,000	NE	1,000	NE	NE	0.48		
Silver	mg/kg	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	<2.00	10,000	NE	1,000	NE	NE	0.55		
CYANIDE																			
Cyanide	mg/kg	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	<1.25	41,000	NE	4,100	NE	NE	0.51		

TABLE 2
SUMMARY OF WARZYN SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Notes:

- (1): Soil remediation objective (SRO) for the soil ingestion or inhalation routes for industrial-commercial exposure (35 IAC 742 Appendix B, Table B).
- (2): Soil remediation objective (SRO) for the soil ingestion or inhalation routes for construction worker exposure (35 IAC 742 Appendix B, Table B).
- (3): The soil remediation objective (SRO) for the soil component of the groundwater ingestion route for Class II groundwater 35 IAC 742 Appendix B, Table B. For metals and cyanide, objectives are based on leached concentrations or pH-specific objectives may be used
- (4): Concentrations of Inorganic Chemicals in Background Soils within Counties Inside Metropolitan Statistical Areas (35 IAC 742 Appendix A, Table G).
Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils within the City of Chicago (35 IAC 742 Appendix A, Table H).
- (5): Results should be considered estimated due to non-homogenous sample matrix
- (6): Soil remediation objective for inhalation route only applies at sites where elemental mercury (CAS#7439-97-6) is a contaminant of concern (35 IAC 742 Appendix B, Tables A and B).

mg/kg Milligram per kilogram

NE Not established by the Illinois Environmental Protection Agency

NA Not analyzed

BOLD Laboratory Analytical Detection

BOLD + HIGHLIGHT Laboratory Analytical Detection that exceeds TACO Tier 1 Industrial-Commercial Objective for sites with Class I Groundwater

Created By: MEJ 7/17/2017

Reviewed By: EJW 12/20/17

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	GP-1A	GP-2B	GP-3A	GP-4B	GP-4E	GP-5A	GP-6A	GP-6C	GP-7D	GP-7F	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)	
		0-2	2-4	0-2	2-4	8-10	0-2	0-2	4-6	6-8	10-12			Ingestion	Inhalation	Ingestion	Inhalation	
Sample Date		9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07							
Parameter																		
VOLATILE ORGANIC COMPOUNDS																		
Acetone	mg/kg	<0.40	<0.053	0.17	0.071	0.067	0.14	0.055	0.074	0.075	<0.26	NE	100,000	NE	100,000	25	NE	
Benzene	mg/kg	<0.0080	<0.0053	<0.0071	0.0064	<0.0050	<0.0076	<0.0052	<0.0050	<0.0066	<0.0051	100	1.6	2,300	2.2	0.17	NE	
Carbon Disulfide	mg/kg	<0.021	<0.011	<0.014	<0.012	<0.010	0.016	0.023	<0.010	<0.013	<0.013	200,000	720	20,000	9	160	NE	
Tetrachloroethene	mg/kg	<0.0080	<0.0053	<0.0071	<0.0061	0.0051	<0.0076	<0.0052	<0.0050	<0.0066	<0.0051	110	20	2,400	28	0.3	NE	
Toluene	mg/kg	<0.016	0.0084	<0.0071	0.0072	0.0075	0.017	0.0075	0.0094	0.0080	<0.010	410,000	650	410,000	42	29	NE	
Xylenes, m & p	mg/kg	<0.0080	<0.0053	<0.0071	<0.0061	<0.0050	0.010	<0.0052	<0.0050	<0.0066	<0.0051	410,000	420	41,000	5.9	200	NE	
POLYNUCLEAR AROMATIC HYDROCARBONS																		
Anthracene	mg/kg	0.11	0.15	2.5 E	0.25	<0.055	<0.057	<0.056	3.2	5.7	0.76	610,000	NE	610,000	NE	59,000	0.25	
Acenaphthylene	mg/kg	0.089	<0.055	<0.056	<0.056	<0.055	<0.057	<0.056	<0.055	0.068	<0.061	NE	NE	NE	NE	NE	0.03	
Acenaphthene	mg/kg	<0.055	<0.055	0.66	0.060	<0.055	<0.057	<0.056	1.2	1.6	0.26	120,000	NE	120,000	NE	2,900	0.09	
Benzo(a)anthracene	mg/kg	0.78	0.59	7.0 E	1.2	0.20	0.092	0.099	6.1	12	3.1 E	8	NE	170	NE	8	1.1	
Benzo(a)pyrene	mg/kg	0.90	0.55	6.3 E	1.1	0.16	0.072	0.086	3.8	13	2.3 E	0.8	NE	17	NE	82	1.3	
Benzo(b)fluoranthene	mg/kg	1.9 E	1.0	8.7 E	1.5	0.28	0.16	0.18	6.4	12	4.8 E	8	NE	170	NE	25	1.5	
Benzo(g,h,i)perylene	mg/kg	1.1	0.46	3.5 E	0.50	0.16	0.12	0.10	1.5	2.3	1.0	NE	NE	NE	NE	NE	0.68	
Benzo(k)fluoranthene	mg/kg	0.47	0.26	3.0 E	0.34	0.10	<0.057	<0.056	2.2	4.6	1.6	78	NE	1,700	NE	250	0.99	
Chrysene	mg/kg	0.51	0.47	4.1 E	0.86	0.16	0.063	0.077	2.8	5.6	1.9	780	NE	17,000	NE	800	1.2	
Dibenzo(a,h)anthracene	mg/kg	0.31	0.13	1.7	0.18	<0.055	<0.057	<0.056	0.82	1.0	0.46	0.8	NE	17	NE	7.6	0.2	
Fluoranthene	mg/kg	1.1	0.99	8.9 E	1.9 E	0.33	0.085	0.11	8.6	14	6.7 E	82,000	NE	82,000	NE	21,000	2.7	
Fluorene	mg/kg	<0.055	<0.055	1.0	0.070	<0.055	<0.057	<0.056	1.8	4.4	0.25	82,000	NE	82,000	NE	2,800	0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	0.88	0.37	3.1 E	0.44	0.11	0.076	0.074	1.6	3.4	1.2	8	NE	170	NE	60	0.86	
Naphthalene	mg/kg	0.087	<0.055	0.17	0.057	<0.055	ND	<0.056	1.4	1.2	0.081	41,000	270	4,100	1.8	18	0.04	
Phenanthrene	mg/kg	0.6	0.68	8.2 E	1.1	0.35	0.11	<0.056	9.6	16	5.2 E	NE	NE	NE	NE	NE	1.3	
Pyrene	mg/kg	0.92	0.75	9.2 E	2.6 E	0.49	0.12	0.11	8.4	15	6.5 E	61,000	NE	61,000	NE	21000	1.9	

*Notes on final page

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	GP-1A	GP-2B	GP-3A	GP-4B	GP-4E	GP-5A	GP-6A	GP-6C	GP-7D	GP-7F	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)	
		0-2	2-4	0-2	2-4	8-10	0-2	0-2	4-6	6-8	10-12			Ingestion	Inhalation	Ingestion	Inhalation	
Sample Date		9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07							
Parameter																		
SEMIVOLATILE ORGANIC COMPOUNDS																		
Carbazole	mg/kg	<0.36	<0.37	0.58	<0.37	<0.36	<0.37	<0.37	1.5	1.9	0.57	290	NE	6,200	NE	2.8	NE	
Dibenzofuran	mg/kg	<0.36	<0.37	0.68	<0.37	<0.36	<0.37	<0.37	1.5	2.8	<0.40	NE	NE	NE	NE	NE	NE	
2-Methylnaphthalene	mg/kg	<0.36	<0.37	<0.37	<0.37	<0.36	<0.37	<0.37	0.66	0.74	<0.40	NE	NE	NE	NE	NE	NE	
METALS, TOTAL																		
Antimony	mg/kg	4.6	4.6	1.2	1.5	23	5.4	<1.1	3.6	2.6	3.0	820	NE	82	NE	20	4.0	
Arsenic	mg/kg	7.9	8.5	4.0	5.2	6.2	6.8	7.7	5.2	11	7.6	13	1,200	61	25,000	120-130	13	
Beryllium	mg/kg	0.29	0.57	0.46	0.33	0.38	0.50	0.47	0.40	0.72	0.42	4,100	2,100	410	44,000	130,000-NE	0.59	
Cadmium	mg/kg	0.80	1.80	0.89	0.75	1.3	0.89	0.63	0.84	3.4	1.8	2,000	2,800	200	59,000	590-NE	0.6	
Chromium	mg/kg	20	19	13	15	23	11	15	13	21	23	6,100	420	4,100	690	NE (32-28)	16.2	
Copper	mg/kg	45	51	24	36	150	61	26	41	62	67	82,000	NE	8,200	NE	330,000-NE	19.6	
Lead	mg/kg	130	160	88	72	310	130	21	110	270	130	800	NE	700	NE	1,420	36.0	
Mercury	mg/kg	0.087	0.081	ND	0.044	0.16	0.087	<0.045	0.16	0.76	0.16	610	16 (5)	61	0.1 (5)	32-NE	0.06	
Nickel	mg/kg	15.0	16.0	14.0	13.0	14	15	26	21	21	20	41,000	21,000	4,100	440,000	14,000-NE	18	
Selenium	mg/kg	0.66	1.60	0.63	0.48	0.69	0.89	0.46	0.46	0.87	0.67	10,000	NE	1,000	NE	3.3-1.8	0.48	
Silver	mg/kg	<0.49	<0.53	<0.53	<0.56	<0.51	<0.55	<0.55	<0.52	<0.55	<0.57	10,000	NE	1,000	NE	39-NE	0.55	
Thallium	mg/kg	<0.25	0.51	0.27	<0.28	<0.26	0.41	0.55	<0.26	0.3	<0.28	160	NE	160	NE	3.4-4.4	0.32	
Zinc	mg/kg	110	260	130	90	180	120	50	140	330	250	610,000	NE	61,000	NE	16,000-NE	95	
pH																		
pH	Standard	8.1	7.9	7.8	8.1	7.4	7.3	7.4	7.9	7.7	7.6	USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12.5						

*Notes on final page

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	GP-8A	GP-9B	GP-10B	GP-11B	GP-11D	GP-13A	GP-13D	GP-14B	GP-15A	GP-16B	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		0-2	2-4	2-4	2-4	6-8	0-2	6-8	2-4	0-2	2-4	Ingestion	Inhalation	Ingestion	Inhalation		
Sample Date		9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07						
Parameter																	
VOLATILE ORGANIC COMPOUNDS																	
Acetone	mg/kg	NA	NA	NA	<0.22	<0.23	<0.36	<0.21	NA	NA	<0.24	NE	100,000	NE	100,000	25	NE
Benzene	mg/kg	NA	NA	NA	<0.0044	<0.0049	<0.0073	<0.0042	NA	NA	<0.0048	100	1.6	2,300	2.2	0.17	NE
Carbon Disulfide	mg/kg	NA	NA	NA	<0.012	<0.012	<0.019	<0.011	NA	NA	<0.012	200,000	720	20,000	9	160	NE
Tetrachloroethene	mg/kg	NA	NA	NA	<0.0044	<0.0049	<0.0073	<0.0042	NA	NA	<0.0048	110	20	2,400	28	0.3	NE
Toluene	mg/kg	NA	NA	NA	<0.0089	<0.0092	<0.015	<0.0085	NA	NA	<0.0096	410,000	650	410,000	42	29	NE
Xylenes, m & p	mg/kg	NA	NA	NA	<0.0044	<0.0049	<0.0073	<0.0042	NA	NA	<0.0048	410,000	420	41,000	5.9	200	NE
POLYNUCLEAR AROMATIC HYDROCARBONS																	
Anthracene	mg/kg	NA	NA	NA	<0.056	0.72	0.070	<0.050	NA	NA	<0.052	610,000	NE	610,000	NE	59,000	0.25
Acenaphthylene	mg/kg	NA	NA	NA	<0.056	<0.11	<0.050	<0.050	NA	NA	<0.052	NE	NE	NE	NE	NE	0.03
Acenaphthene	mg/kg	NA	NA	NA	<0.056	0.18	<0.050	<0.050	NA	NA	<0.052	120,000	NE	120,000	NE	2,900	0.09
Benzo(a)anthracene	mg/kg	NA	NA	NA	0.067	2.0	0.20	<0.050	NA	NA	<0.052	8	NE	170	NE	8	1.1
Benzo(a)pyrene	mg/kg	NA	NA	NA	<0.056	3.1	0.16	<0.050	NA	NA	<0.052	0.8	NE	17	NE	82	1.3
Benzo(b)fluoranthene	mg/kg	NA	NA	NA	0.070	2.1	0.29	<0.050	NA	NA	<0.052	8	NE	170	NE	25	1.5
Benzo(g,h,i)perylene	mg/kg	NA	NA	NA	<0.056	0.52	0.17	<0.050	NA	NA	<0.052	NE	NE	NE	NE	NE	0.68
Benzo(k)fluoranthene	mg/kg	NA	NA	NA	<0.056	0.67	0.10	<0.050	NA	NA	<0.052	78	NE	1,700	NE	250	0.99
Chrysene	mg/kg	NA	NA	NA	<0.056	1.5	0.19	<0.050	NA	NA	<0.052	780	NE	17,000	NE	800	1.2
Dibenzo(a,h)anthracene	mg/kg	NA	NA	NA	<0.056	0.19	0.075	<0.050	NA	NA	<0.052	0.8	NE	17	NE	7.6	0.2
Fluoranthene	mg/kg	NA	NA	NA	0.11	3.4	0.21	<0.050	NA	NA	<0.052	82,000	NE	82,000	NE	21,000	2.7
Fluorene	mg/kg	NA	NA	NA	<0.056	0.17	<0.050	<0.050	NA	NA	<0.052	82,000	NE	82,000	NE	2,800	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	NA	NA	NA	<0.056	0.85	0.12	<0.050	NA	NA	<0.052	8	NE	170	NE	60	0.86
Naphthalene	mg/kg	NA	NA	NA	<0.056	<0.11	0.060	<0.050	NA	NA	<0.052	41,000	270	4,100	1.8	18	0.04
Phenanthrene	mg/kg	NA	NA	NA	0.070	3.2	0.33	<0.050	NA	NA	<0.052	NE	NE	NE	NE	NE	1.3
Pyrene	mg/kg	NA	NA	NA	0.12	5.1 E	0.31	<0.050	NA	NA	<0.052	61,000	NE	61,000	NE	21000	1.9

*Notes on final page

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	GP-8A	GP-9B	GP-10B	GP-11B	GP-11D	GP-13A	GP-13D	GP-14B	GP-15A	GP-16B	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		0-2	2-4	2-4	2-4	6-8	0-2	6-8	2-4	0-2	2-4	Ingestion	Inhalation	Ingestion	Inhalation		
Sample Date		9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07	9/5/07						
Parameter																	
SEMIVOLATILE ORGANIC COMPOUNDS																	
Carbazole	mg/kg	NA	NA	NA	<0.37	<0.72	<0.33	<0.33	NA	NA	<0.34	290	NE	6,200	NE	2.8	NE
Dibenzofuran	mg/kg	NA	NA	NA	<0.37	<0.72	<0.33	<0.33	NA	NA	<0.34	NE	NE	NE	NE	NE	NE
2-Methylnaphthalene	mg/kg	NA	NA	NA	<0.37	<0.72	<0.33	<0.33	NA	NA	<0.34	NE	NE	NE	NE	NE	NE
METALS, TOTAL																	
Antimony	mg/kg	2.5	7.3	<0.97	<1.1	<0.98	5.6	<0.97	<1.0	7.6	<1.0	820	NE	82	NE	20	4.0
Arsenic	mg/kg	5.8	5.5	3.4	9.2	4.6	8.1	2.5	3.9	12	2.6	13	1,200	61	25,000	120-130	13
Beryllium	mg/kg	0.34	0.48	0.19	0.75	0.56	0.58	0.08	0.12	0.87	0.090	4,100	2,100	410	44,000	130,000-NE	0.59
Cadmium	mg/kg	4.50	0.74	0.23	0.55	0.49	1.5	0.13	0.22	3.2	0.16	2,000	2,800	200	59,000	590-NE	0.6
Chromium	mg/kg	10	5.8	6.1	20	15	12	3.5	5.0	20	3.1	6,100	420	4,100	690	NE (32-28)	16.2
Copper	mg/kg	41	31	14	22	19	48	6.6	10	78	6.3	82,000	NE	8,200	NE	330,000-NE	19.6
Lead	mg/kg	83	140	11	15	22	170	4.4	34	320	3.6	800	NE	700	NE	1,420	36.0
Mercury	mg/kg	0.10	<0.041	<0.044	<0.041	0.045	0.12	<0.040	<0.043	0.28	<0.040	610	16 (5)	61	0.1 (5)	32-NE	0.06
Nickel	mg/kg	12	8.8	6.8	30	22	14	5.4	6.8	22	4.6	41,000	21,000	4,100	440,000	14,000-NE	18
Selenium	mg/kg	0.56	0.67	0.28	0.57	0.45	1.1	<0.24	<0.26	1.1	<0.26	10,000	NE	1,000	NE	3.3-1.8	0.48
Silver	mg/kg	<0.50	<0.53	<0.49	<0.55	<0.49	<0.50	<0.49	<0.51	<0.51	<0.51	10,000	NE	1,000	NE	39-NE	0.55
Thallium	mg/kg	<0.25	0.32	<0.24	0.29	0.29	0.42	<0.24	<0.26	0.35	<0.26	160	NE	160	NE	3.4-4.4	0.32
Zinc	mg/kg	190	66	37	40	45	250	20	26	340	18	610,000	NE	61,000	NE	16,000-NE	95
pH																	
pH	Standard	8.2	8.1	8.1	8.3	8.0	7.8	8.4	8.3	7.8	8.7	USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12.5					

*Notes on final page

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	GP-16E	GP-17A	GP-18B	GP-19A							TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)	
		8-10	0-2	2-4	0-2								Ingestion	Inhalation	Ingestion	Inhalation		
Sample Date		9/5/07	9/5/07	9/5/07	9/5/07													
Parameter	Units																	
VOLATILE ORGANIC COMPOUNDS																		
Acetone	mg/kg	<0.24	NA	NA	NA							NE	100,000	NE	100,000	25	NE	
Benzene	mg/kg	<0.0049	NA	NA	NA							100	1.6	2,300	2.2	0.17	NE	
Carbon Disulfide	mg/kg	<0.013	NA	NA	NA							200,000	720	20,000	9	160	NE	
Tetrachloroethene	mg/kg	<0.0049	NA	NA	NA							110	20	2,400	28	0.3	NE	
Toluene	mg/kg	<0.0098	NA	NA	NA							410,000	650	410,000	42	29	NE	
Xylenes, m & p	mg/kg	<0.0049	NA	NA	NA							410,000	420	41,000	5.9	200	NE	
POLYNUCLEAR AROMATIC HYDROCARBONS																		
Anthracene	mg/kg	<0.054	NA	NA	NA							610,000	NE	610,000	NE	59,000	0.25	
Acenaphthylene	mg/kg	<0.054	NA	NA	NA							NE	NE	NE	NE	NE	0.03	
Acenaphthene	mg/kg	<0.054	NA	NA	NA							120,000	NE	120,000	NE	2,900	0.09	
Benzo(a)anthracene	mg/kg	<0.054	NA	NA	NA							8	NE	170	NE	8	1.1	
Benzo(a)pyrene	mg/kg	<0.054	NA	NA	NA							0.8	NE	17	NE	82	1.3	
Benzo(b)fluoranthene	mg/kg	<0.054	NA	NA	NA							8	NE	170	NE	25	1.5	
Benzo(g,h,i)perylene	mg/kg	<0.054	NA	NA	NA							NE	NE	NE	NE	NE	0.68	
Benzo(k)fluoranthene	mg/kg	<0.054	NA	NA	NA							78	NE	1,700	NE	250	0.99	
Chrysene	mg/kg	<0.054	NA	NA	NA							780	NE	17,000	NE	800	1.2	
Dibenzo(a,h)anthracene	mg/kg	<0.054	NA	NA	NA							0.8	NE	17	NE	7.6	0.2	
Fluoranthene	mg/kg	<0.054	NA	NA	NA							82,000	NE	82,000	NE	21,000	2.7	
Fluorene	mg/kg	<0.054	NA	NA	NA							82,000	NE	82,000	NE	2,800	0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	<0.054	NA	NA	NA							8	NE	170	NE	60	0.86	
Naphthalene	mg/kg	<0.054	NA	NA	NA							41,000	270	4,100	1.8	18	0.04	
Phenanthrene	mg/kg	<0.054	NA	NA	NA							NE	NE	NE	NE	NE	1.3	
Pyrene	mg/kg	<0.054	NA	NA	NA							61,000	NE	61,000	NE	21000	1.9	

*Notes on final page

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	GP-16E	GP-17A	GP-18B	GP-19A							TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)		
		8-10	0-2	2-4	0-2								Ingestion	Inhalation	Ingestion	Inhalation			
Sample Date		9/5/07	9/5/07	9/5/07	9/5/07														
Parameter																			
SEMIVOLATILE ORGANIC COMPOUNDS																			
Carbazole	mg/kg	<0.35	NA	NA	NA							290	NE	6,200	NE	2.8	NE		
Dibenzofuran	mg/kg	<0.35	NA	NA	NA							NE	NE	NE	NE	NE	NE		
2-Methylnaphthalene	mg/kg	<0.35	NA	NA	NA							NE	NE	NE	NE	NE	NE		
METALS, TOTAL																			
Antimony	mg/kg	<0.98	3.6	<1.0	1.9							820	NE	82	NE	20	4.0		
Arsenic	mg/kg	3.1	18	2.4	5.4							13	1,200	61	25,000	120-130	13		
Beryllium	mg/kg	0.14	0.68	0.10	0.33							4,100	2,100	410	44,000	130,000-NE	0.59		
Cadmium	mg/kg	0.19	2.3	0.12	1.5							2,000	2,800	200	59,000	590-NE	0.6		
Chromium	mg/kg	6.8	15	3.6	35							6,100	420	4,100	690	NE (32-28) ⁽⁶⁾	16.2		
Copper	mg/kg	11	130	5.7	41							82,000	NE	8,200	NE	330,000-NE	19.6		
Lead	mg/kg	7.5	230	2.8	96							800	NE	700	NE	1,420	36.0		
Mercury	mg/kg	<0.038	7.5	<0.042	0.066							610	16 (5)	61	0.1 (5)	32-NE	0.06		
Nickel	mg/kg	7.1	23	4.5	20							41,000	21,000	4,100	440,000	14,000-NE	18		
Selenium	mg/kg	0.41	0.74	<0.26	0.61							10,000	NE	1,000	NE	3.3-1.8	0.48		
Silver	mg/kg	<0.49	<0.53	<0.51	<0.53							10,000	NE	1,000	NE	39-NE	0.55		
Thallium	mg/kg	<0.24	0.31	<0.26	<0.26							160	NE	160	NE	3.4-4.4	0.32		
Zinc	mg/kg	23	390	16	450							610,000	NE	61,000	NE	16,000-NE	95		
pH																			
pH	Standard	8.2	8.2	8.6	8.2														USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12.5

*Notes on final page

TABLE 3
SUMMARY OF CARLSON SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Notes:

- (1): Soil remediation objective (SRO) for the soil ingestion or inhalation routes for industrial-commercial exposure (35 IAC 742 Appendix B, Table B).
- (2): Soil remediation objective (SRO) for the soil ingestion or inhalation routes for construction worker exposure (35 IAC 742 Appendix B, Table B).
- (3): The soil remediation objective (SRO) for the soil component of the groundwater ingestion route for Class II groundwater 35 IAC 742 Appendix B, Table B. For metals and cyanide, objectives are based on leached concentrations or pH-specific objectives may be used. Objectives are provide for pH range of 7.25 to 8.74
- (4): Concentrations of Inorganic Chemicals in Background Soils within Counties Inside Metropolitan Statistical Areas (35 IAC 742 Appendix A, Table G).
Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils within the City of Chicago (35 IAC 742 Appendix A, Table H).
- (5): Soil remediation objective for inhalation route only applies at sites where elemental mercury (CAS#7439-97-6) is a contaminant of concern (35 IAC 742 Appendix B, Tables A and B).
- (6): There are no Class II objectives for chromium, Class I objectives are provided, Class I objectives are for hexavalent chromium which is more toxic than trivalent chromium which is naturally more prevalent

mg/kg Milligram per kilogram

NE Not established by the Illinois Environmental Protection Agency

NA Not analyzed

ND Not detected

E Laboratory qualifier - value above quantitation range

BOLD Laboratory Analytical Detection

BOLD + HIGHLIGHT Laboratory Analytical Detection that exceeds TACO Tier 1 Industrial-Commercial Objective for sites with Class I Groundwater

Created By: MEJ 7/17/2017

Reviewed By: EJW 12/20/17

TABLE 4
PLANNED SOIL BORINGS AND SAMPLING

4301 W Chicago Ave
Chicago, Illinois

Boring Number	Depth	Sample Number	Sample Depth	Analytical Testing	Notes
PROPOSED GEOTECHNICAL/ENVIRONMENTAL BORINGS					
B-1	40.0	B-1A	0.0 - 3.0	PNAs, PP Metals, pH	Near Former Structures, Near GP-3 with elevated PNAs at 0'-2'.
		B-1B	TBD	TBD	HOLD for Vertical Delineation
B-2	30.0	B-2A	0.0 - 3.0	PNAs, PP Metals, pH	Near Former Structures and Building Demo Pile.
		B-2B	TBD	TBD	HOLD for Vertical Delineation
B-3	40.0	B-3A	0.0 - 3.0	PNAs, PP Metals, pH	Near GP-7 with elevated PNAs at 6'-12'.
		B-3B	6.0' - 12.0'	Target Compound List	Near GP-7 with elevated PNAs at 6'-12'.
		B-3C	TBD	TBD	HOLD for Vertical Delineation
B-4	30.0	B-4A	0.0 - 3.0	PNAs, PP Metals, pH	Near Former Structures and Building Demo Pile, Near GP-3 with elevated PNAs at 0'-2'.
		B-4B	TBD	TBD	HOLD for Vertical Delineation
B-5	30.0	No samples			
B-6	30.0	B-6A	0.0 - 3.0	PNAs, PP Metals, pH	Near Former Structures and Building Demo Pile, Near GP-11 with elevated PNA at 6'-8' and GP-7 with elevated PNAs at 6'-12'.
		B-6B	6.0' - 12.0'	PNAs, PP Metals, pH	Near Former Structures and Building Demo Pile, Near GP-11 with elevated PNA at 6'-8' and GP-7 with elevated PNAs at 6'-12'.
		B-6C	TBD	TBD	HOLD for Vertical Delineation
B-7	40.0	B-7A	0.0 - 3.0	PNAs, PP Metals, pH	Near Former Structures and Building Demo Pile, Near GP-3 with elevated PNAs at 0'-2'.
		B-7B	TBD	TBD	HOLD for Vertical Delineation
B-8	30.0	No samples			
B-9	40.0	B-9A	0.0 - 3.0	PNAs, PP Metals, pH	Near GP-11 with elevated PNA at 6'-8'
		B-9B	TBD	TBD	HOLD for Vertical Delineation
B-10	25.0	B-10A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample.
		B-10B	TBD	TBD	HOLD for Vertical Delineation
B-11	25.0	B-11A	0.0 - 3.0	PNAs, PP Metals, pH, added VOCs	Additional Shallow Sample, soil mound
		B-11B	TBD	TBD	HOLD for Vertical Delineation
B-12	25.0	B-12A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample.
		B-12B	TBD	TBD	HOLD for Vertical Delineation
B-13	30.0	No samples			
B-14	30.0	B-14A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample.
		B-14B	TBD	TBD	HOLD for Vertical Delineation
B-15	25.0	B-15A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample.
		B-15B	TBD	TBD	HOLD for Vertical Delineation
B-16	25.0	B-16A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample.
		B-16B	TBD	TBD	HOLD for Vertical Delineation
B-17	25.0	B-17A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample.
		B-17B	TBD	TBD	HOLD for Vertical Delineation
B-18	16.0	B-18A	0.0 - 3.0	Target Compound List	Additional Shallow Sample, Near GP-3 with elevated PNAs at 0'-2'.
		B-18B	3.0' - 6.0'	PNAs	Vertical Delineation for GP-3 with elevated PNAs at 0'-2'.
		B-18C	TBD	TBD	HOLD for Vertical Delineation
PROPOSED ENVIRONMENTAL BORINGS					
ESB-1	16.0	ESB-1A	0.0 - 3.0	PNAs, PP Metals, pH	Additional Shallow Sample near soil mound
		ESB-1B	12.0' - 16.0'	PNAs	Vertical Delineation for GP-7 with elevated PNAs at 6'-12'.
ESB-2	16.0	ESB-2A	0.0 - 3.0	Target Compound List, herbicides	Additional Shallow Sample, offsite west
		ESB-2B	TBD	PNAs, PP Metals, pH	Near GP-6 with elevated PNAs at 4'-6'.
ESB-3	16.0	ESB-3A	0.0 - 3.0	Target Compound List	Additional Shallow Sample, offsite west
		ESB-3B	TBD	PNAs	Vertical Delineation for GP-6 with elevated PNAs at 4'-6'.
ESB-4	16.0	ESB-4A	0.0 - 3.0	Target Compound List	Additional Shallow Sample, former rail spur
		ESB-4B	TBD	TBD	HOLD for Vertical Delineation
ESB-5	16.0	ESB-5A	0.0 - 3.0	Target Compound List	Additional Shallow Sample, rail spur, south offsite
		ESB-5B	TBD	TBD	Additional Deep Sample.
ESB-6	16.0	ESB-6A	0.0 - 3.0	Target Compound List, herbicides	Additional Shallow Sample. Near Concrete Pile
		ESB-6B	TBD	TBD	HOLD for Vertical Delineation

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	ESB-1A	ESB-1C	ESB-2A	ESB-3A	ESB-3B	ESB-4A	ESB-5A	ESB-6A	B-1A	B-2A	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)	
		0-2	13-14	1.5-2.5	1-4	5.5-6.5	0.5-1.5	0-1	2-4	2-4	0-2			Ingestion	Inhalation	Ingestion	Inhalation	
Sample Date		8/9/17	8/9/17	8/2/17	8/2/17	8/2/17	8/7/17	8/3/17	8/4/17	8/9/17	8/9/17							
Parameter	Units																	
VOLATILE ORGANIC COMPOUNDS																		
Acetone	mg/kg	NA	NA	< 0.10	< 0.096	NA	0.15	< 0.12	< 0.13	NA	NA	NE	100,000	NE	100,000	25	NE	
Benzene	mg/kg	NA	NA	< 0.0067	< 0.0064	NA	< 0.0075	< 0.0083	< 0.0084	NA	NA	100	1.6	2,300	2.2	0.17	NE	
Carbon Disulfide	mg/kg	NA	NA	< 0.067	< 0.064	NA	< 0.075	< 0.083	< 0.084	NA	NA	200,000	720	20,000	9	160	NE	
Carbon Tetrachloride	mg/kg	NA	NA	< 0.0067	< 0.0064	NA	< 0.0075	< 0.0083	0.15	NA	NA	44	0.64	410	0.9	0.33	NE	
Chloroform	mg/kg	NA	NA	< 0.0067	< 0.0064	NA	< 0.0075	< 0.0083	0.034	NA	NA	940	0.54	2,000	0.76	2.9	NE	
Tetrachloroethene	mg/kg	NA	NA	< 0.0067	< 0.0064	NA	< 0.0075	0.027	< 0.0084	NA	NA	110	20	2,400	28	0.3	NE	
Toluene	mg/kg	NA	NA	< 0.0067	< 0.0064	NA	< 0.0075	< 0.0083	< 0.0084	NA	NA	410,000	650	410,000	42	29	NE	
Total Xylenes	mg/kg	NA	NA	< 0.020	< 0.019	NA	< 0.022	< 0.025	< 0.025	NA	NA	410,000	320	41,000	5.6	150	NE	
POLYNUCLEAR AROMATIC HYDROCARBONS																		
Acenaphthylene	mg/kg	< 0.034	< 0.034	< 0.038	< 0.35	0.16	0.11	0.05	0.12	< 0.034	< 0.035	NE	NE	NE	NE	NE	0.03	
Acenaphthene	mg/kg	< 0.034	< 0.034	< 0.038	0.41	0.19	0.41	< 0.034	< 0.036	< 0.034	< 0.035	120,000	NE	120,000	NE	2,900	0.09	
Anthracene	mg/kg	< 0.034	< 0.034	< 0.038	0.82	0.82	1.3	0.092	0.089	0.085	0.045	610,000	NE	610,000	NE	59,000	0.25	
Benzo(a)anthracene	mg/kg	0.084	< 0.034	0.045	2.4	2.6	3.1	0.16	0.25	0.21	0.16	8	NE	170	NE	8	1.1	
Benzo(a)pyrene	mg/kg	0.074	< 0.034	< 0.038	0.84	3.0	3.2	0.13	0.26	0.2	0.16	0.8	NE	17	NE	82	1.3	
Benzo(b)fluoranthene	mg/kg	0.070	< 0.034	< 0.038	< 0.35	2.9	3.3	0.18	0.35	0.18	0.15	8	NE	170	NE	25	1.5	
Benzo(g,h,i)perylene	mg/kg	0.071	< 0.034	< 0.038	1.6	1.9	1.9	0.22	0.22	0.19	0.13	NE	NE	NE	NE	NE	0.68	
Benzo(k)fluoranthene	mg/kg	0.066	< 0.034	< 0.038	< 0.35	2.2	2.5	0.13	0.25	0.16	0.14	78	NE	1,700	NE	250	0.99	
Chrysene	mg/kg	0.11	< 0.034	0.052	4.1	2.8	3.5	0.25	0.34	0.27	0.19	780	NE	17,000	NE	800	1.2	
Dibenzo(a,h)anthracene	mg/kg	0.035	< 0.034	< 0.038	< 0.35	0.87	0.81	0.062	0.094	0.076	0.064	0.8	NE	17	NE	7.6	0.2	
Fluoranthene	mg/kg	0.13	< 0.034	0.071	3.1	4.3	7.7	0.31	0.52	0.34	0.26	82,000	NE	82,000	NE	21,000	2.7	
Fluorene	mg/kg	< 0.034	< 0.034	< 0.038	< 0.35	0.25	0.46	< 0.034	< 0.036	< 0.034	< 0.035	82,000	NE	82,000	NE	2,800	0.1	
Indeno(1,2,3-cd)pyrene	mg/kg	0.057	< 0.034	< 0.038	0.94	1.7	1.7	0.12	0.17	0.14	0.11	8	NE	170	NE	60	0.86	
Naphthalene	mg/kg	< 0.034	< 0.034	< 0.038	< 0.35	0.12	0.088	0.059	0.07	0.051	< 0.035	41,000	270	4,100	1.8	18	0.04	
Phenanthrene	mg/kg	0.13	< 0.034	< 0.038	2.6	2.3	5.7	0.29	0.45	0.37	0.16	NE	NE	NE	NE	NE	1.3	
Pyrene	mg/kg	0.13	< 0.034	0.065	6.4	3.9	6.3	0.29	0.52	0.34	0.22	61,000	NE	61,000	NE	21000	1.9	
SEMIVOLATILE ORGANIC COMPOUNDS																		
Carbazole	mg/kg	NA	NA	< 0.20	< 1.8	NA	0.75	< 0.18	< 0.18	NA	NA	290	NE	6,200	NE	2.8	NE	
Dibenzofuran	mg/kg	NA	NA	< 0.20	< 1.8	NA	0.26	< 0.18	< 0.18	NA	NA	NE	NE	NE	NE	NE	NE	
2-Methylnaphthalene	mg/kg	NA	NA	< 0.20	< 1.8	NA	< 0.18	< 0.18	< 0.18	NA	NA	NE	NE	NE	NE	NE	NE	
PESTICIDES																		
4,4'-DDD	mg/kg	NA	NA	< 0.0018	< 0.0017	NA	< 0.0017	< 0.0016	0.042	NA	NA	24	NE	520	NE	80	NE	
4,4'-DDE	mg/kg	NA	NA	< 0.0018	< 0.0017	NA	< 0.0017	< 0.0016	0.069	NA	NA	17	NE	370	NE	270	NE	
4,4'-DDT	mg/kg	NA	NA	< 0.0018	< 0.0017	NA	< 0.0017	< 0.0016	0.042	NA	NA	17	1,500	100	2,100	160	NE	

*Notes on final page

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	ESB-1A 0-2	ESB-1C 13-14	ESB-2A 1.5-2.5	ESB-3A 1-4	ESB-3B 5.5-6.5	ESB-4A 0.5-1.5	ESB-5A 0-1	ESB-6A 2-4	B-1A 2-4	B-2A 0-2	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)		
											Ingestion	Inhalation	Ingestion	Inhalation				
Sample Date	8/9/17	8/9/17	8/2/17	8/2/17	8/2/17	8/7/17	8/3/17	8/4/17	8/9/17	8/9/17								
Parameter	Units																	
POLYCHLORINATED BIPHENYLS																		
Polychlorinated Biphenyls (PCB's)	mg/kg	NA	NA	< 0.092	< 0.085	NA	< 0.084	< 0.082	< 0.085	NA	NA	1	NE	1	NE	NE	NE	
METALS, TOTAL																		
Aluminum	mg/kg	NA	NA	6600	4400	NA	3900	3600	4500	NA	NA	NE	NE	NE	NE	NE	9500	
Antimony	mg/kg	< 1.8	NA	< 2.1	< 1.9	NA	2	2.2	3.1	< 1.8	< 1.9	820	NE	82	NE	20	4.0	
Arsenic	mg/kg	8.6	NA	8.6	6.4	NA	13	12	18	6.2	12	13	1,200	61	25,000	120-130	13	
Barium	mg/kg	NA	NA	42	45	NA	79	40	57	NA	NA	140,000	910,000	14,000	870,000	1,700-NE	110	
Beryllium	mg/kg	0.53	NA	0.54	< 0.48	NA	0.69	0.62	0.74	< 0.45	0.60	4,100	2,100	410	44,000	17,000-NE	0.59	
Cadmium	mg/kg	0.48	NA	0.59	0.56	NA	2.1	2.1	1.7	0.47	0.76	2,000	2,800	200	59,000	110-NE	0.6	
Calcium	mg/kg	NA	NA	40000	80000	NA	42000	68000	49000	NA	NA	NE	NE	NE	NE	NE	NE	
Chromium	mg/kg	16	NA	17	13	NA	18	21	24	16	18	6,100	420	4,100	690	NE (36-21) ⁽⁶⁾	16.2	
SPLP Chromium	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	1.0	NE	
Cobalt	mg/kg	NA	NA	9.3	4.7	NA	6.3	5.8	7.1	NA	NA	120,000	NE	12,000	NE	NE	8.9	
SPLP Cobalt	mg/L	NA	NA	< 0.0040	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	1.0	NE	
Copper	mg/kg	39	NA	47	77	NA	78	93	700	27	58	82,000	NE	8,200	NE	200,000-NE	19.6	
Iron	mg/kg	NA	NA	24000	19000	NA	28000	35000	39000	NA	NA	NE	NE	NE	NE	NE	15,900	
TCLP Iron	mg/L	NA	NA	NA	<0.25	NA	3.1	2.4	NA	NA	NA	NE	NE	NE	NE	5	NE	
SPLP Iron	mg/L	NA	NA	0.65	NA	NA	NA	NA	0.86	NA	NA	NE	NE	NE	NE	5	NE	
Lead	mg/kg	51	NA	94	160	NA	180	210	420	75	85	800	NE	700	NE	1,420-3,760	36	
Magnesium	mg/kg	NA	NA	23000	43000	NA	23000	31000	26000	NA	NA	NE	NE	730,000	NE	NE	4820	
Manganese	mg/kg	NA	NA	410	340	NA	360	470	1400	NA	NA	41,000	91,000	4,100	8,700	NE	636	
SPLP Manganese	mg/L	NA	NA	NA	NA	NA	NA	NA	0.012	NA	NA	NE	NE	NE	NE	10	NE	
Mercury	mg/kg	0.043	NA	0.038	0.065	NA	0.14	0.15	0.15	0.073	0.061	610	16 (5)	61	0.1 (5)	16-NE	0.06	
Nickel	mg/kg	24	NA	27	15	NA	19	21	20	10	29	41,000	21,000	4,100	440,000	3,500-NE	18	
Potassium	mg/kg	NA	NA	1400	800	NA	630	440	730	NA	NA	NE	NE	NE	NE	NE	1268	
Selenium	mg/kg	< 0.92	NA	< 1.0	< 0.95	NA	< 0.97	1.1	1.1	< 0.91	< 0.96	10,000	NE	1,000	NE	4.5-1.3	0.48	
Silver	mg/kg	< 0.92	NA	< 1.0	< 0.95	NA	< 0.97	< 0.92	< 0.98	< 0.91	< 0.96	10,000	NE	1,000	NE	NE (13-NE) ⁽⁷⁾	0.55	
Sodium	mg/kg	NA	NA	100	180	NA	150	180	250	NA	NA	NE	NE	NE	NE	NE	130	
Thallium	mg/kg	< 0.92	NA	< 1.0	< 0.95	NA	< 0.97	< 0.92	< 0.98	< 0.91	< 0.96	160	NE	160	NE	30-49	0.32	
Vanadium	mg/kg	NA	NA	17	18	NA	18	17	20	NA	NA	14,000	NE	1,400	NE	NE (980) ⁽⁷⁾	25.2	
Zinc	mg/kg	110	NA	130	180	NA	690	750	580	93	180	610,000	NE	61,000	NE	15,000-NE	95	
CYANIDE																		
Cyanide	mg/kg	NA	NA	< 0.29	< 0.27	NA	< 0.27	<0.26	<0.27	NA	NA	41,000	NE	4,100	NE	NE	0.51	
pH																		
pH	Standard	8.05	NA	8.21	8.15	NA	7.86	7.89	7.56	8.07	7.92	USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12.5						

*Notes on final page

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet) Sample Date Parameter	Units	B-3A	B-3B	B-4A	B-6A	B-6B	B-7A	B-9A	B-10A	B-11A	B-12A	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		0-2	6-8	0-2	1-3	8-10	0-2	1-3	0-1	1-2	0-2	Ingestion	Inhalation	Ingestion	Inhalation		
VOLATILE ORGANIC COMPOUNDS																	
Acetone	mg/kg	NA	< 0.081	NA	NA	NA	NA	NA	NA	< 0.074	NA	NE	100,000	NE	100,000	25	NE
Benzene	mg/kg	NA	< 0.0054	NA	NA	NA	NA	NA	NA	< 0.0050	NA	100	1.6	2,300	2.2	0.17	NE
Carbon Disulfide	mg/kg	NA	< 0.054	NA	NA	NA	NA	NA	NA	< 0.050	NA	200,000	720	20,000	9	160	NE
Carbon Tetrachloride	mg/kg	NA	< 0.0054	NA	NA	NA	NA	NA	NA	< 0.0050	NA	44	0.64	410	0.9	0.33	NE
Chloroform	mg/kg	NA	< 0.0054	NA	NA	NA	NA	NA	NA	< 0.0050	NA	940	0.54	2,000	0.76	2.9	NE
Tetrachloroethene	mg/kg	NA	< 0.0054	NA	NA	NA	NA	NA	NA	< 0.0050	NA	110	20	2,400	28	0.3	NE
Toluene	mg/kg	NA	< 0.0054	NA	NA	NA	NA	NA	NA	< 0.0050	NA	410,000	650	410,000	42	29	NE
Total Xylenes	mg/kg	NA	<0.016	NA	NA	NA	NA	NA	NA	<0.015	NA	410,000	320	41,000	5.6	150	NE
POLYNUCLEAR AROMATIC HYDROCARBONS																	
Acenaphthylene	mg/kg	< 0.035	< 0.036	0.05	0.085	0.10	< 0.039	< 0.37	0.12	< 0.039	0.11	610,000	NE	610,000	NE	NE	0.25
Acenaphthene	mg/kg	< 0.035	< 0.036	< 0.035	0.32	< 0.040	< 0.039	< 0.37	< 0.035	< 0.039	< 0.034	NE	NE	NE	NE	2,900	0.03
Anthracene	mg/kg	< 0.035	< 0.036	0.17	2.0	0.25	0.04	0.57	0.28	0.066	0.16	120,000	NE	120,000	NE	59,000	0.09
Benzo(a)anthracene	mg/kg	0.11	< 0.036	0.75	4.9	0.64	0.17	1.3	0.25	0.19	0.73	8	NE	170	NE	8	1.1
Benzo(a)pyrene	mg/kg	0.13	< 0.036	0.71	3.9	0.68	< 0.039	1.2	0.31	0.18	0.91	0.8	NE	17	NE	82	1.3
Benzo(b)fluoranthene	mg/kg	0.11	< 0.036	0.56	3.5	0.53	0.042	1.0	0.41	0.18	0.63	8	NE	170	NE	25	1.5
Benzo(g,h,i)perylene	mg/kg	0.097	< 0.036	0.61	3.3	0.65	0.13	2.0	0.51	0.12	0.66	NE	NE	NE	NE	NE	0.68
Benzo(k)fluoranthene	mg/kg	0.096	< 0.036	0.64	3.2	0.67	< 0.039	0.38	0.29	0.16	0.65	78	NE	1,700	NE	250	0.99
Chrysene	mg/kg	0.13	< 0.036	1.1	5.1	0.89	0.21	2.8	0.41	0.21	0.79	780	NE	17,000	NE	800	1.2
Dibenzo(a,h)anthracene	mg/kg	< 0.035	< 0.036	0.27	1.1	0.25	0.14	0.52	0.11	0.066	0.25	0.8	NE	17	NE	7.6	0.2
Fluoranthene	mg/kg	0.16	0.040	0.95	9.8	0.97	0.32	1.2	0.39	0.34	1.1	82,000	NE	82,000	NE	21,000	2.7
Fluorene	mg/kg	< 0.035	< 0.036	0.049	0.46	0.067	< 0.039	< 0.37	< 0.035	< 0.039	< 0.034	82,000	NE	82,000	NE	2,800	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.075	< 0.036	0.44	2.5	0.51	0.11	0.73	0.30	0.098	0.49	8	NE	170	NE	60	0.86
Naphthalene	mg/kg	< 0.035	< 0.036	0.06	0.061	0.20	< 0.039	1.2	0.064	0.046	< 0.034	41,000	270	4,100	1.8	18	0.04
Phenanthrene	mg/kg	0.088	< 0.036	0.92	6.5	0.91	0.17	5.7	0.34	0.19	0.48	NE	NE	NE	NE	NE	1.3
Pyrene	mg/kg	0.18	0.043	1.1	13	1.2	0.29	2.8	0.40	0.29	1.5	61,000	NE	61,000	NE	21000	1.9
SEMIVOLATILE ORGANIC COMPOUNDS																	
Carbazole	mg/kg	NA	< 0.18	NA	NA	NA	NA	NA	NA	NA	NA	290	NE	6,200	NE	2.8	NE
Dibenzofuran	mg/kg	NA	< 0.18	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	NE
2-Methylnaphthalene	mg/kg	NA	< 0.18	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	NE
PESTICIDES																	
4,4'-DDD	mg/kg	NA	< 0.0017	NA	NA	NA	NA	NA	NA	NA	NA	24	NE	520	NE	80	NE
4,4'-DDE	mg/kg	NA	< 0.0017	NA	NA	NA	NA	NA	NA	NA	NA	17	NE	370	NE	270	NE
4,4'-DDT	mg/kg	NA	< 0.0017	NA	NA	NA	NA	NA	NA	NA	NA	17	1,500	100	2,100	160	NE

*Notes on final page

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Sample Date	B-3A	B-3B	B-4A	B-6A	B-6B	B-7A	B-9A	B-10A	B-11A	B-12A	TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		0-2	6-8	0-2	1-3	8-10	0-2	1-3	0-1	1-2	0-2	Ingestion	Inhalation	Ingestion	Inhalation		
Parameter	Units	8/8/17	8/8/17	8/2/17	8/8/17	8/8/17	8/2/17	8/8/17	8/7/17	8/8/17	8/7/17						
POLYCHLORINATED BIPHENYLS																	
Polychlorinated Biphenyls (PCB's)	mg/kg	NA	< 0.087	NA	NA	NA	NA	NA	NA	NA	NA	1	NE	1	NE	NE	NE
METALS, TOTAL																	
Aluminum	mg/kg	NA	2600	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	9500
Antimony	mg/kg	< 1.9	< 2.0	2.5	< 2.0	3.4	4.6	8	4.1	< 2.0	< 1.8	820	NE	82	NE	20	4.0
Arsenic	mg/kg	4.2	2.7	12	6.8	13	12	14	7.5	8.6	7.2	13	1,200	61	25,000	120-130	13
Barium	mg/kg	NA	13	NA	NA	NA	NA	NA	NA	NA	NA	140,000	910,000	14,000	870,000	1,700-NE	110
Beryllium	mg/kg	< 0.48	< 0.49	1.1	0.56	0.57	1.6	0.56	< 0.46	0.78	0.50	4,100	2,100	410	44,000	17,000-NE	0.59
Cadmium	mg/kg	< 0.48	< 0.49	1.5	< 0.49	2.7	1.4	1.3	0.96	< 0.50	0.60	2,000	2,800	200	59,000	110-NE	0.6
Calcium	mg/kg	NA	50000	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	NE
Chromium	mg/kg	9.5	6.7	16	20	29	13	17	12	20	12	6,100	420	4,100	690	NE (36-21) ⁽⁶⁾	16.2
SPLP Chromium	mg/L	NA	NA	NA	NA	<0.0040	NA	NA	NA	NA	NA	NE	NE	NE	NE	1.0	NE
Cobalt	mg/kg	NA	3.1	NA	NA	NA	NA	NA	NA	NA	NA	120,000	NE	12,000	NE	NE	8.9
SPLP Cobalt	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	1.0	NE
Copper	mg/kg	18	7.7	83	41	170	79	90	67	35	46	82,000	NE	8,200	NE	200,000-NE	19.6
Iron	mg/kg	NA	7600	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	15,900
TCLP Iron	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	5	NE
SPLP Iron	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	5	NE
Lead	mg/kg	29	6.4	190	66	240	160	320	130	38	86	800	NE	700	NE	1,420-3,760	36
Magnesium	mg/kg	NA	26000	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	730,000	NE	NE	4820
Manganese	mg/kg	NA	200	NA	NA	NA	NA	NA	NA	NA	NA	41,000	91,000	4,100	8,700	NE	636
SPLP Manganese	mg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	10	NE
Mercury	mg/kg	0.075	0.047	0.086	0.077	0.24	0.23	0.22	0.20	0.033	0.32	610	16 (5)	61	0.1 (5)	16-NE	0.06
Nickel	mg/kg	12	7.4	17	29	31	18	19	16	31	15	41,000	21,000	4,100	440,000	3,500-NE	18
Potassium	mg/kg	NA	440	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	1268
Selenium	mg/kg	< 0.96	< 0.98	1.6	< 0.98	1.2	2	1.2	< 0.93	< 0.99	< 0.90	10,000	NE	1,000	NE	4.5-1.3	0.48
Silver	mg/kg	< 0.96	< 0.98	< 0.95	< 0.98	< 1.1	< 1.0	< 0.97	< 0.93	< 0.99	< 0.90	10,000	NE	1,000	NE	NE (13-NE) ⁽⁷⁾	0.55
Sodium	mg/kg	NA	95	NA	NA	NA	NA	NA	NA	NA	NA	NE	NE	NE	NE	NE	130
Thallium	mg/kg	< 0.96	< 0.98	< 0.95	< 0.98	< 1.1	< 1.0	< 0.97	< 0.93	< 0.99	< 0.90	160	NE	160	NE	30-49	0.32
Vanadium	mg/kg	NA	12	NA	NA	NA	NA	NA	NA	NA	NA	14,000	NE	1,400	NE	NE (980) ⁽⁷⁾	25.2
Zinc	mg/kg	59	25	280	100	650	180	370	200	67	160	610,000	NE	61,000	NE	15,000-NE	95
CYANIDE																	
Cyanide	mg/kg	NA	<0.27	NA	NA	NA	NA	NA	NA	NA	NA	41,000	NE	4,100	NE	120	0.51
pH																	
pH	Standard	7.77	8.04	7.61	9.92	8.22	7.42	7.74	7.82	7.97	7.81	USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12.5					

*Notes on final page

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	B-14A	B-15A	B-16A	B-17A	B-18A	B-18B					TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class I Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		1-2	1.5-3	1-2	0-2	0-2	4.5-5.5					Ingestion	Inhalation	Ingestion	Inhalation		
Sample Date		8/4/17	8/8/17	8/7/17	8/4/17	8/9/17	8/9/17										
Parameter	Units																
VOLATILE ORGANIC COMPOUNDS																	
Acetone	mg/kg	NA	NA	NA	NA	< 0.11	NA					NE	100,000	NE	100,000	25	NE
Benzene	mg/kg	NA	NA	NA	NA	< 0.0071	NA					100	1.6	2,300	2.2	0.17	NE
Carbon Disulfide	mg/kg	NA	NA	NA	NA	< 0.071	NA					200,000	720	20,000	9	160	NE
Carbon Tetrachloride	mg/kg	NA	NA	NA	NA	< 0.0071	NA					44	0.64	410	0.9	0.33	NE
Chloroform	mg/kg	NA	NA	NA	NA	< 0.0071	NA					940	0.54	2,000	0.76	2.9	NE
Tetrachloroethene	mg/kg	NA	NA	NA	NA	< 0.0071	NA					110	20	2,400	28	0.3	NE
Toluene	mg/kg	NA	NA	NA	NA	< 0.0071	NA					410,000	650	410,000	42	29	NE
Total Xylenes	mg/kg	NA	NA	NA	NA	0.021	NA					410,000	320	41,000	5.6	150	NE
POLYNUCLEAR AROMATIC HYDROCARBONS																	
Acenaphthylene	mg/kg	< 0.035	< 0.035	< 0.034	0.18	< 0.035	< 0.034					NE	NE	NE	NE	NE	0.03
Acenaphthene	mg/kg	< 0.035	0.11	< 0.034	< 0.034	< 0.035	< 0.034					120,000	NE	120,000	NE	2,900	0.09
Anthracene	mg/kg	0.037	< 0.035	< 0.034	0.089	0.061	< 0.034					610,000	NE	610,000	NE	59,000	0.25
Benzo(a)anthracene	mg/kg	0.15	0.24	0.058	0.18	0.16	< 0.034					8	NE	170	NE	8	1.1
Benzo(a)pyrene	mg/kg	0.17	0.22	0.089	0.17	0.11	< 0.034					0.8	NE	17	NE	82	1.3
Benzo(b)fluoranthene	mg/kg	0.18	0.23	0.11	0.23	0.14	< 0.034					8	NE	170	NE	25	1.5
Benzo(g,h,i)perylene	mg/kg	0.14	0.20	0.071	0.15	0.13	< 0.034					NE	NE	NE	NE	NE	0.68
Benzo(k)fluoranthene	mg/kg	0.12	0.16	0.081	0.15	0.095	< 0.034					78	NE	1,700	NE	250	0.99
Chrysene	mg/kg	0.25	0.30	0.086	0.31	0.25	< 0.034					780	NE	17,000	NE	800	1.2
Dibenzo(a,h)anthracene	mg/kg	0.063	0.050	< 0.034	0.066	0.064	< 0.034					0.8	NE	17	NE	7.6	0.2
Fluoranthene	mg/kg	0.22	0.33	0.055	0.34	0.26	< 0.034					82,000	NE	82,000	NE	21,000	2.7
Fluorene	mg/kg	< 0.035	< 0.035	< 0.034	< 0.034	< 0.035	< 0.034					82,000	NE	82,000	NE	2,800	0.1
Indeno(1,2,3-cd)pyrene	mg/kg	0.10	0.13	0.054	0.11	0.092	< 0.034					8	NE	170	NE	60	0.86
Naphthalene	mg/kg	0.082	0.079	< 0.034	< 0.034	0.10	< 0.034					41,000	270	4,100	1.8	18	0.04
Phenanthrene	mg/kg	0.38	0.90	0.063	0.34	0.48	< 0.034					NE	NE	NE	NE	NE	1.3
Pyrene	mg/kg	0.29	0.35	0.096	0.45	0.25	< 0.034					61,000	NE	61,000	NE	21000	1.9
SEMIVOLATILE ORGANIC COMPOUNDS																	
Carbazole	mg/kg	NA	NA	NA	NA	<0.18	NA					290	NE	6,200	NE	2.8	NE
Dibenzofuran	mg/kg	NA	NA	NA	NA	<0.18	NA					NE	NE	NE	NE	NE	NE
2-Methylnaphthalene	mg/kg	NA	NA	NA	NA	0.18	NA					NE	NE	NE	NE	NE	NE
PESTICIDES																	
4,4'-DDD	mg/kg	NA	NA	NA	NA	< 0.0017	NA					24	NE	520	NE	80	NE
4,4'-DDE	mg/kg	NA	NA	NA	NA	< 0.0017	NA					17	NE	370	NE	270	NE
4,4'-DDT	mg/kg	NA	NA	NA	NA	< 0.0017	NA					17	1,500	100	2,100	160	NE

*Notes on final page

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID Sample Depth (feet)	Units	B-14A	B-15A	B-16A	B-17A	B-18A	B-18B					TACO Tier 1 Industrial- Commercial SROs (1)		TACO Tier 1 Construction Worker SROs (2)		TACO Tier 1 SRO Class II Groundwater (3)	TACO Tier 1 Background Concentrations (4)
		1-2	1.5-3	1-2	0-2	0-2	4.5-5.5					Ingestion	Inhalation	Ingestion	Inhalation		
Sample Date		8/4/17	8/8/17	8/7/17	8/4/17	8/9/17	8/9/17										
Parameter	Units																
POLYCHLORINATED BIPHENYLS																	
Polychlorinated Biphenyls (PCB's)	mg/kg	NA	NA	NA	NA	< 0.084	NA					1	NE	1	NE	NE	NE
METALS, TOTAL																	
Aluminum	mg/kg	NA	NA	NA	NA	3500	NA					NE	NE	NE	NE	NE	9500
Antimony	mg/kg	< 1.9	3.3	< 1.9	4.3	3.0	NA					820	NE	82	NE	20	4.0
Arsenic	mg/kg	11	11	8.8	34	20	NA					13	1,200	61	25,000	120-130	13
Barium	mg/kg	NA	NA	NA	NA	99	NA					140,000	910,000	14,000	870,000	1,700-NE	110
Beryllium	mg/kg	< 0.48	0.77	< 0.47	0.89	0.70	NA					4,100	2,100	410	44,000	17,000-NE	0.59
Cadmium	mg/kg	< 0.48	0.8	0.96	1.9	3.1	NA					2,000	2,800	200	59,000	110-NE	0.6
Calcium	mg/kg	NA	NA	NA	NA	19000	NA					NE	NE	NE	NE	NE	NE
Chromium	mg/kg	7.2	11	13	18	61	NA					6,100	420	4,100	690	NE (36-21) ⁽⁶⁾	16.2
SPLP Chromium	mg/L	NA	NA	NA	NA	0.006	NA					NE	NE	NE	NE	1.0	NE
Cobalt	mg/kg	NA	NA	NA	NA	7.7	NA					120,000	NE	12,000	NE	NE	8.9
SPLP Cobalt	mg/L	NA	NA	NA	NA	NA	NA					NE	NE	NE	NE	1.0	NE
Copper	mg/kg	24	66	46	120	210	NA					82,000	NE	8,200	NE	200,000-NE	19.6
Iron	mg/kg	NA	NA	NA	NA	64000	NA					NE	NE	NE	NE	NE	15,900
TCLP Iron	mg/L	NA	NA	NA	NA	2.8	NA					NE	NE	NE	NE	5	NE
SPLP Iron	mg/L	NA	NA	NA	NA	NA	NA					NE	NE	NE	NE	5	NE
Lead	mg/kg	53	170	110	300	280	NA					800	NE	700	NE	1,420-3,760	36
Magnesium	mg/kg	NA	NA	NA	NA	9000	NA					NE	NE	730,000	NE	NE	4820
Manganese	mg/kg	NA	NA	NA	NA	750	NA					41,000	91,000	4,100	8,700	NE	636
SPLP Manganese	mg/L	NA	NA	NA	NA	0.038	NA					NE	NE	NE	NE	10	NE
Mercury	mg/kg	0.091	0.090	0.075	0.097	0.25	NA					610	16 (5)	61	0.1 (5)	16-NE	0.06
Nickel	mg/kg	11	15	13	24	41	NA					41,000	21,000	4,100	440,000	3,500-NE ⁽⁷⁾	18
Potassium	mg/kg	NA	NA	NA	NA	360	NA					NE	NE	NE	NE	NE	1268
Selenium	mg/kg	< 0.96	1.3	< 0.94	2.0	0.97	NA					10,000	NE	1,000	NE	4.5-1.3	0.48
Silver	mg/kg	< 0.96	< 0.96	< 0.94	< 0.95	< 0.94	NA					10,000	NE	1,000	NE	NE (13-NE) ⁽⁷⁾	0.55
Sodium	mg/kg	NA	NA	NA	NA	180	NA					NE	NE	NE	NE	NE	130
Thallium	mg/kg	< 0.96	< 0.96	< 0.94	< 0.95	< 0.94	NA					160	NE	160	NE	30-49	0.32
Vanadium	mg/kg	NA	NA	NA	NA	19	NA					14,000	NE	1,400	NE	NE (980) ⁽⁷⁾	25.2
Zinc	mg/kg	80	210	260	910	500	NA					610,000	NE	61,000	NE	15,000-NE	95
CYANIDE																	
Cyanide	mg/kg	NA	NA	NA	NA	0.27	NA					41,000	NE	4,100	NE	120	0.51
pH																	
pH	Standard	7.21	7.49	8.36	7.95	7.65	NA					USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12					

*Notes on final page

TABLE 5
SUMMARY OF SOIL ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Notes:

- (1): Soil remediation objective (SRO) for the soil ingestion or inhalation routes for industrial-commercial exposure (35 IAC 742 Appendix B, Table B).
- (2): Soil remediation objective (SRO) for the soil ingestion or inhalation routes for construction worker exposure (35 IAC 742 Appendix B, Table B).
- (3): The soil remediation objective (SRO) for the soil component of the groundwater ingestion route for Class II groundwater 35 IAC 742 Appendix B, Table B. For metals and cyanide, objectives are based on leached concentrations or pH-specific objectives may be used. Objectives are provided for pH range of 6.9 to 9.0 (highest pH for which pH-specific objectives are provided)
- (4): Concentrations of Inorganic Chemicals in Background Soils within Counties Inside Metropolitan Statistical Areas (35 IAC 742 Appendix A, Table G).
Concentrations of Polynuclear Aromatic Hydrocarbon Chemicals in Background Soils within the City of Chicago (35 IAC 742 Appendix A, Table H).
- (5): Soil remediation objective for inhalation route only applies at sites where elemental mercury (CAS#7439-97-6) is a contaminant of concern (35 IAC 742 Appendix B, Tables A and B)
- (6): There are no Class II objectives for chromium, Class I objectives are provided, Class I objectives are for hexavalent chromium which is more toxic than trivalent chromium which is naturally more prevalent
- (7): There are no Class II objectives for silver or vanadium, Class I objectives are provided

mg/kg Milligram per kilogram

NE Not established by the Illinois Environmental Protection Agency

NA Not analyzed

ND Not detected

TCLP Toxicity Characteristic Leaching Procedure

SPLP Synthetic Precipitation Leaching Procedure

BOLD Laboratory Analytical Detection

BOLD + HIGHLIGHT Laboratory Analytical Detection that exceeds TACO Tier 1 Industrial-Commercial Objective for sites with Class II Groundwater

Created By: MEJ 11/27/17

Reviewed By: EJW 12/7/17

TABLE 6
SUMMARY OF GROUNDWATER ANALYTICAL RESULTS

4301 W Chicago Ave
Chicago, Illinois

Sample ID		ESB-5	ESB-6	Well I	Well C	TACO	TACO Indoor Inhalation Route -
Sample Date	Units	8/9/17	8/9/17	8/29/17	8/29/17	Tier 1 Remediation Objective Class II Groundwater (1)	Tier 1 Groundwater Remediation Objectives Industrial/Commercial Diffusion and Advection (2)
Parameter	Units						
VOLATILE ORGANIC COMPOUNDS							
Acetone	mg/L	< 0.020	< 0.020 H	< 0.020	< 0.020	6.3	1,000,000
Benzene	mg/L	< 0.005	< 0.0050 H	< 0.0050	< 0.0050	0.025	0.41
Carbon Disulfide	mg/L	< 0.010	< 0.010 H	< 0.010	< 0.010	3.5	210
Carbon Tetrachloride	mg/L	< 0.0050	< 0.0050 H	< 0.0050	< 0.0050	0.025	0.076
Chloroform	mg/L	< 0.0050	< 0.0050 H	< 0.0050	< 0.0050	0.001	0.15
Methylene Chloride	mg/L	< 0.0050	0.13 H (3)	< 0.0050	< 0.0050	0.05	8.2
Tetrachloroethene	mg/L	< 0.0050	< 0.0050 H	< 0.0050	< 0.0050	0.025	0.34
Toluene	mg/L	< 0.0050	< 0.0050 H	< 0.0050	< 0.0050	2.5	530
Total Xylenes	mg/L	< 0.015	< 0.015 H	< 0.015	< 0.015	10	93
POLYNUCLEAR AROMATIC COMPOUNDS (PNAs)							
Acenaphthene	mg/L	< 0.0010	< 0.0010	NA	NA	2.1	NE
Acenaphthylene	mg/L	< 0.0010	< 0.0010	NA	NA	NE	NE
Anthracene	mg/L	< 0.0010	< 0.0010	NA	NA	10.5	NE
Benzo(a)anthracene	mg/L	< 0.00010	< 0.00010	NA	NA	0.00065	NE
Benzo(a)pyrene	mg/L	< 0.00010	< 0.00010	NA	NA	0.002	NE
Benzo(b)fluoranthene	mg/L	< 0.00010	< 0.00010	NA	NA	0.0009	NE
Benzo(g,h,i)perylene	mg/L	< 0.0010	< 0.0010	NA	NA	NE	NE
Benzo(k)fluoranthene	mg/L	< 0.00010	< 0.00010	NA	NA	0.00085	NE
Chrysene	mg/L	< 0.00010	< 0.00010	NA	NA	0.0075	NE
Dibenzo(a,h)anthracene	mg/L	< 0.00010	< 0.00010	NA	NA	0.0015	NE
Fluoranthene	mg/L	< 0.0010	< 0.0010	NA	NA	1.4	NE
Fluorene	mg/L	< 0.0010	< 0.0010	NA	NA	1.4	NE
Indeno(1,2,3-cd)pyrene	mg/L	< 0.00010	< 0.00010	NA	NA	0.00215	NE
Naphthalene	mg/L	< 0.0010	< 0.0010	NA	NA	0.22	NE
Phenanthrene	mg/L	< 0.0010	< 0.0010	NA	NA	NE	NE
Pyrene	mg/L	< 0.0010	< 0.0010	NA	NA	1.05	NE
METALS, TOTAL							
Aluminum	mg/L	< 0.040	NA	NA	NA	NE	NE
Antimony	mg/L	< 0.0060	< 0.0060	NA	NA	0.024	NE
Arsenic	mg/L	0.0074	< 0.0040	NA	NA	0.2	NE
Barium	mg/L	0.079	NA	NA	NA	2.0	NE
Beryllium	mg/L	< 0.0020	< 0.0020	NA	NA	0.5	NE
Cadmium	mg/L	< 0.0020	< 0.0020	NA	NA	0.05	NE
Calcium	mg/L	84	NA	NA	NA	NE	NE
Chromium	mg/L	< 0.0040	< 0.0040	NA	NA	1.0	NE
Cobalt	mg/L	< 0.0040	NA	NA	NA	1.0	NE
Copper	mg/L	< 0.010	< 0.010	NA	NA	0.65	NE
Iron	mg/L	1.4	NA	NA	NA	5.0	NE
Lead	mg/L	< 0.0020	< 0.0020	NA	NA	0.1	NE
Magnesium	mg/L	28	NA	NA	NA	NE	NE
Manganese	mg/L	0.43	NA	NA	NA	10.0	NE
Mercury	mg/L	< 0.00020	< 0.00020	NA	NA	0.01	0.060
Nickel	mg/L	< 0.0040	< 0.0040	NA	NA	2.0	NE
Potassium	mg/L	3.6	NA	NA	NA	NE	NE
Selenium	mg/L	< 0.0040	< 0.0040	NA	NA	0.05	NE
Silver	mg/L	< 0.0040	< 0.0040	NA	NA	NE (0.05)	NE
Sodium	mg/L	9.6	NA	NA	NA	NE	NE
Thallium	mg/L	< 0.0020	< 0.0020	NA	NA	0.02	NE
Vanadium	mg/L	< 0.0040	NA	NA	NA	0.1	NE
Zinc	mg/L	0.04	0.037	NA	NA	10	NE
CYANIDE							
Cyanide	mg/L	0.0055	NA	NA	NA	0.6	NE
pH							
pH	Standard	7.3	NA	NA	NA	USEPA Criteria for determination of hazardous waste: not less than 2 or greater than 12.5	

Notes:

Sample ESB-5 was analyzed for the entire Target Compound List from 35 IAC 740 Appendix A, including Semivolatile Organic Compounds (SVOCs), Pesticides and PCBs. No SVOCs (other than PNAs), pesticides or PCBs were detected.

- (1): The groundwater remediation objective (GRO) for the groundwater ingestion route for Class II groundwater 35 IAC 742 Appendix B, Table E.
- (2): The groundwater remediation objective for the indoor inhalation route (diffusion and advection) for industrial/commercial sites from 35 IAC 742 Appendix B, Table H.
- (3): The laboratory has indicated that the methylene chloride detected is a laboratory artifact, the result of analyzing the sample from an unpreserved amber jar from which previous aliquots for other analyses had been taken

mg/L Milligrams per liter

NE Not established by the Illinois Environmental Protection Agency

NA Not analyzed

H Sample was analyzed from unpreserved sample, past holding time for an unpreserved sample

BOLD Detected concentration

BOLD + HIGHLIGHT Concentration above objectives

Created By:
Reviewed By:

MEJ 11/27/17
EJW 12/20/17

Table 7
Summary of Concentrations Exceeding Objectives
4301 West Chicago Avenue
Chicago, Illinois 60624
Page 1 of 3

Sample Identification	Parameter	Concentration (mg/kg) or (mg/L)	Industrial/ Commercial Ingestion or Inhalation Objectives ⁽¹⁾ (mg/kg)	Class II Groundwater Objectives ⁽²⁾ (mg/kg)
SOIL				
SB2-1 (1.0-3.0 ft)	Mercury	0.31*	0.1 (CW Inhalation)⁽³⁾	
SB3-1 (1.0-3.0 ft)	Mercury	0.17	0.1 (CW Inhalation)⁽³⁾	
SB10-4 (8.5-10.5 ft)	Arsenic Mercury	13.8 0.14	13 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
GP-3A (0-2.0 ft)	Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene	6.3 E 8.7 E 1.7	1.3 (ingestion) 8 (ingestion) 0.8 (ingestion)	
GP-4E (8-10 ft)	Antimony Mercury	23 0.16	0.1 (CW Inhalation)⁽³⁾	20
GP-6C (4.0-6.0 ft)	Benzo(a)pyrene Dibenzo(a,h)anthracene Mercury	3.8 0.82 0.16	1.3 (ingestion) 0.8 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
GP-7D (6.0-8.0 ft)	Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Dibenzo(a,h)anthracene Mercury	12 13 12 1.0 0.76	8 (ingestion) 1.3 (ingestion) 8 (ingestion) 0.8 (ingestion) 0.1 (CW Inhalation)⁽³⁾	8
GP-7F (10-12 ft)	Benzo(a)pyrene Mercury	2.3 E 0.16	1.3 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
GP-11D (1.0-3.0 ft)	Benzo(a)pyrene	3.1	1.3 (ingestion)	
GP-13A (0-2.0 ft)	Mercury	0.12	0.1 (CW Inhalation)⁽³⁾	

Table 7
Summary of Concentrations Exceeding Objectives
4301 West Chicago Avenue
Chicago, Illinois 60624
Page 2 of 3

Sample Identification	Parameter	Concentration (mg/kg) or (mg/L)	Industrial/ Commercial Ingestion or Inhalation Objectives ⁽¹⁾ (mg/kg)	Class II Groundwater Objectives ⁽²⁾ (mg/kg)
GP-15A (0-2.0 ft)	Mercury	0.28	0.1 (CW Inhalation)⁽³⁾	
GP-17A (0-2 ft)	Arsenic Mercury	18 7.5	13 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
GP-19A (0-2 ft)	Chromium	35		28
ESB-3B (5.5-6.5 ft)	Benzo(a)pyrene Dibenzo(a,h)anthracene	3.0 0.87	1.3 (ingestion) 0.8 (ingestion)	
ESB-4A (0.5-1.5 ft)	Benzo(a)pyrene Dibenzo(a,h)anthracene Mercury	3.2 0.81 0.14	1.3 (ingestion) 0.8 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
ESB-5A (0-1.0 ft)	Mercury	0.15	0.1 (CW Inhalation)⁽³⁾	
ESB-6A (2-4 ft)	Arsenic Mercury	18 0.15	13 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
B-6A (1-3 ft)	Benzo(a)pyrene Dibenzo(a,h)anthracene	3.9 1.1	1.3 (ingestion) 0.8 (ingestion)	
B-6B (8.0-10.0 ft)	Mercury	0.24	0.1 (CW Inhalation)⁽³⁾	
B-7A (0-2.0 ft)	Mercury	0.23	0.1 (CW Inhalation)⁽³⁾	
B-9A (1-3 ft)	Arsenic Mercury	14 0.22	13 (ingestion) 0.1 (CW Inhalation)⁽³⁾	
B-10A	Mercury	0.20	0.1 (CW	

Table 7
Summary of Concentrations Exceeding Objectives
4301 West Chicago Avenue
Chicago, Illinois 60624
Page 3 of 3

Sample Identification	Parameter	Concentration (mg/kg) or (mg/L)	Industrial/Commercial Ingestion or Inhalation Objectives ⁽¹⁾ (mg/kg)	Class II Groundwater Objectives ⁽²⁾ (mg/kg)
(0-1.0 ft)			Inhalation ⁽³⁾	
B-12A (0-2.0 ft)	Mercury	0.32	0.1 (CW Inhalation) ⁽³⁾	
B-17A (0-2 ft)	Arsenic	34	13 (ingestion)	
B-18A (0-2 ft)	Arsenic Mercury	20 0.25	13 (ingestion) 0.1 (CW Inhalation) ⁽³⁾	

(1) Illinois EPA TACO objectives for Industrial/Commercial sites (35 IAC 742 Appendix B, Table B) most restrictive of inhalation or ingestion pathway objectives, or background concentrations, includes construction worker ingestion or inhalation concentrations

(2) Illinois EPA TACO objectives (soil) for Sites with Class II Groundwater (35 IAC 742 Appendix B, Table B)

(3) Soil remediation objective for inhalation route only applies at sites where elemental mercury (CAS#7439-97-6) is a contaminant of concern (35 IAC 742 Appendix B, Tables A and B).

E = Laboratory qualifier – value above quantitation limit

* Laboratory qualified as estimated due to non-homogenous sample matrix

CW = Construction Worker

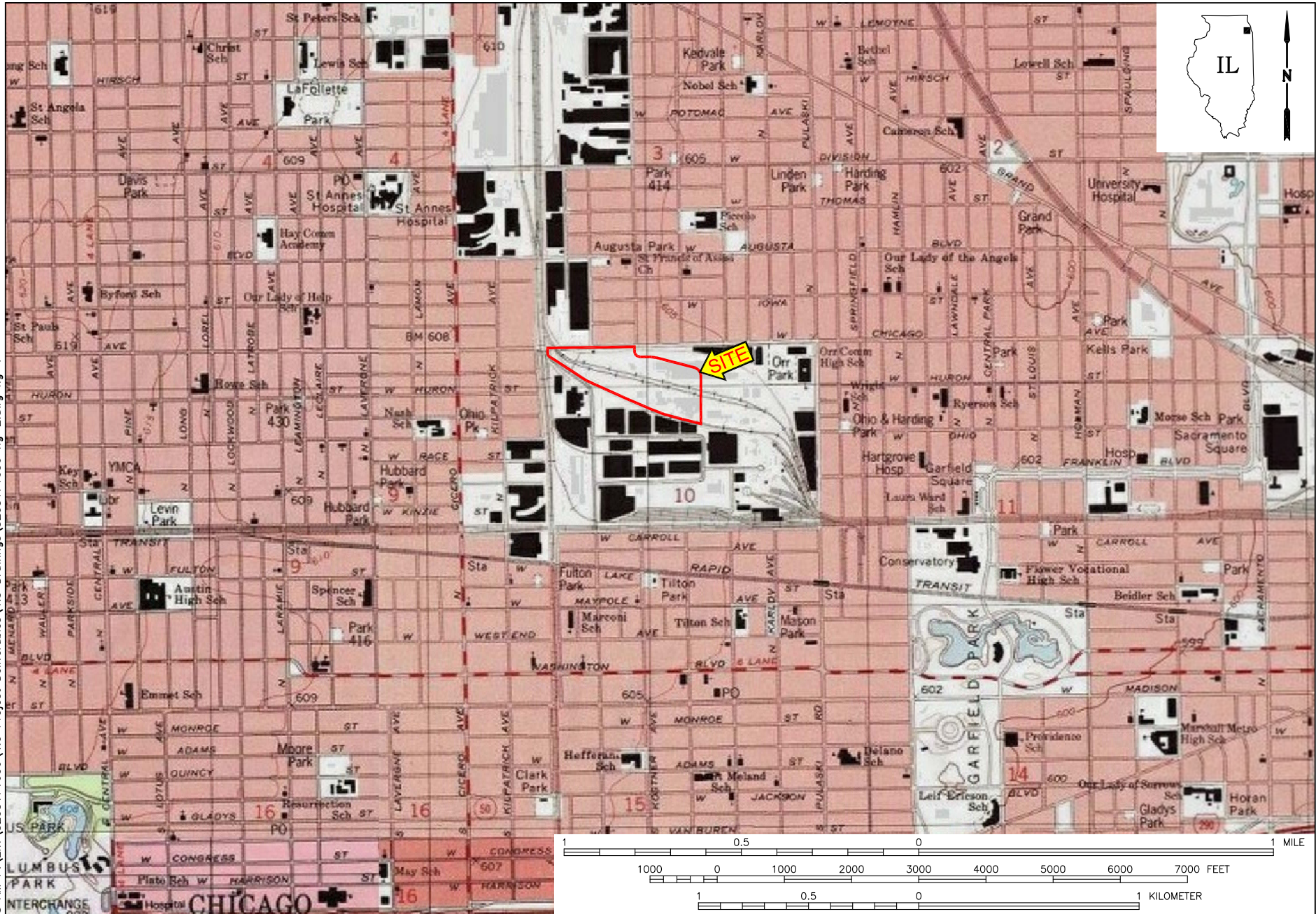
mg/kg = milligrams per kilogram

mg/L = milligrams per liter



FIGURES

12/5/2017 10:38 AM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606 fig-2.dwg fig-1



LEGEND:

 = APPROXIMATE SITE BOUNDARY



Amec Foster Wheeler
Environment & Infrastructure, Inc.

Property Location Map
Vacant Parcel
Chicago Avenue & Kilbourn Avenue
Chicago, IL

DRAWN: GAP
PROJECT NUMBER: 3205171606

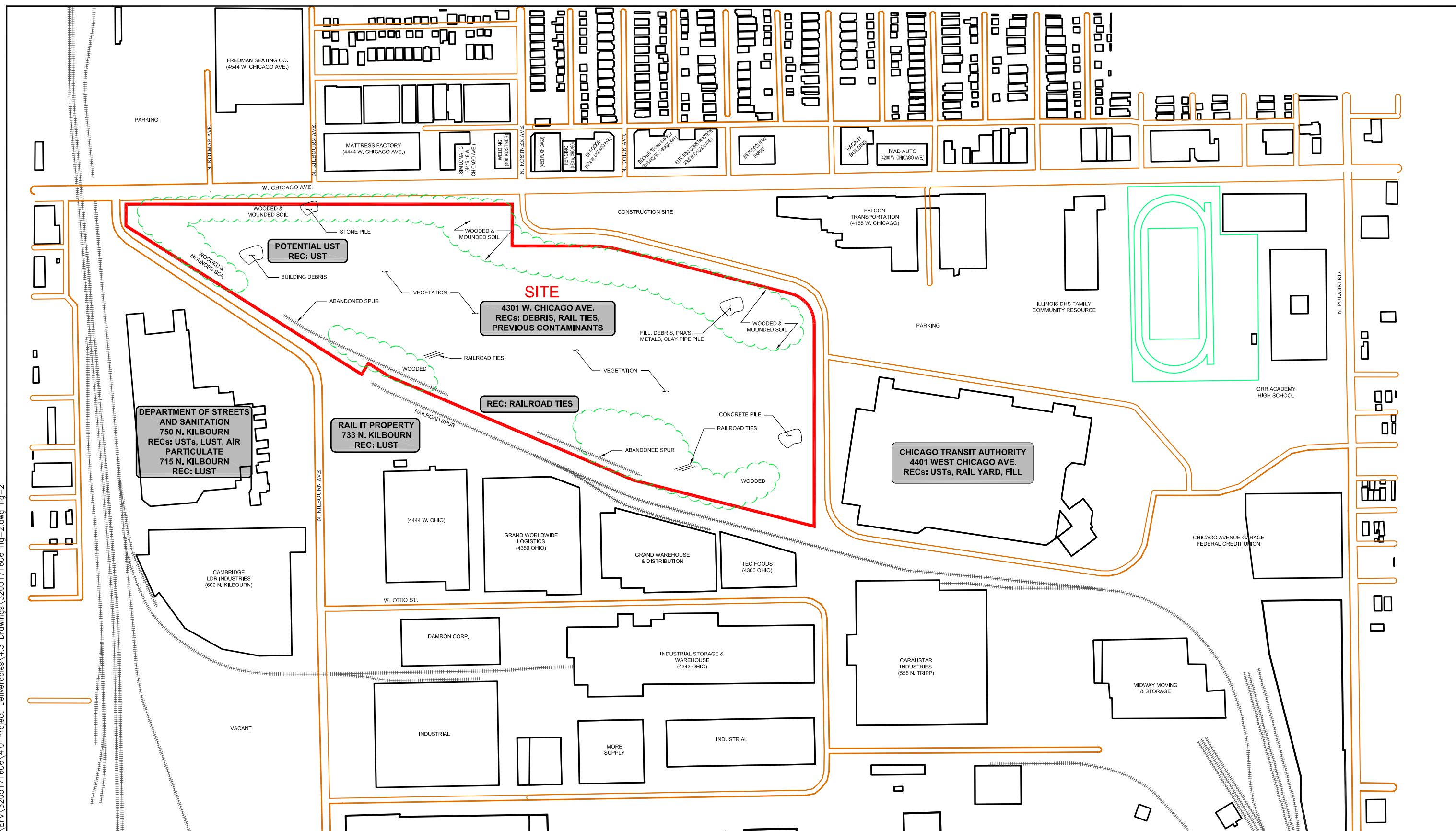
APPROVED: [Signature]
DATE: 6/19/17

REVISED DATE: [Blank]
REV. #: [Blank]

FIGURE

1

1/8/2018 12:00 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606 fig-2.dwg fig-2



POTENTIAL UST
REC: UST

4301 W. CHICAGO AVE.
RECs: DEBRIS, RAIL TIES, PREVIOUS CONTAMINANTS

REC: RAILROAD TIES

RAIL IT PROPERTY
733 N. KILBOURN
REC: LUST

DEPARTMENT OF STREETS AND SANITATION
750 N. KILBOURN
RECs: USTs, LUST, AIR PARTICULATE
715 N. KILBOURN
REC: LUST

CHICAGO TRANSIT AUTHORITY
4401 WEST CHICAGO AVE.
RECs: USTs, RAIL YARD, FILL

LEGEND:
 = APPROXIMATE SITE BOUNDARY

SCALE: NOT TO SCALE

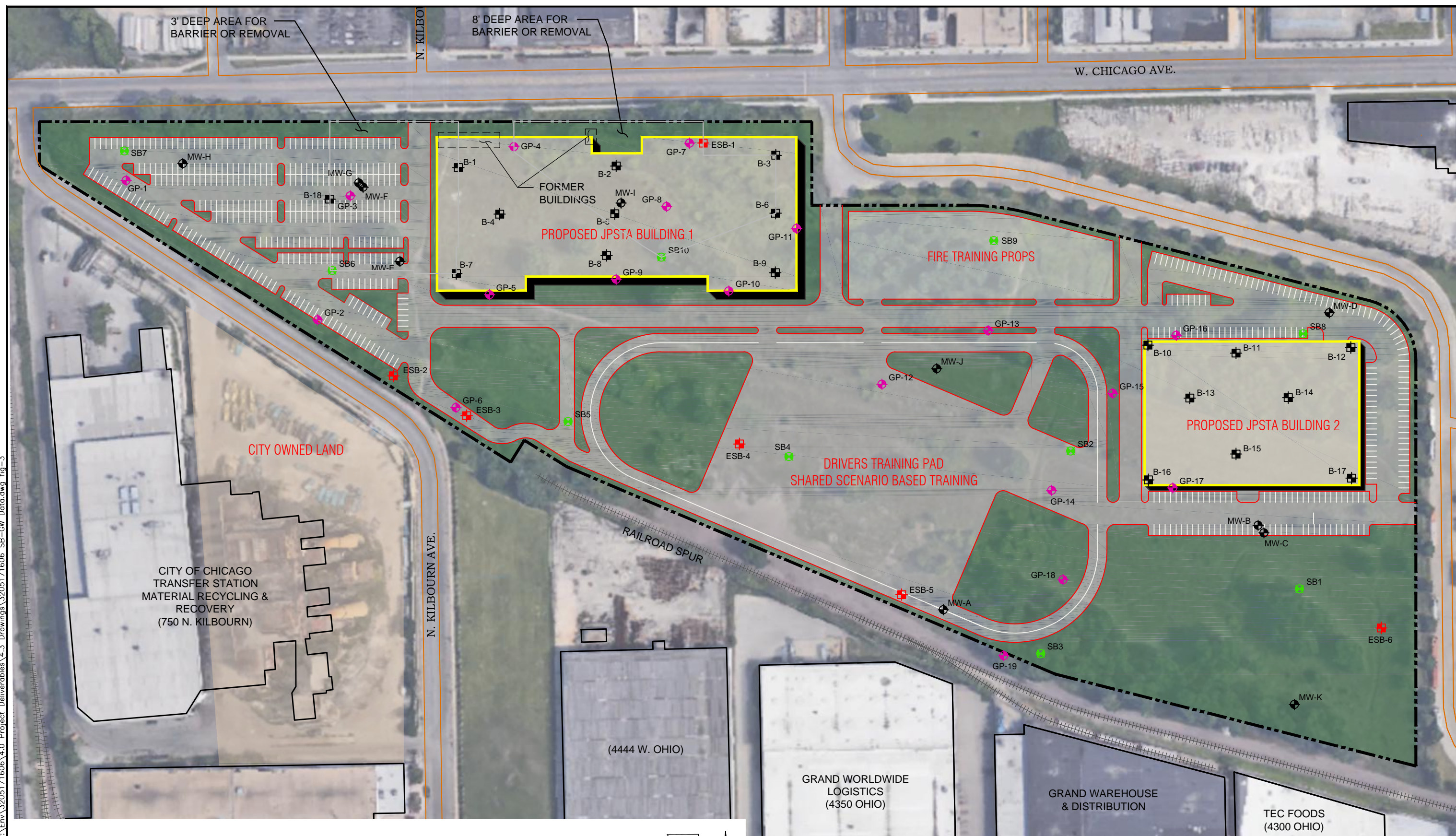


Map Showing RECs
 Vacant Parcel
 Chicago Avenue & Kilbourne Avenue
 Chicago, IL

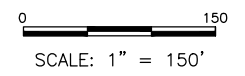
DRAWN GAP	PROJECT NUMBER 3205171606	APPROVED	DATE 6/19/17	REVISED DATE	REV. No.
--------------	------------------------------	----------	-----------------	--------------	----------

FIGURE
2

1/8/2018 12:04 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-3



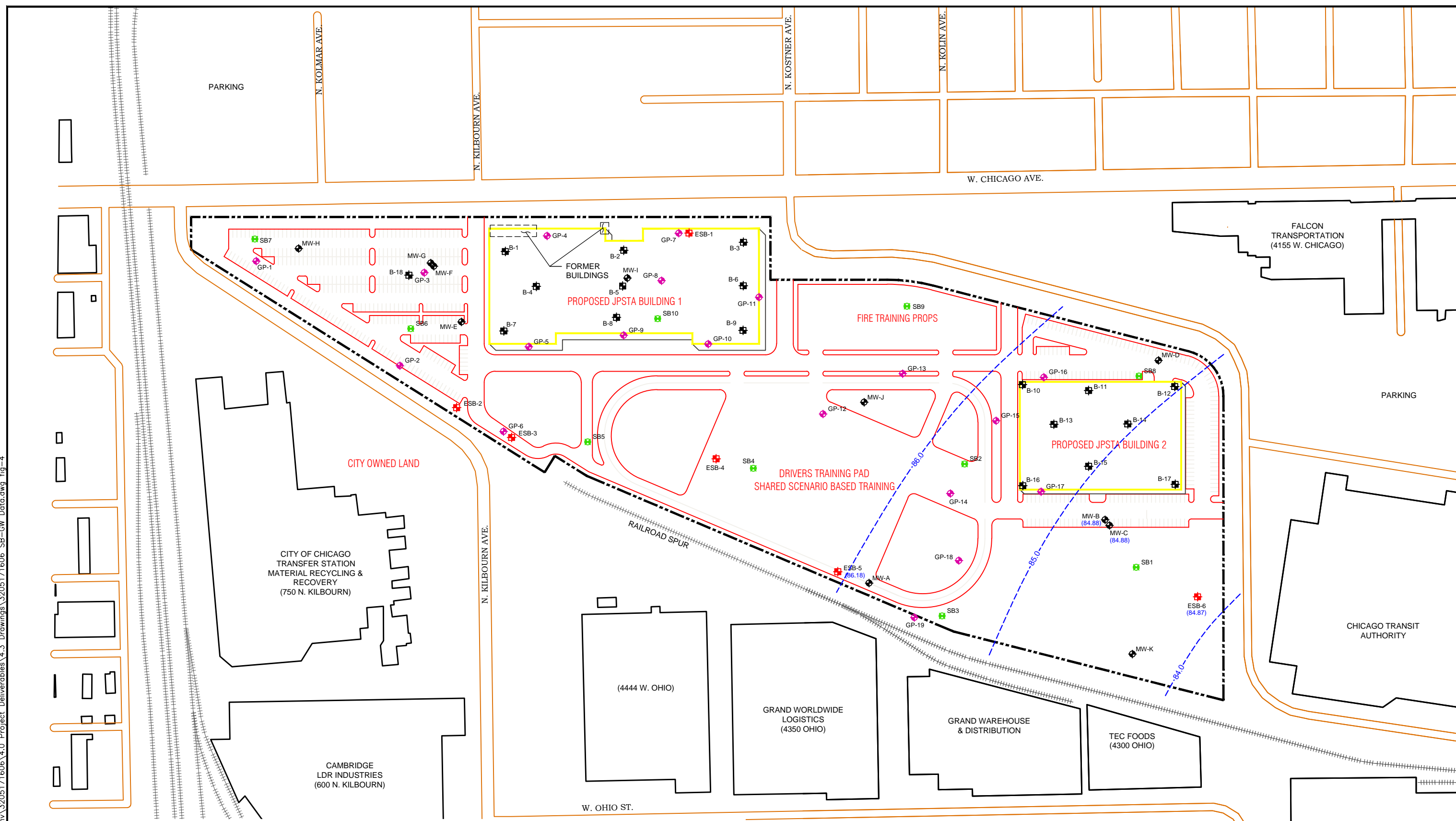
- LEGEND:**
- APPROXIMATE SITE BOUNDARY
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER



Map Showing Planned Land Development & Boring Locations
 Vacant Parcel
 4303 W. Chicago Avenue
 Chicago, IL

DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE	REV. No.
GAP	3205171606		11/9/17		

1/8/2018 12:05 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-4



- LEGEND:
- = APPROXIMATE SITE BOUNDARY
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - = GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - = ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - = MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER
 - = GROUNDWATER CONTOUR
 - = GROUNDWATER ELEVATION (AUGUST 2017)

0 100 200
SCALE: 1" = 200'



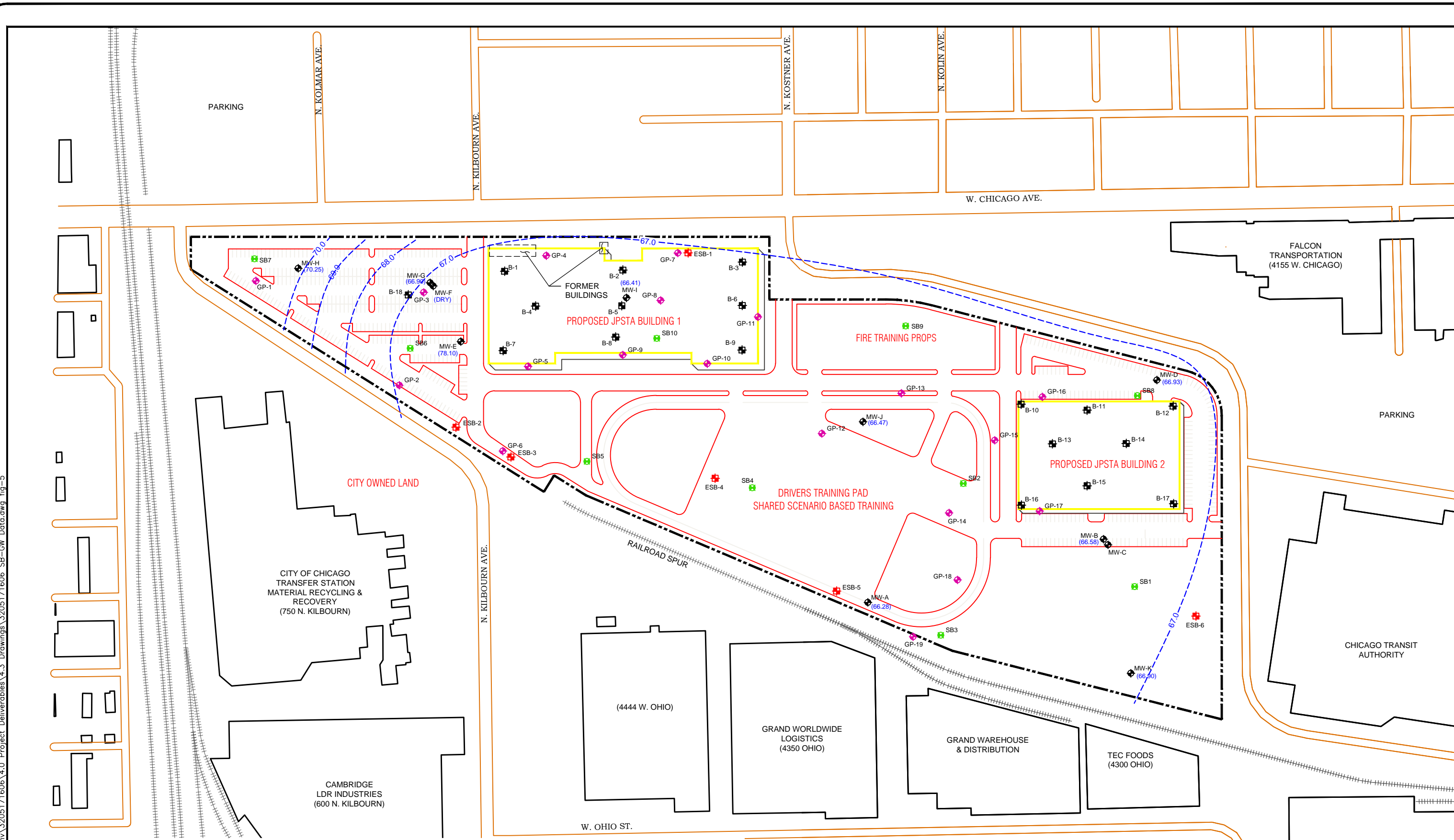
Amec Foster Wheeler
Environment & Infrastructure, Inc.

Shallow Groundwater Contour
Vacant Parcel
4303 W. Chicago Avenue
Chicago, IL

DRAWN GAP	PROJECT NUMBER 3205171606	APPROVED DATE 11/9/17	REVISED DATE	REV. No.
--------------	------------------------------	-----------------------------	--------------	----------

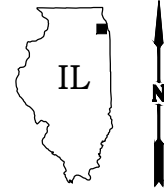
FIGURE
4

1/8/2018 12:06 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-5



- LEGEND:
- = APPROXIMATE SITE BOUNDARY
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - = GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - = ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - = MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER
 - = GROUNDWATER CONTOUR
 - = GROUNDWATER ELEVATION (AUGUST 2017)

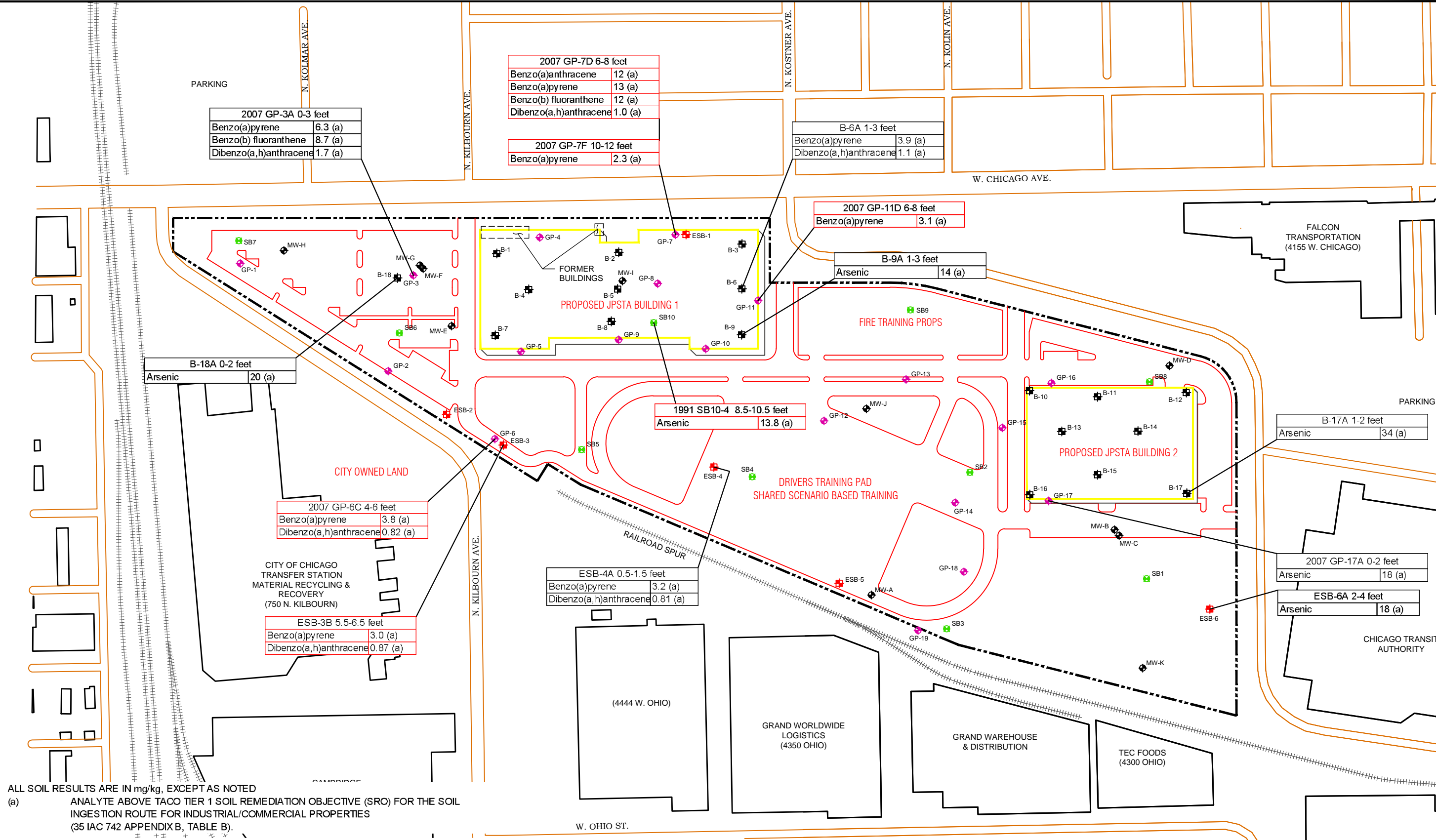
0 100 200
SCALE: 1" = 200'



Amec Foster Wheeler
Environment & Infrastructure, Inc.

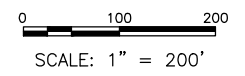
<p>Deep Groundwater Contour Vacant Parcel 4303 W. Chicago Avenue Chicago, IL</p>				<p>FIGURE 5</p>
<p>DRAWN GAP</p>	<p>PROJECT NUMBER 3205171606</p>	<p>APPROVED DATE 11/9/17</p>	<p>REVISED DATE</p>	<p>REV. No.</p>

1/8/2018 12:07 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-6



ALL SOIL RESULTS ARE IN mg/kg, EXCEPT AS NOTED
 (a) ANALYTE ABOVE TACO TIER 1 SOIL REMEDIATION OBJECTIVE (SRO) FOR THE SOIL INGESTION ROUTE FOR INDUSTRIAL/COMMERCIAL PROPERTIES (35 IAC 742 APPENDIX B, TABLE B).

- LEGEND:**
- = APPROXIMATE SITE BOUNDARY
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - = GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - = ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - = MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER
 - = SHALLOW SAMPLE
 - = DEEP SAMPLE

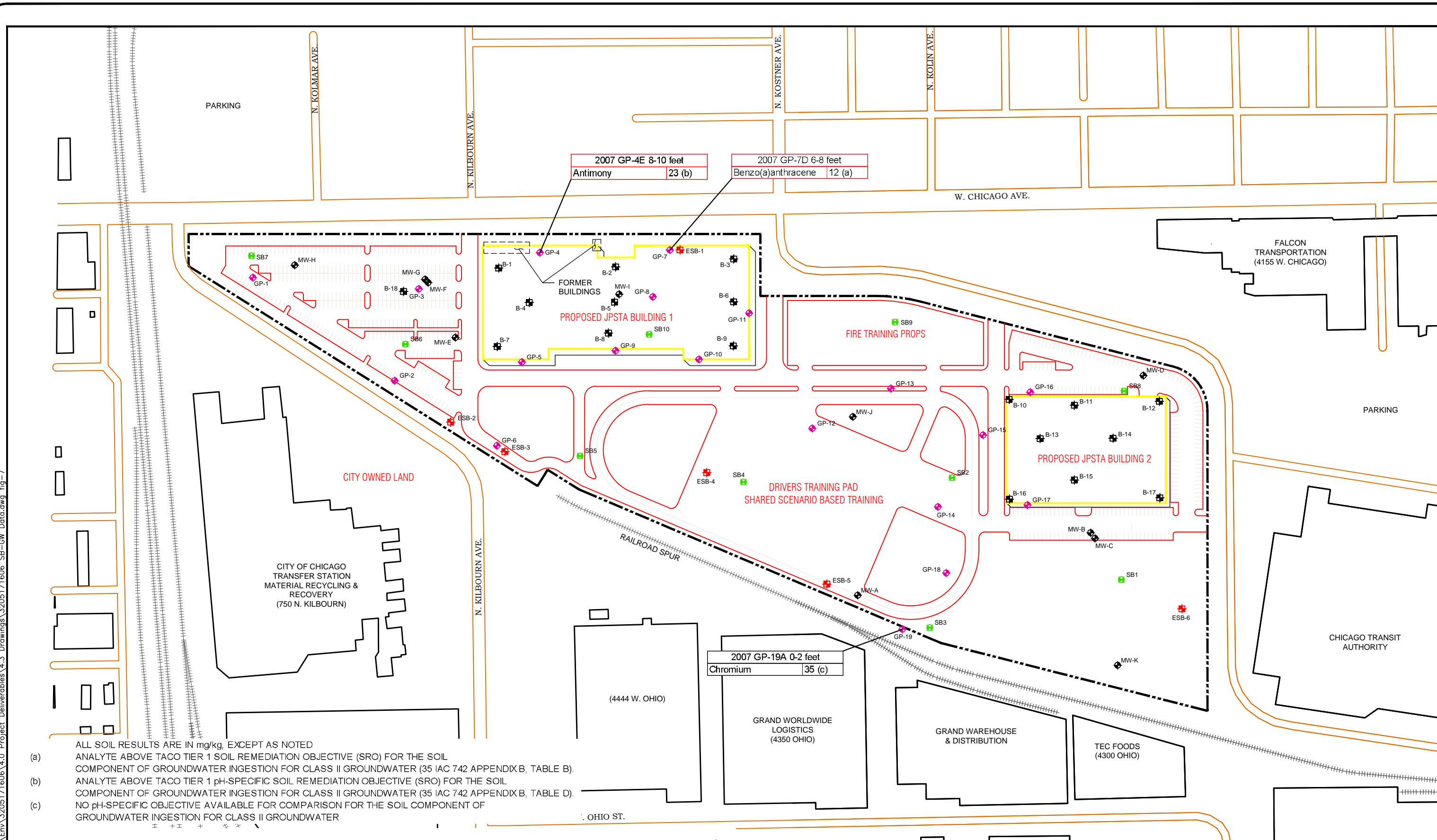


Soil Ingestion Pathway Exceedences
 Vacant Parcel
 4303 W. Chicago Avenue
 Chicago, IL

FIGURE 6

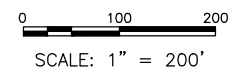
DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE	REV. No.
GAP	3205171606		11/9/17		

1/8/2018 12:21 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-7



- ALL SOIL RESULTS ARE IN mg/kg, EXCEPT AS NOTED
- (a) ANALYTE ABOVE TACO TIER 1 SOIL REMEDIATION OBJECTIVE (SRO) FOR THE SOIL COMPONENT OF GROUNDWATER INGESTION FOR CLASS II GROUNDWATER (35 IAC 742 APPENDIX B, TABLE B).
 - (b) ANALYTE ABOVE TACO TIER 1 pH-SPECIFIC SOIL REMEDIATION OBJECTIVE (SRO) FOR THE SOIL COMPONENT OF GROUNDWATER INGESTION FOR CLASS II GROUNDWATER (35 IAC 742 APPENDIX B, TABLE D).
 - (c) NO pH-SPECIFIC OBJECTIVE AVAILABLE FOR COMPARISON FOR THE SOIL COMPONENT OF GROUNDWATER INGESTION FOR CLASS II GROUNDWATER

- LEGEND:
- APPROXIMATE SITE BOUNDARY
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER



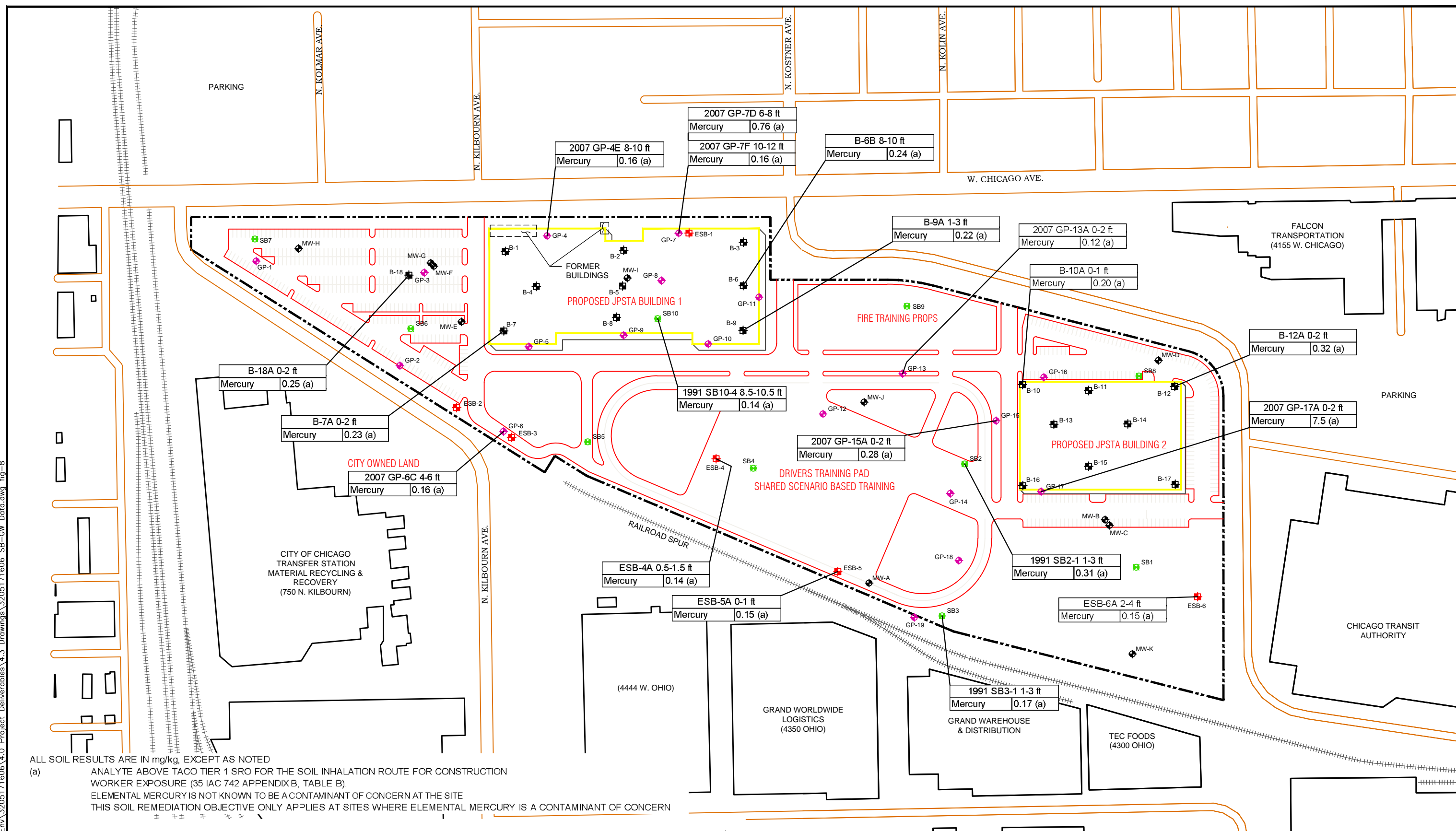
Soil Component of Groundwater Ingestion Pathway Exceedances

Vacant Parcel
4303 W. Chicago Avenue
Chicago, IL

FIGURE 7

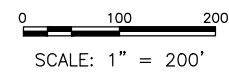
DRAWN	PROJECT NUMBER	APPROVED	DATE	REVISED DATE	REV. No.
GAP	3205171606		11/9/17		

1/9/2018 2:03 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-8



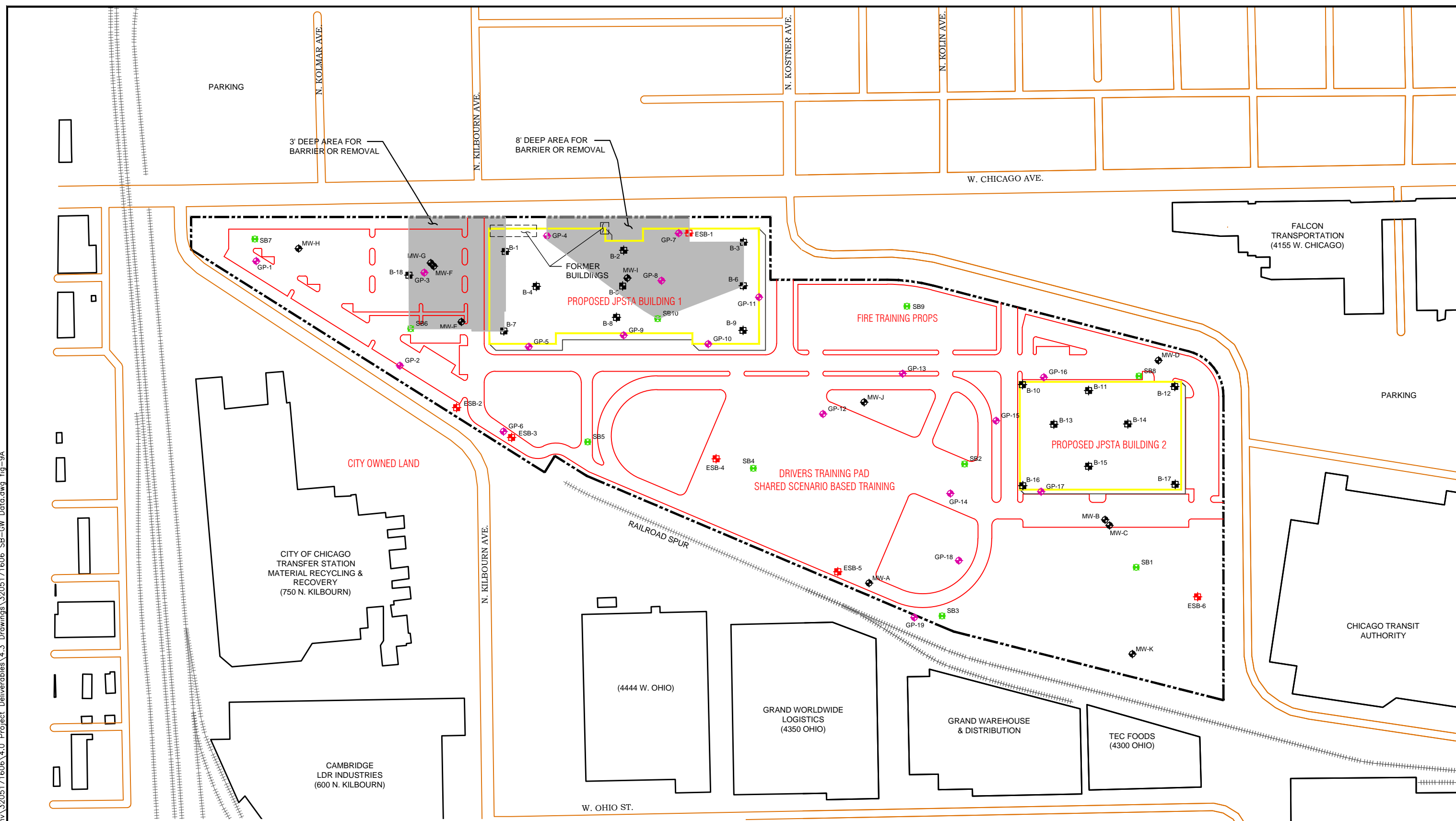
ALL SOIL RESULTS ARE IN mg/kg, EXCEPT AS NOTED
 (a) ANALYTE ABOVE TACO TIER 1 SRO FOR THE SOIL INHALATION ROUTE FOR CONSTRUCTION WORKER EXPOSURE (35 IAC 742 APPENDIX B, TABLE B). ELEMENTAL MERCURY IS NOT KNOWN TO BE A CONTAMINANT OF CONCERN AT THE SITE THIS SOIL REMEDIATION OBJECTIVE ONLY APPLIES AT SITES WHERE ELEMENTAL MERCURY IS A CONTAMINANT OF CONCERN

- LEGEND:**
- APPROXIMATE SITE BOUNDARY
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER

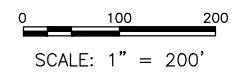


Construction Worker Inhalation Exceedances		FIGURE	
Vacant Parcel 4303 W. Chicago Avenue Chicago, IL		8	
DRAWN	PROJECT NUMBER	APPROVED	DATE
GAP	3205171606		11/9/17
		REVISED DATE	REV. No.

1/8/2018 12:51 PM P:\Env\3205171606\4.0 Project Deliverables\4.3 Drawings\3205171606_SB-GW_Data.dwg fig-9A



- LEGEND:**
- APPROXIMATE SITE BOUNDARY
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - GEOTECHNICAL / ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - MONITORING WELL, UNKNOWN DATE, UNKNOWN INSTALLER



Areas for Barrier or Removal		FIGURE	
Vacant Parcel		9	
4303 W. Chicago Avenue			
Chicago, IL			
DRAWN	PROJECT NUMBER	APPROVED	DATE
GAP	3205171606		11/9/17
		REVISED DATE	REV. No.



APPENDIX A

Boring Logs



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	ESB-1	4301 West Chicago Avenue	
DATE:	8/9/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	Northeast of B-2, on berm and in tree line	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	18 feet

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	ESB-1A	50%	0.0	dry	0-2' FILL: brown clayey silt with little sand and gravel, rootlets, dry	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH
1					2' - 3' FILL: Concrete fragments	
2					3'-6' FILL: dark brown to black clayey silt, with little gravel, dry	
3	ESB-1B	50%	0.0	dry	6-11' FILL: dark brown to black clayey silt, with little slag or asphalt grindings, little gravel, dry	A soil sample was collected at 10'-12' feet bgs and held for potential later analysis
4					increased clay with depth, becoming slightly moist	
5					chunks of metal noted	
6	ESB-1C	75%	0.0	dry to moist	wood pieces noted	A soil sample was collected at 13'-14' feet bgs to be analyzed for PNAs,
7					11'-11.5' FILL: reddish brown brick fragments, dry	
8					11.5'-12.5' FILL: dark brown to black clayey silt with some pieces of gravel, dry	
9	ESB-1C	75%	0.0	slightly moist	12.5'-13.5' FILL: Brown sand with little gravel, dry	A soil sample was collected at 13'-14' feet bgs to be analyzed for PNAs,
10					13.5'-15' FILL: dark brown silty clay with slag and gravel, dry to moist	
11					15'-17' FILL: brown sand with little gravel, slightly moist	
12	ESB-1C	75%	0.0	slightly moist	becomes very moist to wet with increased gravel	
13					17'-18' dark brown silty clay with trace sand and gravel, moist	
14					Boring terminated at 18' below ground surface (bgs)	
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	ESB-2	4301 West Chicago Avenue	
DATE:	8/2/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	Southwest central area near trees	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	16 feet

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS	
0					About 3 inches roots and organics		
1	ESB-2A	80%	0.0	dry	0.25'-1.25' FILL: brown silty clay with trace gravel, dry	A soil sample was collected at 1.5'-2.5' feet bgs to be analyzed for SRP Target Compound List parameters and herbicides	
2					1.25'-2.5' FILL: black silt with rootlets and large white gravel		
3					2.5'-11.5' FILL: brown sand, medium, little to trace grey gravel, dry		
4	ESB-2B	50%	0.0	dry	4'-6' No recovery		
5					0%		
6					6'-8' Little recovery continue gravelly brown sand, dry		
7	ESB-2C	25%	0.0	dry	sand, dry		A soil sample was collected at 6'-8' feet bgs and held for potential later analysis
8					35%		
9					50%		
10	ESB-2C	60%	0.0	slightly moist	11.5-13 FILL: dark brown clay silt with sand and a little gravel, and cinders or slag, moist		
11					13'-15' dark gray to graybrown silty clay, slightly moist, firm		
12					15'-16' brown to light gray to orangish brown silty clay, trace gravel, moist, firm		
13	ESB-2C	75%	0.0	moist	Boring terminated at 16' below ground surface (bgs)		
14							
15							
16							
17							
18							
19							
20							
21							
22							
23							
24							
25							



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	ESB-3	4301 West Chicago Avenue	
DATE:	8/2/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	Southwest central near south edge, up on berm	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	16 feet

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					1-2 inches grass and roots	
1	ESB-3A	50%	0.0	dry	2" to 5' FILL: Black to very dark brown to grey silt (asphalt grindings with soil), little gravel, dry	A soil sample was collected at 1'-4' feet bgs to be analyzed for SRP Target Compound List parameters
2						
3		50%	0.0	dry		
4						
5	ESB-3B	75%	0.0	dry	rootlets at 5.5' to 6'	A soil sample was collected at 5.5'-6.5' feet bgs to be analyzed for PNAs
6					5' to 8' FILL: Brown to dark brown sand with silt, clay and gravel, some small slag, dry	
7		10%	0.0	dry		
8						
9	ESB-3C	70%	0.0	dry	8' to 13' FILL: Brown to orangish brown medium sand with little gravel, dry	A soil sample was collected at 14.5'-15.5' feet bgs and held for potential later analysis
10					trace gravel, still dry	
11		60%	0.0	dry		
12						
13			0.0	moist	13.5' to 14.5' FILL: Brown silty sand, trace gravel, moist	
14					14.5' to 15.5' FILL: Sand, ground slag with gravel, very moist	
15			0.0	very moist	15.5' to 16' Dark brown silty clay, firm, trace gravel	
16					Boring terminated at 16' below ground surface (bgs)	
17						
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	ESB-4	4301 West Chicago Avenue	
DATE:	8/7/2017	Chicago, Illinois	
LOGGED BY:	Craig T. Cabrera	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	Center south, near south boundary	HOLE DIA.:	7 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	16 feet

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	ESB-4A	10%	2.3	moist	0' to 2' Black organic soil with trace gravel, moist	A soil sample was collected at 0-3' feet bgs to be analyzed for SRP Target Compound List parameters A soil sample was collected at 3'-4' feet bgs and held for potential later analysis
1					2' to 9' FILL: Tan medium sand, silty, trace gravel, moist	
2	ESB-4B	50%	0.0	moist	Groundwater encountered	
3						
4						
5	50%	0.0	moist	wet	Black slag at 8 feet	
6						
7						
8						
9					9' to 16' Dark brown silty clay, firm, trace gravel	
10						
11						
12						
13						
14						
15						
16					Boring terminated at 16' below ground surface (bgs)	
17						
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	ESB-5	4301 West Chicago Avenue	
DATE:	8/3/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	South edge; near rail spur line	HOLE DIA.:	7 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	16 feet

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	ESB-5A	50%	0.0	dry	0 to 1' FILL: Black to dark brown sandy silt with little gravel, dry	<p>A soil sample was collected at 0-1' feet bgs to be analyzed for SRP Target Compound List parameters</p> <p>A soil sample was collected at 4'-5' feet bgs and held for potential later analysis</p> <p>A soil sample was collected at 6'-7' feet bgs and held for potential later analysis</p>
1					1' to 6' FILL: Brown medium sand with little gravel, dry	
2	ESB-2B	50%	0.0	dry		
3						
4	ESB-2C	50%	0.0	dry		
5						
6	ESB-2C	50%	0.0	wet to very moist	6' to 7' FILL: Brown to dark brown gravelly sand, wet to very moist	
7					7' to 10' Gray to dark gray silty clay, moist, firm to stiff, trace sand and gravel	
8		60%	0.0	moist		
9						
10		60%	0.0	slightly moist	10' to 14' Brown to gray silty clay with trace to little sand and gravel, slightly moist, stiff	
11						
12			0.0	slightly moist		
13						
14		90%	0.0	slightly moist	14' to 16' Grayish brown silty clay, hard, trace gravel, slightly moist	
15						
16					Boring terminated at 16' below ground surface (bgs)	
17						
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	ESB-6	4301 West Chicago Avenue	
DATE:	8/4/2017	Chicago, Illinois	
LOGGED BY:	Craig T. Cabrera	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	Southeast corner; near property boundary on east side	HOLE DIA.:	7 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	16 feet

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 2' FILL: Black silty soil with gravel and stone, dry	
1	ESB-4A	10%	0.0	dry		A soil sample was collected at 2'-4' feet bgs to be analyzed for SRP Target Compound List parameters
2						
3	ESB-4B	50%	0.0	moist	4 to 8' FILL: tan silty sand, medium, moist	A soil sample was collected at 5'-6' feet bgs and held for potential later analysis
4						
5	ESB-4B	50%	0.0	wet	wet	
6						
7	ESB-4B	50%	0.0	wet	8 to 10' FILL: tan sand with pebbles, wet	
8						
9	ESB-4B	50%	0.0	moist	10 to 14' gray to green silty clay, moist, pliable	
10						
11	ESB-4B	75%	0.0			
12						
13	ESB-4B	100%	0.0			
14						
15	ESB-4B	75%	0.0	moist	14 to 16' Gray to brown silty clay with shale fragments	
16						
17					Boring terminated at 16' below ground surface (bgs)	
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-1		4301 West Chicago Avenue
DATE:	8/9/2017		Chicago, Illinois
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	northwest corner of planned location of building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	40'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 1' FILL: sandy and clayey concrete	
1		25%	0.0	dry	1' to 12' FILL: Grayish brown gravelly silt with little clay and silt, concrete debris, dry	A soil sample was collected at 2'-4' feet bgs to be analyzed for PNAs, PP metals and pH
2	B-1A					
3		50%	0.0	dry		
4						
5		50%	0.0	dry	less concrete debris, but still slag and some gravel	A soil sample was collected at 9'-10' feet bgs and held for potential later analysis
6						
7		50%	0.0	dry	concrete again	
8					some blackish to dark brown sandy silt with gravel/debris (concrete and brick), dry	
9	B-1B	75%	0.0	dry		
10					increased silt and clay, still some gravel and brick fragments, dry	
11		75%	0.0	moist		A soil sample was collected at 14'-15' feet bgs and held for potential later analysis
12					12' to 15' FILL: grayish brown silty clay with little gravel and brick fragments, moist, soft	
13		75%	0.0	moist		
14	B-1C					
15		75%	0.0		15' to 17' Dark brown and black silty clay (topsoil), moist	
16						
17					17' to 21' Brown to orangish brown silty clay with trace sand and gravel, slightly moist, stiff	
18						
19						
20						
21		100%	0.0	slightly moist to moist	21' to 28' Brown and gray silty clay, trace gravel, slightly moist to moist, hard to stiff	
22						
23						
24		75%	0.0	moist		
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-1	4301 West Chicago Avenue	
DATE:	8/9/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	northwest corner of planned location of building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	40'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28					28' to 32' gray silty sand with trace gravel, dry	
29		100%	0.0	dry		
30						
31						
32					32' to 40' Gray silty clay with little gravel, hard, dry	
33						
34		100%	0.0	dry		
35						
36						
37						
38						
39		100%	0.0	dry		
40					Boring terminated at 40' below ground surface (bgs)	
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-2		4301 West Chicago Avenue
DATE:	8/9/2017		Chicago, Illinois
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	north edge of site on berm, south side	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-2A	25%	0.0	dry	0 to 4.5' FILL: Brown to dark brown clayey silt, little gravel, dry	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH
1					concrete fragments at 2' (spoon refusal)	
2	B-2B	0%	0.0	dry	4.5' to 7' FILL: Dark brown to black clayey silt, little sand and gravel, dry	A soil sample was collected at 4'-6' feet bgs and held for potential later analysis
3						
4		70%	0.0	dry to slightly moist	7' to 8' FILL: Brown sand with gravel, dry to slightly moist	No data from 8' to 10' Shelby tube collected for geotechnical testing
5						
6		50%	0.0	slightly moist	10' to 14' FILL: Brown to dark brown medium sand with little to trace gravel, slightly moist	
7						
8		50%	0.0	slightly moist wet	within the sand, two less than 0.5 inch seams of grayish brown silty clay with sand	
9						
10		50%	0.0	moist to very moist	14' to 15.5': Tan to brown sand with trace to little gravel, wet	
11						
12		0.0	0.0	very moist	15.5' to 18.5' Dark brown to grayish brown silty clay with trace to little gravel, moist to very moist	
13						
14		0.0	0.0	moist	18.5' to 20' Dark brown silty clay with trace gravel, very moist, soft, plastic	
15						
16		75%	0.0	slightly moist	20' to 23' Grayish brown silty clay with trace gravel, moist, firm	
17						
18		75%	0.0	slightly moist	23' to 30' Gray silty clay with trace to little gravel, hard, slightly moist	
19						
20						
21						
22						
23						
24						
25						

140000



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-2	4301 West Chicago Avenue	
DATE:	8/9/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	north edge of site on berm, south side	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28						
29		75%	0.0			
30					Boring terminated at 30' below ground surface (bgs)	
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-3	4301 West Chicago Avenue	
DATE:	8/8/2017	Chicago, Illinois	
LOGGED BY:	Eric Walkowiak	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	north of berm	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	39.5'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS	
0	B-3A	75%	1.1		0 to 1.5' FILL: Brown to black silty sand, gravel, concrete debris, slightly moist	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH	
1			0.0	slightly moist	1.5 to 2.5 FILL: Brown to black silty sandy clay, slightly moist		
2			0.0	slightly moist	2.5 to 9.5 FILL: Brown to black silty sand with trace gravel, slightly moist		
3	B-3B	75%	0.0	slightly moist		A soil sample was collected at 6'-8' feet bgs to be analyzed for SRP Target Compound List parameters	
4			0.0	slightly moist			
5			0.0	slightly moist			
6	B-3C	25%	0.0	moist		A soil sample was collected at 12'-13' feet bgs to be held for potential later analysis	
7			100%	0.0	wet		wet at 7.5 feet
8			0.0	wet			
9	B-3C	25%	0.0	slightly moist	9.5 to 39.5': Gray silty clay with trace sand, orange mottling, wet		
10			0.0	slightly moist			
11			0.0	moist			
12	B-3C	75%	0.0	slightly moist			
13			0.0	slightly moist			
14			0.0	slightly moist	no mottling		
15	B-3C	100%	0.0	slightly moist			
16			0.0	slightly moist			
17			0.0	slightly moist			
18	B-3C	50%	0.0	slightly moist			
19			0.0	slightly moist			
20			0.0	dry	stiffer, dryer		
21	B-3C	75%	0.0	dry			
22			0.0	dry			
23			0.0	dry			
24	B-3C	100%	0.0	slightly	more plastic		
25			0.0	slightly			



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-3	4301 West Chicago Avenue	
DATE:	8/8/2017	Chicago, Illinois	
LOGGED BY:	Eric Walkowiak	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	north of berm	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	39.5'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28						
29		100%	0.0	dry	stiffer	
30						
31						
32						
33						
34		100%	0.0	dry		
35						
36						
37						
38						
39					stiffer, refusal at 39.5'	
40					Boring terminated at 39.5' below ground surface (bgs)	
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-4	4301 West Chicago Avenue	
DATE:	8/2/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	interior boring, west side of building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-4A	20%	0.0	dry	0 to 2.5' FILL: Dark brown silt with sand and trace gravel, dry	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH
1					2.5' to 10' FILL: Brown to dark brown medium sand, dry	
2	B-4B	50%	0.0	dry	trace to little gravel	A soil sample was collected at 4.5'-5.5' feet bgs and held for potential later analysis
3						
4						
5						
6	10%	0.0	dry wet	slightly moist to moist	10' to 10.5': Black sand, wet to very moist	
7					10.5' to 13': Gray to dark gray clay, slightly moist to moist, stiff	
8	75%	0.0	slightly moist	slightly moist	13' to 18': Brown to gray to orangish brown silty clay, trace gravel	
9					stiff, slightly moist	
10	75%	0.0	slightly moist	slightly moist	18' to 21': Gray to grayish brown silty clay, very stiff, slightly moist	
11						
12	slightly moist	slightly moist	slightly moist	slightly moist	21' to 30': Grayish brown silty clay with little gravel, very hard, slightly moist	
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-4	4301 West Chicago Avenue	
DATE:	8/2/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	interior boring, west side of building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28						
29						
30					Boring terminated at 30' below ground surface (bgs)	
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT: City of Chicago 2FM	SITE: JPSTA
BORING NO: B-5	4301 West Chicago Avenue
DATE: 8/4/2017	Chicago, Illinois
LOGGED BY: Craig Cabrera	DRILLED BY: Groff Testing Corporation
DRILLING METHOD: CME 75 ATV Hollow stem auger	SAMPLING METHOD: Split spoon

BORING LOCATION: interior boring, center of building 1	HOLE DIA.: 7 5/8 inches
AMEC PROJECT NUMBER: 3205171606	TOTAL DEPTH: 40'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					1 inch black topsoil	No environmental samples from this boring
1		50%	0.0	dry	1" to 6' FILL: Brown silty sand with gravel, dry	
2						
3		50%	0.0	dry		
4						
5		50%	0.0	dry		
6					6 to 7.5' FILL: Black silty sand with pebbles, moist to wet	
7		50%	0.0	moist to wet		
8					7.5 to 8.5' FILL: Black silty clay, moist	
9		100%		moist	8.5" to 16": Gray silty clay, plastic, moist	
10						
11						
12						
13		100%	0.0	moist		
14					stiffer	
15		75%	0.0	moist		
16					16 to 21': Gray silty clay with some gravel, stiff, moist	
17		90%	0.0	moist		
18						
19		100%	0.0	moist		
20						
21					21' to 23.5': Gray silty clay, stiff, dry	
22		100%	0.0	dry		
23						
24					23.5 to 35': Gray silty clay, wet	
25		50%	0.0	wet		

Shelby tube collected for geotechnical testing at 8.5' to 11'



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-5	4301 West Chicago Avenue	
DATE:	8/4/2017	Chicago, Illinois	
LOGGED BY:	Craig Cabrera	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	interior boring, center of building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	40'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28						
29						
30						
31		0%				No Recovery
32						
33						
34						
35					35' to 40': Gray silty clay, stiff, moist	
36		50%	0.0	moist		
37						
38						
39						
40					Boring terminated at 40' below ground surface (bgs)	
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-6	4301 West Chicago Avenue	
DATE:	8/8/2017	Chicago, Illinois	
LOGGED BY:	Eric Walkowiak	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	top of berm	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-6A	25%	0.0	dry	0 to 1' FILL: Gray to black silty sandy clay with gravel dry obstruction at 1 foot bgs	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH
1					1' to 4' FILL: Gray to black fine silty sand with gravel, debris	
2		25%	0.0	dry		
3	B-6B	0%			4' to 6' concrete chunk, no recovery	A soil sample was collected at 8'-10' feet bgs to be analyzed for PNAs, PP metals and pH
4						
5		30%	0.0	slightly moist	6' to 6.5' FILL: Black silty sand with clay, slag-crystalline 6.5' to 8.5' FILL: Black to gray silty clay with sand and gravel	
6	B-6C	50%	0.0	slightly moist	8.5' to 9.5' FILL: Black to brown silty sand with trace gravel	A soil sample was collected at 12'-14' feet bgs to be held for potential later analysis
7					9.5' to 16' FILL: Tan silty sand with trace gravel	
8		75%	0.0	slightly moist		
9						
10						
11						
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-6	4301 West Chicago Avenue	
DATE:	8/8/2017	Chicago, Illinois	
LOGGED BY:	Eric Walkowiak	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	top of berm	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28		25%	0.0	wet	28.5" to 30" Gray sand and gravel	
29						
30					Boring terminated at 30' below ground surface (bgs)	
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-7	4301 West Chicago Avenue	
DATE:	8/2/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	southwest corner of proposed Building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	40'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-7A	50%	0.0	dry	0 to 3" grass and topsoil	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH
1					3" to 3' FILL: Black to dark brown sand with little gravel and silt, dry	
2	B-7B	60%	0.0	dry	3' to 11,25' FILL: Brown to tan medium sand, little gravel to trace gravel, dry	A soil sample was collected at 3'-4' feet bgs and held for potential later analysis
3					less gravel with depth	
4					finer sand, moist	
5					coarser sand, very moist	
6	B-7C	60%	0.0	very moist to wet	11.25' to 13': Sand to gravel, very moist to wet	A soil sample was collected at 11'-11.75' feet bgs and held for potential later analysis
7					13' to 15' Dark brown to dark gray silty clay, firm, moist	
8					15' to 18' Light gray silty clay, moist	
9					18' to 23,5' Brown and gray silty clay, firm to stiff	
10					slightly moist	
11					very moist to wet	
12	60%	0.0	moist	same clay, very moist to wet		
13						slightly moist
14						
15	60%	0.0	moist			
16	60%	0.0	moist			
17	60%	0.0	moist			
18						
19						
20						
21						
22						
23						
24						
25						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-7	4301 West Chicago Avenue	
DATE:	8/2/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	southwest corner of proposed Building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	40

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28				wet	28.5' to 29.5' Gray sandy, silty seam, wet	
29				moist	29.5' to 40' Gray silty clay, hard, moist	
30						
31						
32						
33				slightly moist to dry	trace gravel, slightly moist to dry	
34						
35						
36						
37						
38						
39					very hard	
40					Boring terminated at 40' below ground surface (bgs)	
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-8	4301 West Chicago Avenue	
DATE:	8/3/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	south edge of Building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0-1' FILL: Dark brown topsoil/silt	No environmental samples from this boring
1		30%	0.0	dry	1' to 7' FILL: Brown sand, medium, little gravel, dry	
2						
3						
4		50%	0.0	slightly moist		
5						
6		50%	0.0	moist		
7					7' to 9' FILL: Black to dark brown gravelly sad with ground slag, moist	
8						
9		60%	0.0	very moist	9' to 11' FILL: Orangish brown to brown, gravelly sand, very moist	
10						
11						
12						
13					11' to 19' Brown to gray to orangish brown silty clay, trace gravel slightly most	
14		70%	0.0	slightly moist		
15						
16						
17						
18						
19			0.0	wet	19' to 20' Dark gray sandy gravel, wet	
20					20' to 22.5' Dark gray gravelly sand, wet	
21						
22				wet	22.5' to 23' Dark gray clay with silt, wet	
23					23' to 30' Dark gray to gray silty clay with trace to little gravel	
24				slightly moist	hard	
25						

Shelby tube collected for geotechnical testing at 11' to 13'



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-8	4301 West Chicago Avenue	
DATE:	8/3/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	south edge of Building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	30'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28						
29						
30					Boring terminated at 30' below ground surface (bgs)	
31						
32						
33						
34						
35						
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT: City of Chicago 2FM	SITE: JPSTA
BORING NO: B-9	4301 West Chicago Avenue
DATE: 8/8/2017	Chicago, Illinois
LOGGED BY: Eric Walkowiak	DRILLED BY: Groff Testing Corporation
DRILLING METHOD: CME 75 ATV Hollow stem auger	SAMPLING METHOD: Split spoon

BORING LOCATION: southeast corner of building 1	HOLE DIA.: 5 5/8 inches
AMEC PROJECT NUMBER: 3205171606	TOTAL DEPTH: 35'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-9A	75%	0.0	dry	0 to 1' FILL: Black to gray silty sandy clay, dry	A soil sample was collected at 1-3' feet bgs to be analyzed for PNAs, PP metals and pH
1					1' to 3' FILL: Black silty sand with trace gravel, debris (concrete, brick), dry to slightly moist	
2		75%	0.0	slightly moist	3' to 7.5' FILL: tan to brown silty sand with trace gravel	
3	B-9B					A soil sample was collected at 6'-8' feet bgs to be held for potential later analysis
4		50%	0.0	slightly moist		
5		50%	0.0	moist wet	wet at 7.5'	
6	B-9C					A soil sample was collected at 11.5'-12.5' feet bgs to be held for potential later analysis
7		25%	0.0	wet	7.5' to 11.5' FILL: Black to dark gray sandy gravel with silty clay, wet at 8', about 3" of black sandy slag and concrete	
8						
9						
10						
11						
12		100%	0.0	slightly moist	11.5' to 35' Gray silty clay with trace sand, stiff, with some tan mottling	
13						
14		100%	0.0	slightly moist		
15						
16		50%	0.0	slightly moist	higher plasticity	
17						
18						
19						
20		75%	0.0	moist	stiff, no mottling	
21						
22		50%		dry	stiffer	
23						
24						
25		75%		dry		



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-9	4301 West Chicago Avenue	
DATE:	8/8/2017	Chicago, Illinois	
LOGGED BY:	Eric Walkowiak	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	southeast corner of building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	35'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
26						
27						
28						
29		75%	0.0	dry		
30						
31						
32						
33						
34		50%	0.0	dry	Refusal at 35'	
35					Boring terminated at 35' below ground surface (bgs)	
36						
37						
38						
39						
40						
41						
42						
43						
44						
45						
46						
47						
48						
49						
50						
51						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-10		4301 West Chicago Avenue
DATE:	8/7/2017		Chicago, Illinois
LOGGED BY:	Craig Cabrera	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	northwest corner of Building 2	HOLE DIA.:	7 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	25'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-10A	100%	0.0	moist	Black silty organic soil	A soil sample was collected at 0-1' feet bgs to be analyzed for PNAs, PP metals and pH
1					3' to 4' FILL: Tan silty sand with gravel, moist	
2	B-10B	50%	0.0	moist		A soil sample was collected at 2'-4' feet bgs to be held for potential later analysis
3					4' to 6' FILL: Tan silty sand with pebbles, wet	
4		50%	0.0	wet		
5	6' to 6.5' FILL: Black silty sand with pebbles, wet					
6		10%	0.0	wet	6.5' to 7.5' FILL: Black silty sand with slag chips, wet	
7	7.5' to 25': Green-gray silty clay, moist					
8		50%	0.0	moist	stiff	
9						
10						Shelby tube collected for geotechnical testing at 11' to 13'
11				moist	stiff	
12		100%	0.0	moist		
13	gray silty clay, moist, stiff					
14		50%	0.0	moist		
15						
16		25%	0.0	moist	large stone at 18'	
17						
18		50%	0.0	moist	large stone at 21'	
19						
20		50%	0.0	moist	gray silty clay, moist, stiff	
21						
22						
23						
24						
25					Boring terminated at 25' below ground surface (bgs)	



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-11		4301 West Chicago Avenue
DATE:	8/8/2017		Chicago, Illinois
LOGGED BY:	Eric Walkowiak	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	north central building 2	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	25'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 0.5' topsoil	
1	B-11A	75%		dry	0.5' to 1.5' FILL: Gray silty clay with some concrete, petroleum odor	A soil sample was collected at 1-2' feet bgs to be analyzed for VOCs PNAs, PP metals and pH
2			6.2		1.5' to 2' FILL: Black silty sand with concrete	
3		75%	3.7	slightly moist	2' to 7.5' FILL: Tan silty sand with trace gravel	
4						
5	B-11B	75%	0.0	slightly moist	cement debris at 5.5'	
6						
7		50%	0.0	wet	wet at 7.5'	
8					7.5' to 10' Black silty clay, organic debris (soil?)	
9		0%	0.0		No recovery 8' to 10'	
10					10' to 25': Gray silty clay with trace sand, some tan mottling	
11	B-11C	100%	0.0	slightly moist		A soil sample was collected at 11'-12' feet bgs to be held for potential later analysis
12						
13		75%	0.0			
14						
15		100%	0.0	slightly moist	higher plasticity at 15' to 16'	
16						
17		100%	0.0	moist		
18						
19					stiff	
20		75%	0.0	dry		
21						
22		75%	0.0	slightly moist		
23						
24						
25					Boring terminated at 25' below ground surface (bgs)	



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-12	4301 West Chicago Avenue	
DATE:	8/7/2017	Chicago, Illinois	
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	northeast corner building 2	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	24'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-12A	50%	0.0	moist	0 to 1.5' FILL: Black silty sand and organic soil with pebbles	A soil sample was collected at 0-2' feet bgs to be analyzed for PNAs, PP metals and pH
1					1.5' to 4' FILL: Tan silty sand	
2	B-12B	75%	0.0	wet	4 to 5.5' FILL: Tan silty sand with pebbles, wet	A soil sample was collected at 3'-4' feet bgs and held for potential later analysis
3					5.5' to 8' Black silty clay, wet to moist	
4					8' to 12' Gray silty clay, stiff, moist	
5	B-12C	50%	0.0	moist	stiff	A soil sample was collected at 7'-8' feet bgs and held for potential later analysis
6					12' to 16' Gray to brown silty clay, stiff, moist	
7		50%	0.0	moist	16' to 21' Gray silty clay, stiff, moist	
8					21' to 24' Gray silty clay with trace pebbles, stiff, moist	
9						
10						
11		75%	0.0	moist		
12						
13		100%	0.0	moist		
14						
15		100%	0.0	moist		
16						
17		75%	0.0	moist		
18						
19		75%	0.0	moist		
20						
21		50%	0.0	moist		
22						
23		50%	0.0	moist		
24						
25					Boring terminated at 24' below ground surface (bgs)	



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT: City of Chicago 2FM	SITE: JPSTA
BORING NO: B-13	4301 West Chicago Avenue
DATE: 8/7/2017	Chicago, Illinois
LOGGED BY: Andrew E. Hastings	DRILLED BY: Groff Testing Corporation
DRILLING METHOD: CME 75 ATV Hollow stem auger	SAMPLING METHOD: Split spoon

BORING LOCATION: center west building 2	HOLE DIA.: 5 5/8 inches
AMEC PROJECT NUMBER: 3205171606	TOTAL DEPTH: 26'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 1' FILL: Black organic soil with tan sand, moist	No environmental samples from this boring
1		5%	0.0	moist	1' to 4' FILL: Tan silty sand with gravel, moist	
2						
3		50%	0.0	moist		
4					4' to 5' FILL: Tan silty sand and pebbles, wet	
5		50%	0.0	wet	5' to 6' Black silty clay, wet	
6					6' to 8.5' Gray silty clay, firm, moist	
7						
8		50%	0.0	moist		
9					8.5' to 13.5' Gray to brown silty clay, firm, moist	
10		75%	0.0	moist		
11						
12		100%	0.0	moist		
13					13.5' to 16' Gray silty clay, firm, moist	
14						
15		50%	0.0	moist	pebbles at 15'	
16					16' to 26' Gray silty clay, firm, moist	
17						
18		75%	0.0	moist		
19						
20		75%	0.0	moist		
21						
22						
23		50%	0.0	moist		
24						
25		75%	0.0	moist		
					Boring terminated at 26' below ground surface (bgs)	



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-14		4301 West Chicago Avenue
DATE:	8/4/2017		Chicago, Illinois
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	center east building 2	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	26'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 1' FILL: Black organic soil	
1	B-14A	50%	0.0	moist	1' to 2' FILL: Tan silty sand, moist	A soil sample was collected at 1-2' feet bgs to be analyzed for PNAs, PP metals and pH
2					2' to 4' FILL: Brown to black silty sand	
3		50%	0.0			
4					4' to 6' FILL: Tan silty clay with trace gravel	
5		50%	0.0			
6	B-14B				6 to 12' Gray silty clay, pliable, moist	A soil sample was collected at 6'-7' feet bgs and held for potential later analysis
7		50%	0.0	moist		
8					decayed wood	
9		50%	0.0	moist		
10						
11		75%	0.0	moist		
12					12' to 14' Gray silty clay, soft, pliable, moist	
13		100%	0.0	moist		
14					14' to 21' Gray silty clay, firm, moist	
15		100%	0.0	moist		
16						
17		50%	0.0	moist		
18						
19		75%	0.0	moist		
20						
21					21' to 26' Gray silty clay, stiff, moist	
22		50%	0.0	moist		
23						
24		75%	0.0	moist		
25						
Boring terminated at 26' below ground surface (bgs)						



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT: City of Chicago 2FM	SITE: JPSTA
BORING NO: B-15	4301 West Chicago Avenue
DATE: 8/8/2017	Chicago, Illinois
LOGGED BY: Eric Walkowiak	DRILLED BY: Groff Testing Corporation
DRILLING METHOD: CME 75 ATV Hollow stem auger	SAMPLING METHOD: Split spoon

BORING LOCATION: central south building 2	HOLE DIA.: 5 5/8 inches
AMEC PROJECT NUMBER: 3205171606	TOTAL DEPTH: 25'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 0.5' Topsoil organic	
1	B-15A	75%	0.0	dry	0.5' to 1.5' FILL: Black silty sand with gravel	A soil sample was collected at 1.5'-3' feet bgs to be analyzed for PNAs, PP metals and pH
2		50%	0.0	slightly moist	1.5' to 3' FILL: Black slag material with silty sand	
3					3' to 7' FILL: Tan to brown silty sand with trace gravel	
4	B-15B	75%	0.0	moist		A soil sample was collected at 5'-6' feet bgs to be held for potential later analysis
5				wet	at 5', 2" concrete debris	
6		25%	0.0	wet	wet at 7'	
7					7' to 9' Brown to black silty sandy clay, wet	
8						
9		50%	0.0	wet	9' to 11' Sand with gravel, silt and clay	
10						
11		50%	0.0	slightly moist	11' to 25' Black to gray silty clay with trace sand, stiff, moist to dry	
12						
13		25%	0.0	moist		
14	B-15C	75%	0.0	slightly moist	at 15' Gray silty clay with tan mottling, some debris	A soil sample was collected at 14'-15' feet bgs to be held for potential later analysis
15						
16		75%	0.0	dry		
17					no mottling	
18					stiff to 25'	
19						
20		100%	0.0	dry		
21						
22						
23		75%	0.0	slightly moist		
24						
25					Boring terminated at 25' below ground surface (bgs)	



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-16		4301 West Chicago Avenue
DATE:	8/7/2017		Chicago, Illinois
LOGGED BY:	Craig Cabrera	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	southwest corner Building 2	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	25'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0					0 to 1' FILL: Black silty organic soil with trace wood and pebbles	
1	B-16A	50%	0.0	moist	1' to 4' FILL: Tan silty sand with gravel, moist	A soil sample was collected at 1-2' feet bgs to be analyzed for PNAs, PP metals and pH A soil sample was collected at 2'-4' feet bgs and held for potential later analysis
2						
3	B-16B	50%	0.0	moist	4' to 7' FILL: Tan silty sand, moist	
4						
5		50%	0.0	moist		
6						
7		50%	0.0	wet	7' to 8' FILL: Black gravel and decayed wood, wet	
8					8' to 10" Black silty clay, soft, moist	
9						
10		2%	0.0	moist	10' to 11" Green silty clay, soft, moist	
11		100%	0.0	moist	11' to 25' Tan to brown silty clay, stiff, moist	
12						
13						
14						
15						
16						
17						
18						
19						
20						
21						
22						
23						
24						
25					Boring terminated at 25' below ground surface (bgs)	



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-17		4301 West Chicago Avenue
DATE:	8/4/2017		Chicago, Illinois
LOGGED BY:	Craig Cabrera	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	southeast corner Building 2	HOLE DIA.:	7 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	23.5'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS		
0					0 to 1' FILL: Black silty organic soil with pebbles, dry			
1	B-17A	50%	1.0	dry	1' to 5' FILL: Tan silty sand with gravel, dry	A soil sample was collected at 1-2' feet bgs to be analyzed for PNAs, PP metals and pH		
2					10%		0.2	dry
3								
4								
5	B-17B	75%	0.2	moist	5' to 7' FILL: Tan silty sand, moist	A soil sample was collected at 7'-8' feet bgs to be held for potential later analysis		
6								
7					50%		0.0	moist
8					7.5' to 8' FILL: Black silty clay, moist			
9					8' to 12' Tan to green silty clay, moist			
10		50%	0.0	moist				
11								
12		100%	0.0	moist	12' to 14' Shelby tube			
13								
14					14' to 16' Brown to Gray silty clay, moist			
15		100%	0.0	moist				
16					16' to 21' Grey silty clay, moist			
17		100%	0.0	moist				
18								
19								
20		75%	0.0	moist				
21					21' to 23.5' Gray to brown silty sand, moist			
22								
23								
24					Boring terminated at 23.5' below ground surface (bgs)			
25								



8745 West Higgins Road
Suite 300
Chicago, IL 60631

TEST BORING RECORD

CLIENT:	City of Chicago 2FM	SITE:	JPSTA
BORING NO:	B-18		4301 West Chicago Avenue
DATE:	8/9/2017		Chicago, Illinois
LOGGED BY:	Andrew E. Hastings	DRILLED BY:	Groff Testing Corporation
DRILLING METHOD:	CME 75 ATV Hollow stem auger	SAMPLING METHOD:	Split spoon

BORING LOCATION:	westmost, parking area boring, west of Building 1	HOLE DIA.:	5 5/8 inches
AMEC PROJECT NUMBER:	3205171606	TOTAL DEPTH:	16'

DEPTH	SAMPLE NUMBER	SAMPLE RECOVERY	PID READING (PPM)	MOISTURE CONTENT	LITHOLOGY	REMARKS
0	B-18A	10%	0.0	dry	0 to 4.5' FILL: Brown to darker brown silty clay with sand and gravel dry	A soil sample was collected at 0-2' feet bgs to be analyzed for SRP Target Compound List parameters
1						
2	B-18B	40%	0.0	dry	4.5' to 12.5' FILL: Tan to brown sand, medium, with trace to little gravel, dry	A soil sample was collected at 4.5'-5.5' feet bgs to be analyzed for PNAs, PP metals and pH
3						
4						
5						
6						
7	B-18B	60%	0.0	dry	more brown	
8						
9						
10						
11						
12	B-18B	50%	0.0	moist	trace gravel	
13						
14						
15	B-18B	50%	0.0	very moist	12.5' to 13.5' FILL: Dark brown to black gravelly sand, slag, wet	
16						
17	B-18B	50%	0.0	moist	13.5' to 14.5' Dark brown to black silty clay with organic material (topsoil?), trace sand and gravel, very moist	
18						
19						
20						
21						
22						
23						
24						
25						
26						



APPENDIX B

Monitoring Well Construction Diagrams

Amec Foster Wheeler Environment & Infrastructure, Inc.			STICK-UP OVERBURDEN WELL/PIEZOMETER	
Project: Phase II ESA 4301 W Chicago Avenue		Number: ESB-5		
Client: City of Chicago 2FM		Date: 8/3/2017		Subcontractor: Groff
Drilling Method: 4 1/4" Hollow Stem Auger			Measuring Point	
Development Method: Peristaltic Pump/Dedicated Tubing			Type: Top of Casing	
			Elevation (ft): 95.77	
Item	Depth, below surface grade (ft)	Elevation (ft)	Description	
Riser Pipe				
Top of Inner Casing	-4.38	95.77		
Grade	0.00	91.39		
Top of Bacfill/Grout	0.00	91.39		
			Protective Casing Length:	None
			Material:	NA
			Surface Seal Type:	Medium Bentonite Chips, Hydrated
			Backfill/Grout Type:	Medium Bentonite Chips, Hydrated
			Riser Pipe Type:	PVC
			Riser Pipe ID:	2"
			Borehole Diameter:	8 1/2"
Top of Seal	0.00	91.39		
			Type of Seal:	Medium Bentonite Chips, Hydrated
Top of Filter Pack	4.25	87.14		
Top of Screen	5.53	85.86		
			Screen Type:	PVC
			Screen ID:	2"
			Screen Slot Size:	0.010"
			Screen Length:	10'
			Filter/Sand Pack Type:	#5 Filter Sand
Base of Screen	15.53	75.86		
End Cap	15.78	75.61		
			Sump:	PVC
Drilled Depth	16.00	75.39		
			Fallback/Backfill:	Natural Formation
Total Depth	16.00	75.39		
Notes: Elevations referenced to 100.00 feet designated for MW E			Prepared By: MEJ 12/17/2018	
			Reviewed By: EJW 12/21/2017	

Amec Foster Wheeler Environment & Infrastructure, Inc.			STICK-UP OVERBURDEN WELL/PIEZOMETER				
Project:	Phase II ESA 4301 W Chicago Avenue	Number:			ESB-6		
Client:	City of Chicago 2FM	Date:	8/4/2017	Subcontractor:	Groff		
Drilling Method:	4 1/4" Hollow Stem Auger			Measuring Point			
Development Method:	Peristaltic Pump/Dedicated Tubing			Type:	Top of Casing		
				Elevation (ft):	95.50		
Item	Depth, below surface grade (ft)	Elevation (ft)	Description				
Riser Pipe							
Top of Inner Casing	-3.00	95.50				Protective Casing Length:	None
Grade	0.00	92.50				Material:	NA
Top of Bacfill/Grout	0.00	92.50				Surface Seal Type:	Medium Bentonite Chips, Hydrated
						Backfill/Grout Type:	Medium Bentonite Chips, Hydrated
						Riser Pipe Type:	PVC
						Riser Pipe ID:	2"
						Borehole Diameter:	8 1/2"
Top of Seal	0.00	92.50				Type of Seal:	Medium Bentonite Chips, Hydrated
Top of Filter Pack	2.00	90.50				Screen Type:	PVC
Top of Screen	3.63	88.87				Screen ID:	2"
						Screen Slot Size:	0.010"
						Screen Length:	10'
						Filter/Sand Pack Type:	#5 Filter Sand
Base of Screen	13.63	78.87				Sump:	PVC
End Cap	13.88	78.62				Fallback/Backfill:	Natural Formation
Drilled Depth	16.00	76.50					
Total Depth	16.00	76.50					
Notes:	Elevations referenced to 100.00 feet designated for MW E			Prepared By:	MEJ 12/17/2018		
			Reviewed By:	EJW 12/21/2017			



APPENDIX C

Analytical Data

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

December 14, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17080088 Revision 3

RE: City of Chicago JPSTA, Chicago, IL

Dear Mary Jank:

STAT Analysis received 10 samples for the referenced project on 8/2/2017 6:00:00 PM. The analytical results are presented in the following report.

This report is revised to reflect additional analysis requested after the last report revision.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAP standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Martin Kucan

Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure
Project: City of Chicago JPSTA, Chicago, IL
Work Order: 17080088 Revision 3

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17080088-001A	ESB-2A		8/2/2017 10:45:00 AM	8/2/2017
17080088-001B	ESB-2A		8/2/2017 10:45:00 AM	8/2/2017
17080088-002A	ESB-2B		8/2/2017 10:55:00 AM	8/2/2017
17080088-003A	ESB-2C		8/2/2017 11:10:00 AM	8/2/2017
17080088-004A	ESB-3A		8/2/2017 12:05:00 PM	8/2/2017
17080088-004B	ESB-3A		8/2/2017 12:05:00 PM	8/2/2017
17080088-005A	ESB-3B		8/2/2017 12:20:00 PM	8/2/2017
17080088-006A	B-7A		8/2/2017 1:25:00 PM	8/2/2017
17080088-007A	B-7B		8/2/2017 1:30:00 PM	8/2/2017
17080088-008A	B-7C		8/2/2017 1:50:00 PM	8/2/2017
17080088-009A	B-4A		8/2/2017 3:35:00 PM	8/2/2017
17080088-010A	B-4B		8/2/2017 3:45:00 PM	8/2/2017

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-2A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 10:45:00 AM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/3/2017		Analyst: RRS	
Acetone	ND	0.10		mg/Kg-dry	1	8/8/2017
Benzene	ND	0.0067		mg/Kg-dry	1	8/8/2017
Bromodichloromethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
Bromoform	ND	0.0067		mg/Kg-dry	1	8/8/2017
Bromomethane	ND	0.013		mg/Kg-dry	1	8/8/2017
2-Butanone	ND	0.10		mg/Kg-dry	1	8/8/2017
Carbon disulfide	ND	0.067		mg/Kg-dry	1	8/8/2017
Carbon tetrachloride	ND	0.0067		mg/Kg-dry	1	8/8/2017
Chlorobenzene	ND	0.0067		mg/Kg-dry	1	8/8/2017
Chloroethane	ND	0.013		mg/Kg-dry	1	8/8/2017
Chloroform	ND	0.0067		mg/Kg-dry	1	8/8/2017
Chloromethane	ND	0.013		mg/Kg-dry	1	8/8/2017
Dibromochloromethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,1-Dichloroethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,2-Dichloroethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,1-Dichloroethene	ND	0.0067		mg/Kg-dry	1	8/8/2017
cis-1,2-Dichloroethene	ND	0.0067		mg/Kg-dry	1	8/8/2017
trans-1,2-Dichloroethene	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,2-Dichloropropane	ND	0.0067		mg/Kg-dry	1	8/8/2017
cis-1,3-Dichloropropene	ND	0.0027		mg/Kg-dry	1	8/8/2017
trans-1,3-Dichloropropene	ND	0.0027		mg/Kg-dry	1	8/8/2017
Ethylbenzene	ND	0.0067		mg/Kg-dry	1	8/8/2017
2-Hexanone	ND	0.027		mg/Kg-dry	1	8/8/2017
4-Methyl-2-pentanone	ND	0.027		mg/Kg-dry	1	8/8/2017
Methylene chloride	ND	0.013		mg/Kg-dry	1	8/8/2017
Methyl tert-butyl ether	ND	0.0067		mg/Kg-dry	1	8/8/2017
Styrene	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,1,2,2-Tetrachloroethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
Tetrachloroethene	ND	0.0067		mg/Kg-dry	1	8/8/2017
Toluene	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,1,1-Trichloroethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
1,1,2-Trichloroethane	ND	0.0067		mg/Kg-dry	1	8/8/2017
Trichloroethene	ND	0.0067		mg/Kg-dry	1	8/8/2017
Vinyl chloride	ND	0.0067		mg/Kg-dry	1	8/8/2017
Xylenes, Total	ND	0.020		mg/Kg-dry	1	8/8/2017
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/3/2017		Analyst: RRS	
Trichlorofluoromethane	ND	0.0067		mg/Kg-dry	1	8/8/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-2A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 10:45:00 AM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/4/2017		Analyst: DM	
Acenaphthene	ND	0.038		mg/Kg-dry	1	8/8/2017
Acenaphthylene	ND	0.038		mg/Kg-dry	1	8/8/2017
Aniline	ND	0.38		mg/Kg-dry	1	8/8/2017
Anthracene	ND	0.038		mg/Kg-dry	1	8/8/2017
Benz(a)anthracene	0.045	0.038		mg/Kg-dry	1	8/8/2017
Benzidine	ND	0.38		mg/Kg-dry	1	8/8/2017
Benzo(a)pyrene	ND	0.038		mg/Kg-dry	1	8/8/2017
Benzo(b)fluoranthene	ND	0.038		mg/Kg-dry	1	8/8/2017
Benzo(g,h,i)perylene	ND	0.038		mg/Kg-dry	1	8/8/2017
Benzo(k)fluoranthene	ND	0.038		mg/Kg-dry	1	8/8/2017
Benzoic acid	ND	0.95		mg/Kg-dry	1	8/8/2017
Benzyl alcohol	ND	0.20		mg/Kg-dry	1	8/8/2017
Bis(2-chloroethoxy)methane	ND	0.20		mg/Kg-dry	1	8/8/2017
Bis(2-chloroethyl)ether	ND	0.20		mg/Kg-dry	1	8/8/2017
Bis(2-ethylhexyl)phthalate	ND	0.95		mg/Kg-dry	1	8/8/2017
4-Bromophenyl phenyl ether	ND	0.20		mg/Kg-dry	1	8/8/2017
Butyl benzyl phthalate	ND	0.20		mg/Kg-dry	1	8/8/2017
Carbazole	ND	0.20		mg/Kg-dry	1	8/8/2017
4-Chloroaniline	ND	0.20		mg/Kg-dry	1	8/8/2017
4-Chloro-3-methylphenol	ND	0.38		mg/Kg-dry	1	8/8/2017
2-Chloronaphthalene	ND	0.20		mg/Kg-dry	1	8/8/2017
2-Chlorophenol	ND	0.20		mg/Kg-dry	1	8/8/2017
4-Chlorophenyl phenyl ether	ND	0.20		mg/Kg-dry	1	8/8/2017
Chrysene	0.052	0.038		mg/Kg-dry	1	8/8/2017
Dibenz(a,h)anthracene	ND	0.038		mg/Kg-dry	1	8/8/2017
Dibenzofuran	ND	0.20		mg/Kg-dry	1	8/8/2017
1,2-Dichlorobenzene	ND	0.20		mg/Kg-dry	1	8/8/2017
1,3-Dichlorobenzene	ND	0.20		mg/Kg-dry	1	8/8/2017
1,4-Dichlorobenzene	ND	0.20		mg/Kg-dry	1	8/8/2017
3,3'-Dichlorobenzidine	ND	0.20		mg/Kg-dry	1	8/8/2017
2,4-Dichlorophenol	ND	0.20		mg/Kg-dry	1	8/8/2017
Diethyl phthalate	ND	0.20		mg/Kg-dry	1	8/8/2017
2,4-Dimethylphenol	ND	0.20		mg/Kg-dry	1	8/8/2017
Dimethyl phthalate	ND	0.20		mg/Kg-dry	1	8/8/2017
4,6-Dinitro-2-methylphenol	ND	0.38		mg/Kg-dry	1	8/8/2017
2,4-Dinitrophenol	ND	0.95		mg/Kg-dry	1	8/8/2017
2,4-Dinitrotoluene	ND	0.038		mg/Kg-dry	1	8/8/2017
2,6-Dinitrotoluene	ND	0.038		mg/Kg-dry	1	8/8/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-2A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 10:45:00 AM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
----------	--------	----	-----------	-------	----	---------------

Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/4/2017		Analyst: DM	
--	--------------------------	--	----------------------------	--	--------------------	--

Di-n-butyl phthalate	ND	0.20		mg/Kg-dry	1	8/8/2017
Di-n-octyl phthalate	ND	0.20		mg/Kg-dry	1	8/8/2017
Fluoranthene	0.071	0.038		mg/Kg-dry	1	8/8/2017
Fluorene	ND	0.038		mg/Kg-dry	1	8/8/2017
Hexachlorobenzene	ND	0.20		mg/Kg-dry	1	8/8/2017
Hexachlorobutadiene	ND	0.20		mg/Kg-dry	1	8/8/2017
Hexachlorocyclopentadiene	ND	0.20		mg/Kg-dry	1	8/8/2017
Hexachloroethane	ND	0.20		mg/Kg-dry	1	8/8/2017
Indeno(1,2,3-cd)pyrene	ND	0.038		mg/Kg-dry	1	8/8/2017
Isophorone	ND	0.20		mg/Kg-dry	1	8/8/2017
2-Methylnaphthalene	ND	0.20		mg/Kg-dry	1	8/8/2017
2-Methylphenol	ND	0.20		mg/Kg-dry	1	8/8/2017
4-Methylphenol	ND	0.20		mg/Kg-dry	1	8/8/2017
Naphthalene	ND	0.038		mg/Kg-dry	1	8/8/2017
2-Nitroaniline	ND	0.20		mg/Kg-dry	1	8/8/2017
3-Nitroaniline	ND	0.20		mg/Kg-dry	1	8/8/2017
4-Nitroaniline	ND	0.20		mg/Kg-dry	1	8/8/2017
2-Nitrophenol	ND	0.20		mg/Kg-dry	1	8/8/2017
4-Nitrophenol	ND	0.38		mg/Kg-dry	1	8/8/2017
Nitrobenzene	ND	0.038		mg/Kg-dry	1	8/8/2017
N-Nitrosodi-n-propylamine	ND	0.038		mg/Kg-dry	1	8/8/2017
N-Nitrosodimethylamine	ND	0.20		mg/Kg-dry	1	8/8/2017
N-Nitrosodiphenylamine	ND	0.038		mg/Kg-dry	1	8/8/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.20		mg/Kg-dry	1	8/8/2017
Pentachlorophenol	ND	0.038		mg/Kg-dry	1	8/8/2017
Phenanthrene	ND	0.038		mg/Kg-dry	1	8/8/2017
Phenol	ND	0.20		mg/Kg-dry	1	8/8/2017
Pyrene	0.065	0.038		mg/Kg-dry	1	8/8/2017
Pyridine	ND	0.77		mg/Kg-dry	1	8/8/2017
1,2,4-Trichlorobenzene	ND	0.20		mg/Kg-dry	1	8/8/2017
2,4,5-Trichlorophenol	ND	0.20		mg/Kg-dry	1	8/8/2017
2,4,6-Trichlorophenol	ND	0.20		mg/Kg-dry	1	8/8/2017

PCBs	SW8082 (SW3550B)		Prep Date: 8/5/2017		Analyst: GVC	
-------------	-------------------------	--	----------------------------	--	---------------------	--

Aroclor 1016	ND	0.092		mg/Kg-dry	1	8/7/2017
Aroclor 1221	ND	0.092		mg/Kg-dry	1	8/7/2017
Aroclor 1232	ND	0.092		mg/Kg-dry	1	8/7/2017
Aroclor 1242	ND	0.092		mg/Kg-dry	1	8/7/2017
Aroclor 1248	ND	0.092		mg/Kg-dry	1	8/7/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-2A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 10:45:00 AM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)				Prep Date: 8/5/2017	Analyst: GVC
Aroclor 1254	ND	0.092		mg/Kg-dry	1	8/7/2017
Aroclor 1260	ND	0.092		mg/Kg-dry	1	8/7/2017
Pesticides	SW8081 (SW3550B)				Prep Date: 8/5/2017	Analyst: GVC
4,4'-DDD	ND	0.0018		mg/Kg-dry	1	8/7/2017
4,4'-DDE	ND	0.0018		mg/Kg-dry	1	8/7/2017
4,4'-DDT	ND	0.0018		mg/Kg-dry	1	8/7/2017
Aldrin	ND	0.0018		mg/Kg-dry	1	8/7/2017
alpha-BHC	ND	0.0018		mg/Kg-dry	1	8/7/2017
alpha-Chlordane	ND	0.0018		mg/Kg-dry	1	8/7/2017
beta-BHC	ND	0.0018		mg/Kg-dry	1	8/7/2017
Chlordane	ND	0.018		mg/Kg-dry	1	8/7/2017
delta-BHC	ND	0.0018		mg/Kg-dry	1	8/7/2017
Dieldrin	ND	0.0018		mg/Kg-dry	1	8/7/2017
Endosulfan I	ND	0.0018		mg/Kg-dry	1	8/7/2017
Endosulfan II	ND	0.0018		mg/Kg-dry	1	8/7/2017
Endosulfan sulfate	ND	0.0018		mg/Kg-dry	1	8/7/2017
Endrin	ND	0.0018		mg/Kg-dry	1	8/7/2017
Endrin aldehyde	ND	0.0018		mg/Kg-dry	1	8/7/2017
Endrin ketone	ND	0.0018		mg/Kg-dry	1	8/7/2017
gamma-BHC	ND	0.0018		mg/Kg-dry	1	8/7/2017
gamma-Chlordane	ND	0.0018		mg/Kg-dry	1	8/7/2017
Heptachlor	ND	0.0018		mg/Kg-dry	1	8/7/2017
Heptachlor epoxide	ND	0.0018		mg/Kg-dry	1	8/7/2017
Methoxychlor	ND	0.0018		mg/Kg-dry	1	8/7/2017
Toxaphene	ND	0.038		mg/Kg-dry	1	8/7/2017
Herbicides in Soil	SW8321A (SW3550B)				Prep Date: 8/3/2017	Analyst: MEP
2,4,5-TP (Silvex)	ND	0.0038		mg/Kg-dry	1	8/3/2017
2,4-D	ND	0.0038		mg/Kg-dry	1	8/3/2017
Dalapon	ND	0.038		mg/Kg-dry	1	8/3/2017
Dinoseb	ND	0.0077		mg/Kg-dry	1	8/3/2017
Pentachlorophenol	ND	0.012	*	mg/Kg-dry	1	8/3/2017
Picloram	ND	0.0077	*	mg/Kg-dry	1	8/3/2017
Metals by ICP/MS	SW6020 (SW3050B)				Prep Date: 8/8/2017	Analyst: JG
Aluminum	6600	21		mg/Kg-dry	10	8/9/2017
Antimony	ND	2.1		mg/Kg-dry	10	8/9/2017
Arsenic	8.6	1.0		mg/Kg-dry	10	8/9/2017
Barium	42	1.0		mg/Kg-dry	10	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-2A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 10:45:00 AM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/8/2017		Analyst: JG	
Beryllium	0.54	0.52		mg/Kg-dry	10	8/9/2017
Cadmium	0.59	0.52		mg/Kg-dry	10	8/9/2017
Calcium	40000	62		mg/Kg-dry	10	8/9/2017
Chromium	17	1.0		mg/Kg-dry	10	8/9/2017
Cobalt	9.3	1.0		mg/Kg-dry	10	8/9/2017
Copper	47	2.6		mg/Kg-dry	10	8/9/2017
Iron	24000	31		mg/Kg-dry	10	8/9/2017
Lead	94	0.52		mg/Kg-dry	10	8/9/2017
Magnesium	23000	31		mg/Kg-dry	10	8/9/2017
Manganese	410	1.0		mg/Kg-dry	10	8/9/2017
Nickel	27	1.0		mg/Kg-dry	10	8/9/2017
Potassium	1400	31		mg/Kg-dry	10	8/9/2017
Selenium	ND	1.0		mg/Kg-dry	10	8/9/2017
Silver	ND	1.0		mg/Kg-dry	10	8/9/2017
Sodium	100	62		mg/Kg-dry	10	8/9/2017
Thallium	ND	1.0		mg/Kg-dry	10	8/9/2017
Vanadium	17	1.0		mg/Kg-dry	10	8/9/2017
Zinc	130	5.2		mg/Kg-dry	10	8/9/2017
SPLP Metals by ICP/MS	SW1312/6020A (SW3005A)		Prep Date: 11/24/2017		Analyst: JG	
Cobalt	ND	0.0040		mg/L	2	11/24/2017
Iron	0.65	0.10		mg/L	2	11/24/2017
Mercury	SW7471A		Prep Date: 8/3/2017		Analyst: LB	
Mercury	0.038	0.021		mg/Kg-dry	1	8/4/2017
Cyanide, Total	SW9012A		Prep Date: 8/4/2017		Analyst: MD	
Cyanide	ND	0.29		mg/Kg-dry	1	8/5/2017
pH (25 °C)	SW9045C		Prep Date: 8/3/2017		Analyst: RW	
pH	8.21			pH Units	1	8/3/2017
Percent Moisture	D2974		Prep Date: 8/3/2017		Analyst: KKA	
Percent Moisture	13.2	0.2	*	wt%	1	8/4/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-3A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 12:05:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-004

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/3/2017		Analyst: RRS	
Acetone	ND	0.096		mg/Kg-dry	1	8/8/2017
Benzene	ND	0.0064		mg/Kg-dry	1	8/8/2017
Bromodichloromethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
Bromoform	ND	0.0064		mg/Kg-dry	1	8/8/2017
Bromomethane	ND	0.013		mg/Kg-dry	1	8/8/2017
2-Butanone	ND	0.096		mg/Kg-dry	1	8/8/2017
Carbon disulfide	ND	0.064		mg/Kg-dry	1	8/8/2017
Carbon tetrachloride	ND	0.0064		mg/Kg-dry	1	8/8/2017
Chlorobenzene	ND	0.0064		mg/Kg-dry	1	8/8/2017
Chloroethane	ND	0.013		mg/Kg-dry	1	8/8/2017
Chloroform	ND	0.0064		mg/Kg-dry	1	8/8/2017
Chloromethane	ND	0.013		mg/Kg-dry	1	8/8/2017
Dibromochloromethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,1-Dichloroethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,2-Dichloroethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,1-Dichloroethene	ND	0.0064		mg/Kg-dry	1	8/8/2017
cis-1,2-Dichloroethene	ND	0.0064		mg/Kg-dry	1	8/8/2017
trans-1,2-Dichloroethene	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,2-Dichloropropane	ND	0.0064		mg/Kg-dry	1	8/8/2017
cis-1,3-Dichloropropene	ND	0.0026		mg/Kg-dry	1	8/8/2017
trans-1,3-Dichloropropene	ND	0.0026		mg/Kg-dry	1	8/8/2017
Ethylbenzene	ND	0.0064		mg/Kg-dry	1	8/8/2017
2-Hexanone	ND	0.026		mg/Kg-dry	1	8/8/2017
4-Methyl-2-pentanone	ND	0.026		mg/Kg-dry	1	8/8/2017
Methylene chloride	ND	0.013		mg/Kg-dry	1	8/8/2017
Methyl tert-butyl ether	ND	0.0064		mg/Kg-dry	1	8/8/2017
Styrene	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,1,2,2-Tetrachloroethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
Tetrachloroethene	ND	0.0064		mg/Kg-dry	1	8/8/2017
Toluene	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,1,1-Trichloroethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
1,1,2-Trichloroethane	ND	0.0064		mg/Kg-dry	1	8/8/2017
Trichloroethene	ND	0.0064		mg/Kg-dry	1	8/8/2017
Vinyl chloride	ND	0.0064		mg/Kg-dry	1	8/8/2017
Xylenes, Total	ND	0.019		mg/Kg-dry	1	8/8/2017
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/3/2017		Analyst: RRS	
Trichlorofluoromethane	ND	0.0064		mg/Kg-dry	1	8/8/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-3A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 12:05:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-004

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/4/2017		Analyst: DM	
Acenaphthene	0.41	0.35		mg/Kg-dry	1	8/8/2017
Acenaphthylene	ND	0.35		mg/Kg-dry	1	8/8/2017
Aniline	ND	3.6		mg/Kg-dry	1	8/8/2017
Anthracene	0.82	0.35		mg/Kg-dry	1	8/8/2017
Benz(a)anthracene	2.4	0.35		mg/Kg-dry	1	8/8/2017
Benzidine	ND	3.5		mg/Kg-dry	1	8/8/2017
Benzo(a)pyrene	0.84	0.35		mg/Kg-dry	1	8/8/2017
Benzo(b)fluoranthene	ND	0.35		mg/Kg-dry	1	8/8/2017
Benzo(g,h,i)perylene	1.6	0.35		mg/Kg-dry	1	8/8/2017
Benzo(k)fluoranthene	ND	0.35		mg/Kg-dry	1	8/8/2017
Benzoic acid	ND	8.8		mg/Kg-dry	1	8/8/2017
Benzyl alcohol	ND	1.8		mg/Kg-dry	1	8/8/2017
Bis(2-chloroethoxy)methane	ND	1.8		mg/Kg-dry	1	8/8/2017
Bis(2-chloroethyl)ether	ND	1.8		mg/Kg-dry	1	8/8/2017
Bis(2-ethylhexyl)phthalate	ND	8.8		mg/Kg-dry	1	8/8/2017
4-Bromophenyl phenyl ether	ND	1.8		mg/Kg-dry	1	8/8/2017
Butyl benzyl phthalate	ND	1.8		mg/Kg-dry	1	8/8/2017
Carbazole	ND	1.8		mg/Kg-dry	1	8/8/2017
4-Chloroaniline	ND	1.8		mg/Kg-dry	1	8/8/2017
4-Chloro-3-methylphenol	ND	3.5		mg/Kg-dry	1	8/8/2017
2-Chloronaphthalene	ND	1.8		mg/Kg-dry	1	8/8/2017
2-Chlorophenol	ND	1.8		mg/Kg-dry	1	8/8/2017
4-Chlorophenyl phenyl ether	ND	1.8		mg/Kg-dry	1	8/8/2017
Chrysene	4.1	0.35		mg/Kg-dry	1	8/8/2017
Dibenz(a,h)anthracene	ND	0.35		mg/Kg-dry	1	8/8/2017
Dibenzofuran	ND	1.8		mg/Kg-dry	1	8/8/2017
1,2-Dichlorobenzene	ND	1.8		mg/Kg-dry	1	8/8/2017
1,3-Dichlorobenzene	ND	1.8		mg/Kg-dry	1	8/8/2017
1,4-Dichlorobenzene	ND	1.8		mg/Kg-dry	1	8/8/2017
3,3'-Dichlorobenzidine	ND	1.8		mg/Kg-dry	1	8/8/2017
2,4-Dichlorophenol	ND	1.8		mg/Kg-dry	1	8/8/2017
Diethyl phthalate	ND	1.8		mg/Kg-dry	1	8/8/2017
2,4-Dimethylphenol	ND	1.8		mg/Kg-dry	1	8/8/2017
Dimethyl phthalate	ND	1.8		mg/Kg-dry	1	8/8/2017
4,6-Dinitro-2-methylphenol	ND	3.5		mg/Kg-dry	1	8/8/2017
2,4-Dinitrophenol	ND	8.8		mg/Kg-dry	1	8/8/2017
2,4-Dinitrotoluene	ND	0.35		mg/Kg-dry	1	8/8/2017
2,6-Dinitrotoluene	ND	0.35		mg/Kg-dry	1	8/8/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-3A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 12:05:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-004

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS		SW8270C (SW3550B)		Prep Date: 8/4/2017		Analyst: DM
Di-n-butyl phthalate	ND	1.8		mg/Kg-dry	1	8/8/2017
Di-n-octyl phthalate	ND	1.8		mg/Kg-dry	1	8/8/2017
Fluoranthene	3.1	0.35		mg/Kg-dry	1	8/8/2017
Fluorene	ND	0.35		mg/Kg-dry	1	8/8/2017
Hexachlorobenzene	ND	1.8		mg/Kg-dry	1	8/8/2017
Hexachlorobutadiene	ND	1.8		mg/Kg-dry	1	8/8/2017
Hexachlorocyclopentadiene	ND	1.8		mg/Kg-dry	1	8/8/2017
Hexachloroethane	ND	1.8		mg/Kg-dry	1	8/8/2017
Indeno(1,2,3-cd)pyrene	0.94	0.35		mg/Kg-dry	1	8/8/2017
Isophorone	ND	1.8		mg/Kg-dry	1	8/8/2017
2-Methylnaphthalene	ND	1.8		mg/Kg-dry	1	8/8/2017
2-Methylphenol	ND	1.8		mg/Kg-dry	1	8/8/2017
4-Methylphenol	ND	1.8		mg/Kg-dry	1	8/8/2017
Naphthalene	ND	0.35		mg/Kg-dry	1	8/8/2017
2-Nitroaniline	ND	1.8		mg/Kg-dry	1	8/8/2017
3-Nitroaniline	ND	1.8		mg/Kg-dry	1	8/8/2017
4-Nitroaniline	ND	1.8		mg/Kg-dry	1	8/8/2017
2-Nitrophenol	ND	1.8		mg/Kg-dry	1	8/8/2017
4-Nitrophenol	ND	3.5		mg/Kg-dry	1	8/8/2017
Nitrobenzene	ND	0.35		mg/Kg-dry	1	8/8/2017
N-Nitrosodi-n-propylamine	ND	0.35		mg/Kg-dry	1	8/8/2017
N-Nitrosodimethylamine	ND	1.8		mg/Kg-dry	1	8/8/2017
N-Nitrosodiphenylamine	ND	0.35		mg/Kg-dry	1	8/8/2017
2, 2'-oxybis(1-Chloropropane)	ND	1.8		mg/Kg-dry	1	8/8/2017
Pentachlorophenol	ND	0.35		mg/Kg-dry	1	8/8/2017
Phenanthrene	2.6	0.35		mg/Kg-dry	1	8/8/2017
Phenol	ND	1.8		mg/Kg-dry	1	8/8/2017
Pyrene	6.4	0.35		mg/Kg-dry	1	8/8/2017
Pyridine	ND	7.1		mg/Kg-dry	1	8/8/2017
1,2,4-Trichlorobenzene	ND	1.8		mg/Kg-dry	1	8/8/2017
2,4,5-Trichlorophenol	ND	1.8		mg/Kg-dry	1	8/8/2017
2,4,6-Trichlorophenol	ND	1.8		mg/Kg-dry	1	8/8/2017
PCBs		SW8082 (SW3550B)		Prep Date: 8/5/2017		Analyst: GVC
Aroclor 1016	ND	0.085		mg/Kg-dry	1	8/7/2017
Aroclor 1221	ND	0.085		mg/Kg-dry	1	8/7/2017
Aroclor 1232	ND	0.085		mg/Kg-dry	1	8/7/2017
Aroclor 1242	ND	0.085		mg/Kg-dry	1	8/7/2017
Aroclor 1248	ND	0.085		mg/Kg-dry	1	8/7/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-3A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 12:05:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-004

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)			Prep Date: 8/5/2017		Analyst: GVC
Aroclor 1254	ND	0.085		mg/Kg-dry	1	8/7/2017
Aroclor 1260	ND	0.085		mg/Kg-dry	1	8/7/2017
Pesticides	SW8081 (SW3550B)			Prep Date: 8/5/2017		Analyst: GVC
4,4'-DDD	ND	0.0017		mg/Kg-dry	1	8/7/2017
4,4'-DDE	ND	0.0017		mg/Kg-dry	1	8/7/2017
4,4'-DDT	ND	0.0017		mg/Kg-dry	1	8/7/2017
Aldrin	ND	0.0017		mg/Kg-dry	1	8/7/2017
alpha-BHC	ND	0.0017		mg/Kg-dry	1	8/7/2017
alpha-Chlordane	ND	0.0017		mg/Kg-dry	1	8/7/2017
beta-BHC	ND	0.0017		mg/Kg-dry	1	8/7/2017
Chlordane	ND	0.017		mg/Kg-dry	1	8/7/2017
delta-BHC	ND	0.0017		mg/Kg-dry	1	8/7/2017
Dieldrin	ND	0.0017		mg/Kg-dry	1	8/7/2017
Endosulfan I	ND	0.0017		mg/Kg-dry	1	8/7/2017
Endosulfan II	ND	0.0017		mg/Kg-dry	1	8/7/2017
Endosulfan sulfate	ND	0.0017		mg/Kg-dry	1	8/7/2017
Endrin	ND	0.0017		mg/Kg-dry	1	8/7/2017
Endrin aldehyde	ND	0.0017		mg/Kg-dry	1	8/7/2017
Endrin ketone	ND	0.0017		mg/Kg-dry	1	8/7/2017
gamma-BHC	ND	0.0017		mg/Kg-dry	1	8/7/2017
gamma-Chlordane	ND	0.0017		mg/Kg-dry	1	8/7/2017
Heptachlor	ND	0.0017		mg/Kg-dry	1	8/7/2017
Heptachlor epoxide	ND	0.0017		mg/Kg-dry	1	8/7/2017
Methoxychlor	ND	0.0017		mg/Kg-dry	1	8/7/2017
Toxaphene	ND	0.035		mg/Kg-dry	1	8/7/2017
Metals by ICP/MS	SW6020 (SW3050B)			Prep Date: 8/8/2017		Analyst: JG
Aluminum	4400	19		mg/Kg-dry	10	8/9/2017
Antimony	ND	1.9		mg/Kg-dry	10	8/9/2017
Arsenic	6.4	0.95		mg/Kg-dry	10	8/9/2017
Barium	45	0.95		mg/Kg-dry	10	8/9/2017
Beryllium	ND	0.48		mg/Kg-dry	10	8/9/2017
Cadmium	0.56	0.48		mg/Kg-dry	10	8/9/2017
Calcium	80000	57		mg/Kg-dry	10	8/9/2017
Chromium	13	0.95		mg/Kg-dry	10	8/9/2017
Cobalt	4.7	0.95		mg/Kg-dry	10	8/9/2017
Copper	77	2.4		mg/Kg-dry	10	8/9/2017
Iron	19000	29		mg/Kg-dry	10	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-3A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 12:05:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-004

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/8/2017		Analyst: JG	
Lead	160	0.48		mg/Kg-dry	10	8/9/2017
Magnesium	43000	29		mg/Kg-dry	10	8/9/2017
Manganese	340	0.95		mg/Kg-dry	10	8/9/2017
Nickel	15	0.95		mg/Kg-dry	10	8/9/2017
Potassium	800	29		mg/Kg-dry	10	8/9/2017
Selenium	ND	0.95		mg/Kg-dry	10	8/9/2017
Silver	ND	0.95		mg/Kg-dry	10	8/9/2017
Sodium	180	57		mg/Kg-dry	10	8/9/2017
Thallium	ND	0.95		mg/Kg-dry	10	8/9/2017
Vanadium	18	0.95		mg/Kg-dry	10	8/9/2017
Zinc	180	4.8		mg/Kg-dry	10	8/9/2017
TCLP Metals by ICP/MS	SW1311/6020 (SW3005A)		Prep Date: 12/12/2017		Analyst: JG	
Iron	ND	0.25		mg/L	5	12/13/2017
Mercury	SW7471A		Prep Date: 8/3/2017		Analyst: LB	
Mercury	0.065	0.019		mg/Kg-dry	1	8/4/2017
Cyanide, Total	SW9012A		Prep Date: 8/4/2017		Analyst: MD	
Cyanide	ND	0.27		mg/Kg-dry	1	8/5/2017
pH (25 °C)	SW9045C		Prep Date: 8/3/2017		Analyst: RW	
pH	8.15			pH Units	1	8/3/2017
Percent Moisture	D2974		Prep Date: 8/3/2017		Analyst: KKA	
Percent Moisture	6.7	0.2	*	wt%	1	8/4/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-3B

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 12:20:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-005

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS	SW8270C (SW3550B)				Prep Date: 8/4/2017	Analyst: DM
Acenaphthene	0.16	0.034		mg/Kg-dry	1	8/8/2017
Acenaphthylene	0.19	0.034		mg/Kg-dry	1	8/8/2017
Anthracene	0.82	0.034		mg/Kg-dry	1	8/8/2017
Benzo(a)anthracene	2.6	0.034		mg/Kg-dry	1	8/8/2017
Benzo(a)pyrene	3.0	0.034		mg/Kg-dry	1	8/8/2017
Benzo(b)fluoranthene	2.9	0.034		mg/Kg-dry	1	8/8/2017
Benzo(g,h,i)perylene	1.9	0.034		mg/Kg-dry	1	8/8/2017
Benzo(k)fluoranthene	2.2	0.034		mg/Kg-dry	1	8/8/2017
Chrysene	2.8	0.034		mg/Kg-dry	1	8/8/2017
Dibenz(a,h)anthracene	0.87	0.034		mg/Kg-dry	1	8/8/2017
Fluoranthene	4.3	0.17		mg/Kg-dry	5	8/9/2017
Fluorene	0.25	0.034		mg/Kg-dry	1	8/8/2017
Indeno(1,2,3-cd)pyrene	1.7	0.034		mg/Kg-dry	1	8/8/2017
Naphthalene	0.12	0.034		mg/Kg-dry	1	8/8/2017
Phenanthrene	2.3	0.034		mg/Kg-dry	1	8/8/2017
Pyrene	3.9	0.034		mg/Kg-dry	1	8/8/2017
Percent Moisture	D2974				Prep Date: 8/3/2017	Analyst: KKA
Percent Moisture	5.6	0.2	*	wt%	1	8/4/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-7A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 1:25:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-006

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS SW8270C (SW3550B) Prep Date: 8/4/2017 Analyst: DM						
Acenaphthene	ND	0.039		mg/Kg-dry	1	8/9/2017
Acenaphthylene	ND	0.039		mg/Kg-dry	1	8/9/2017
Anthracene	0.040	0.039		mg/Kg-dry	1	8/9/2017
Benz(a)anthracene	0.17	0.039		mg/Kg-dry	1	8/9/2017
Benzo(a)pyrene	ND	0.039		mg/Kg-dry	1	8/9/2017
Benzo(b)fluoranthene	0.042	0.039		mg/Kg-dry	1	8/9/2017
Benzo(g,h,i)perylene	0.13	0.039		mg/Kg-dry	1	8/9/2017
Benzo(k)fluoranthene	ND	0.039		mg/Kg-dry	1	8/9/2017
Chrysene	0.21	0.039		mg/Kg-dry	1	8/9/2017
Dibenz(a,h)anthracene	0.14	0.039		mg/Kg-dry	1	8/9/2017
Fluoranthene	0.32	0.039		mg/Kg-dry	1	8/9/2017
Fluorene	ND	0.039		mg/Kg-dry	1	8/9/2017
Indeno(1,2,3-cd)pyrene	0.11	0.039		mg/Kg-dry	1	8/9/2017
Naphthalene	ND	0.039		mg/Kg-dry	1	8/9/2017
Phenanthrene	0.17	0.039		mg/Kg-dry	1	8/9/2017
Pyrene	0.29	0.039		mg/Kg-dry	1	8/9/2017
Metals by ICP/MS SW6020 (SW3050B) Prep Date: 8/8/2017 Analyst: JG						
Antimony	4.6	2.0		mg/Kg-dry	10	8/9/2017
Arsenic	12	1.0		mg/Kg-dry	10	8/9/2017
Beryllium	1.6	0.50		mg/Kg-dry	10	8/10/2017
Cadmium	1.4	0.50		mg/Kg-dry	10	8/9/2017
Chromium	13	1.0		mg/Kg-dry	10	8/9/2017
Copper	79	2.5		mg/Kg-dry	10	8/9/2017
Lead	160	0.50		mg/Kg-dry	10	8/9/2017
Nickel	18	1.0		mg/Kg-dry	10	8/9/2017
Selenium	2.0	1.0		mg/Kg-dry	10	8/9/2017
Silver	ND	1.0		mg/Kg-dry	10	8/9/2017
Thallium	ND	1.0		mg/Kg-dry	10	8/9/2017
Zinc	180	5.0		mg/Kg-dry	10	8/9/2017
Mercury SW7471A Prep Date: 8/3/2017 Analyst: LB						
Mercury	0.23	0.020		mg/Kg-dry	1	8/4/2017
pH (25 °C) SW9045C Prep Date: 8/3/2017 Analyst: RW						
pH	7.42			pH Units	1	8/3/2017
Percent Moisture D2974 Prep Date: 8/3/2017 Analyst: KKA						
Percent Moisture	15.4	0.2	*	wt%	1	8/4/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 14, 2017

ANALYTICAL RESULTS

Date Printed: December 14, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-4A

Work Order: 17080088 Revision 3

Collection Date: 8/2/2017 3:35:00 PM

Project: City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080088-009

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS SW8270C (SW3550B) Prep Date: 8/4/2017 Analyst: DM						
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/9/2017
Acenaphthylene	0.050	0.035		mg/Kg-dry	1	8/9/2017
Anthracene	0.17	0.035		mg/Kg-dry	1	8/9/2017
Benzo(a)anthracene	0.75	0.035		mg/Kg-dry	1	8/9/2017
Benzo(a)pyrene	0.71	0.035		mg/Kg-dry	1	8/9/2017
Benzo(b)fluoranthene	0.56	0.035		mg/Kg-dry	1	8/9/2017
Benzo(g,h,i)perylene	0.61	0.035		mg/Kg-dry	1	8/9/2017
Benzo(k)fluoranthene	0.64	0.035		mg/Kg-dry	1	8/9/2017
Chrysene	1.1	0.035		mg/Kg-dry	1	8/9/2017
Dibenz(a,h)anthracene	0.27	0.035		mg/Kg-dry	1	8/9/2017
Fluoranthene	0.95	0.035		mg/Kg-dry	1	8/9/2017
Fluorene	0.049	0.035		mg/Kg-dry	1	8/9/2017
Indeno(1,2,3-cd)pyrene	0.44	0.035		mg/Kg-dry	1	8/9/2017
Naphthalene	0.060	0.035		mg/Kg-dry	1	8/9/2017
Phenanthrene	0.92	0.035		mg/Kg-dry	1	8/9/2017
Pyrene	1.1	0.035		mg/Kg-dry	1	8/9/2017
Metals by ICP/MS SW6020 (SW3050B) Prep Date: 8/8/2017 Analyst: JG						
Antimony	2.5	1.9		mg/Kg-dry	10	8/9/2017
Arsenic	12	0.95		mg/Kg-dry	10	8/9/2017
Beryllium	1.1	0.47		mg/Kg-dry	10	8/10/2017
Cadmium	1.5	0.47		mg/Kg-dry	10	8/9/2017
Chromium	16	0.95		mg/Kg-dry	10	8/9/2017
Copper	83	2.4		mg/Kg-dry	10	8/9/2017
Lead	190	0.47		mg/Kg-dry	10	8/9/2017
Nickel	17	0.95		mg/Kg-dry	10	8/9/2017
Selenium	1.6	0.95		mg/Kg-dry	10	8/9/2017
Silver	ND	0.95		mg/Kg-dry	10	8/9/2017
Thallium	ND	0.95		mg/Kg-dry	10	8/9/2017
Zinc	280	4.7		mg/Kg-dry	10	8/9/2017
Mercury SW7471A Prep Date: 8/3/2017 Analyst: LB						
Mercury	0.086	0.019		mg/Kg-dry	1	8/4/2017
pH (25 °C) SW9045C Prep Date: 8/3/2017 Analyst: RW						
pH	7.61			pH Units	1	8/3/2017
Percent Moisture D2974 Prep Date: 8/3/2017 Analyst: KKA						
Percent Moisture	6.9	0.2	*	wt%	1	8/4/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

CHAIN OF CUSTODY RECORD

Company: <u>Amec Foster Wheeler</u>		Client Tracking No.:					
Project Number:		Project Name: <u>City of Chicago JPSTA</u>					
Project Location: <u>Chicago, IL</u>		Sampler(s): <u>Andrew Hastings</u>					
Report To: <u>Mary Jane</u>		Phone: <u>773-693-6030</u>					
Report To: <u>Andrew Hastings</u>		Fax: <u>-</u>					
QC Level: 1 2 3 4		e-mail: <u>MaryJane@amfc.com</u>					
Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab	Preserv.	No. of Containers
ESB-2A	8/2/17	1045	Soil	X	F	X	5
ESB-2B	8/2/17	1055	Soil	X	A	X	1
ESB-2C	8/2/17	1110	Soil	X	A	X	1
ESB-3A	8/2/17	1205	Soil	X	F	X	4
ESB-3B	8/2/17	1220	Soil	X	A	X	1
B-7A	8/2/17	1325	Soil	X	A	X	1
B-7B	8/2/17	1330	Soil	X	A	X	1
B-7C	8/2/17	1350	Soil	X	A	X	1
B-4A	8/2/17	1535	Soil	X	A	X	1
B-4B	8/2/17	1545	Soil	X	A	X	1

Reinquished by: (Signature) <u>Andrew Hastings</u>	Date/Time: <u>8/2/17 18:00</u>
Received by: (Signature) <u>Andrew Hastings</u>	Date/Time: <u>8/2/17 18:00</u>
Reinquished by: (Signature)	Date/Time:
Received by: (Signature)	Date/Time:
Reinquished by: (Signature)	Date/Time:
Received by: (Signature)	Date/Time:

Comments:
Target Compound List (SRM) <u>X</u>
Priority Pollutant Metals <u>X</u>
PAHs <u>X</u>
PH <u>X</u>
Herbicides <u>X</u>

Quote No.:	
P.O. No.:	
Turn Around Time (Days):	1 2 3 4 5 7 10
Results Needed:	/ /
Additional Information:	Lab No.:
Extra 402jer	001
HOLD	002
HOLD	003
	004
	005
	006
HOLD	007
HOLD	008
HOLD	009
HOLD	010

Laboratory Work Order No:	<u>1708088</u>
Received on Ice: Yes <input checked="" type="checkbox"/> No <input type="checkbox"/>	Temperature: <u>470</u> °C

Sample Receipt Checklist

Client Name **AMEC**

Date and Time Received: **8/2/2017 6:00:00 PM**

Work Order Number **17080088**

Received by: **JNW**

Checklist completed by: _____

Signature

Date

Reviewed by: **MK**

Initials

Date

Matrix:

Carrier name Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature **4.6 °C**
- Water - VOA vials have zero headspace? No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: _____
- Water - Samples properly preserved? Yes No pH Adjusted? _____

Any No response must be detailed in the comments section below.

Comments: Report trichlorofluoromethane per Mary Jank verbal 8/22/17.

Client / Person contacted: _____

Date contacted: _____

Contacted by: _____

Response: _____

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Monday, November 20, 2017 3:47 PM
To: Craig Chawla; Frank Capoccia
Subject: Additional Testing -

Please perform additional leaching procedure testing (TCLP or SPLP) for the following metals on the identified samples:

B-18A – chromium and manganese your sample # 17080321-011

B-6B – chromium your sample #17080265-014

ESB-2A – cobalt, iron – your sample #17080088-001

ESB-4A – iron your sample #17080223-001

ESB-5A – iron your sample #17080126-001

ESB-6A – iron, manganese your sample #17080177-001

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Thursday, December 07, 2017 6:48 PM
To: Craig Chawla; Frank Capoccia
Subject: More TCLP/SPLP for JPSTA

Please run TCLP/SPLP for the following samples for the listed metals:

B-18A – Iron your sample #17080321-011 – chromium and manganese were already done
ESB-3A – Iron - your sample #17080088-004

Thank you

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

November 27, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17080126 Revision 2

RE: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Dear Mary Jank:

STAT Analysis received 3 samples for the referenced project on 8/3/2017 4:05:00 PM. The analytical results are presented in the following report.

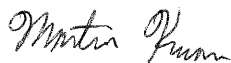
This report is revised to reflect additional analysis requested after the last report revision.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAP standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Martin Kucan

Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure**Project:** 3205-17-1606, City of Chicago JPSTA, Chicago, IL**Work Order:** 17080126 Revision 2**Work Order Sample Summary**

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17080126-001A	ESB-5A		8/3/2017 10:55:00 AM	8/3/2017
17080126-001B	ESB-5A		8/3/2017 10:55:00 AM	8/3/2017
17080126-002A	ESB-5B		8/3/2017 11:05:00 AM	8/3/2017
17080126-002B	ESB-5B		8/3/2017 11:05:00 AM	8/3/2017
17080126-003A	ESB-5C		8/3/2017 11:15:00 AM	8/3/2017

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5A

Work Order: 17080126 Revision 2

Collection Date: 8/3/2017 10:55:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080126-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/3/2017		Analyst: PS	
Acetone	ND	0.12		mg/Kg-dry	1	8/9/2017
Benzene	ND	0.0083		mg/Kg-dry	1	8/9/2017
Bromodichloromethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
Bromoform	ND	0.0083		mg/Kg-dry	1	8/9/2017
Bromomethane	ND	0.017		mg/Kg-dry	1	8/9/2017
2-Butanone	ND	0.12		mg/Kg-dry	1	8/9/2017
Carbon disulfide	ND	0.083		mg/Kg-dry	1	8/9/2017
Carbon tetrachloride	ND	0.0083		mg/Kg-dry	1	8/9/2017
Chlorobenzene	ND	0.0083		mg/Kg-dry	1	8/9/2017
Chloroethane	ND	0.017		mg/Kg-dry	1	8/9/2017
Chloroform	ND	0.0083		mg/Kg-dry	1	8/9/2017
Chloromethane	ND	0.017		mg/Kg-dry	1	8/9/2017
Dibromochloromethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,1-Dichloroethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,2-Dichloroethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,1-Dichloroethene	ND	0.0083		mg/Kg-dry	1	8/9/2017
cis-1,2-Dichloroethene	ND	0.0083		mg/Kg-dry	1	8/9/2017
trans-1,2-Dichloroethene	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,2-Dichloropropane	ND	0.0083		mg/Kg-dry	1	8/9/2017
cis-1,3-Dichloropropene	ND	0.0033		mg/Kg-dry	1	8/9/2017
trans-1,3-Dichloropropene	ND	0.0033		mg/Kg-dry	1	8/9/2017
Ethylbenzene	ND	0.0083		mg/Kg-dry	1	8/9/2017
2-Hexanone	ND	0.033		mg/Kg-dry	1	8/9/2017
4-Methyl-2-pentanone	ND	0.033		mg/Kg-dry	1	8/9/2017
Methylene chloride	ND	0.017		mg/Kg-dry	1	8/9/2017
Methyl tert-butyl ether	ND	0.0083		mg/Kg-dry	1	8/9/2017
Styrene	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,1,2,2-Tetrachloroethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
Tetrachloroethene	0.027	0.0083		mg/Kg-dry	1	8/9/2017
Toluene	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,1,1-Trichloroethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
1,1,2-Trichloroethane	ND	0.0083		mg/Kg-dry	1	8/9/2017
Trichloroethene	ND	0.0083		mg/Kg-dry	1	8/9/2017
Vinyl chloride	ND	0.0083		mg/Kg-dry	1	8/9/2017
Xylenes, Total	ND	0.025		mg/Kg-dry	1	8/9/2017
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/3/2017		Analyst: PS	
Trichlorofluoromethane	ND	0.0083		mg/Kg-dry	1	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5A

Work Order: 17080126 Revision 2

Collection Date: 8/3/2017 10:55:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080126-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/5/2017		Analyst: DM	
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/10/2017
Acenaphthylene	0.050	0.034		mg/Kg-dry	1	8/10/2017
Aniline	ND	0.35		mg/Kg-dry	1	8/10/2017
Anthracene	0.092	0.034		mg/Kg-dry	1	8/10/2017
Benz(a)anthracene	0.16	0.034		mg/Kg-dry	1	8/10/2017
Benzidine	ND	0.34		mg/Kg-dry	1	8/10/2017
Benzo(a)pyrene	0.13	0.034		mg/Kg-dry	1	8/10/2017
Benzo(b)fluoranthene	0.18	0.034		mg/Kg-dry	1	8/10/2017
Benzo(g,h,i)perylene	0.22	0.034		mg/Kg-dry	1	8/10/2017
Benzo(k)fluoranthene	0.13	0.034		mg/Kg-dry	1	8/10/2017
Benzoic acid	ND	0.87		mg/Kg-dry	1	8/10/2017
Benzyl alcohol	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-chloroethoxy)methane	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-chloroethyl)ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-ethylhexyl)phthalate	ND	0.87		mg/Kg-dry	1	8/10/2017
4-Bromophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Butyl benzyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Carbazole	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chloroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chloro-3-methylphenol	ND	0.34		mg/Kg-dry	1	8/10/2017
2-Chloronaphthalene	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Chlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chlorophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Chrysene	0.25	0.034		mg/Kg-dry	1	8/10/2017
Dibenz(a,h)anthracene	0.062	0.034		mg/Kg-dry	1	8/10/2017
Dibenzofuran	ND	0.18		mg/Kg-dry	1	8/10/2017
1,2-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
1,3-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
1,4-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
3,3'-Dichlorobenzidine	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4-Dichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Diethyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4-Dimethylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Dimethyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
4,6-Dinitro-2-methylphenol	ND	0.34		mg/Kg-dry	1	8/10/2017
2,4-Dinitrophenol	ND	0.87		mg/Kg-dry	1	8/10/2017
2,4-Dinitrotoluene	ND	0.034		mg/Kg-dry	1	8/10/2017
2,6-Dinitrotoluene	ND	0.034		mg/Kg-dry	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5A

Work Order: 17080126 Revision 2

Collection Date: 8/3/2017 10:55:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080126-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/5/2017		Analyst: DM	
Di-n-butyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Di-n-octyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Fluoranthene	0.31	0.034		mg/Kg-dry	1	8/10/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/10/2017
Hexachlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachlorobutadiene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachlorocyclopentadiene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachloroethane	ND	0.18		mg/Kg-dry	1	8/10/2017
Indeno(1,2,3-cd)pyrene	0.12	0.034		mg/Kg-dry	1	8/10/2017
Isophorone	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Methylnaphthalene	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Methylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Methylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Naphthalene	0.059	0.034		mg/Kg-dry	1	8/10/2017
2-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
3-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Nitrophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Nitrophenol	ND	0.34		mg/Kg-dry	1	8/10/2017
Nitrobenzene	ND	0.034		mg/Kg-dry	1	8/10/2017
N-Nitrosodi-n-propylamine	ND	0.034		mg/Kg-dry	1	8/10/2017
N-Nitrosodimethylamine	ND	0.18		mg/Kg-dry	1	8/10/2017
N-Nitrosodiphenylamine	ND	0.034		mg/Kg-dry	1	8/10/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.18		mg/Kg-dry	1	8/10/2017
Pentachlorophenol	ND	0.034		mg/Kg-dry	1	8/10/2017
Phenanthrene	0.29	0.034		mg/Kg-dry	1	8/10/2017
Phenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Pyrene	0.29	0.034		mg/Kg-dry	1	8/10/2017
Pyridine	ND	0.70		mg/Kg-dry	1	8/10/2017
1,2,4-Trichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4,5-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4,6-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
PCBs	SW8082 (SW3550B)		Prep Date: 8/5/2017		Analyst: GVC	
Aroclor 1016	ND	0.082		mg/Kg-dry	1	8/8/2017
Aroclor 1221	ND	0.082		mg/Kg-dry	1	8/8/2017
Aroclor 1232	ND	0.082		mg/Kg-dry	1	8/8/2017
Aroclor 1242	ND	0.082		mg/Kg-dry	1	8/8/2017
Aroclor 1248	ND	0.082		mg/Kg-dry	1	8/8/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5A

Work Order: 17080126 Revision 2

Collection Date: 8/3/2017 10:55:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080126-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)			Prep Date: 8/5/2017		Analyst: GVC
Aroclor 1254	ND	0.082		mg/Kg-dry	1	8/8/2017
Aroclor 1260	ND	0.082		mg/Kg-dry	1	8/8/2017
Pesticides	SW8081 (SW3550B)			Prep Date: 8/5/2017		Analyst: GVC
4,4'-DDD	ND	0.0016		mg/Kg-dry	1	8/8/2017
4,4'-DDE	ND	0.0016		mg/Kg-dry	1	8/8/2017
4,4'-DDT	ND	0.0016		mg/Kg-dry	1	8/8/2017
Aldrin	ND	0.0016		mg/Kg-dry	1	8/8/2017
alpha-BHC	ND	0.0016		mg/Kg-dry	1	8/8/2017
alpha-Chlordane	ND	0.0016		mg/Kg-dry	1	8/8/2017
beta-BHC	ND	0.0016		mg/Kg-dry	1	8/8/2017
Chlordane	ND	0.016		mg/Kg-dry	1	8/8/2017
delta-BHC	ND	0.0016		mg/Kg-dry	1	8/8/2017
Dieldrin	ND	0.0016		mg/Kg-dry	1	8/8/2017
Endosulfan I	ND	0.0016		mg/Kg-dry	1	8/8/2017
Endosulfan II	ND	0.0016		mg/Kg-dry	1	8/8/2017
Endosulfan sulfate	ND	0.0016		mg/Kg-dry	1	8/8/2017
Endrin	ND	0.0016		mg/Kg-dry	1	8/8/2017
Endrin aldehyde	ND	0.0016		mg/Kg-dry	1	8/8/2017
Endrin ketone	ND	0.0016		mg/Kg-dry	1	8/8/2017
gamma-BHC	ND	0.0016		mg/Kg-dry	1	8/8/2017
gamma-Chlordane	ND	0.0016		mg/Kg-dry	1	8/8/2017
Heptachlor	ND	0.0016		mg/Kg-dry	1	8/8/2017
Heptachlor epoxide	ND	0.0016		mg/Kg-dry	1	8/8/2017
Methoxychlor	ND	0.0016		mg/Kg-dry	1	8/8/2017
Toxaphene	ND	0.034		mg/Kg-dry	1	8/8/2017
Metals by ICP/MS	SW6020 (SW3050B)			Prep Date: 8/4/2017		Analyst: JG
Aluminum	3600	18		mg/Kg-dry	10	8/4/2017
Antimony	2.2	1.8		mg/Kg-dry	10	8/7/2017
Arsenic	12	0.92		mg/Kg-dry	10	8/4/2017
Barium	40	0.92		mg/Kg-dry	10	8/7/2017
Beryllium	0.62	0.46		mg/Kg-dry	10	8/4/2017
Cadmium	2.1	0.46		mg/Kg-dry	10	8/4/2017
Calcium	68000	55		mg/Kg-dry	10	8/4/2017
Chromium	21	0.92		mg/Kg-dry	10	8/4/2017
Cobalt	5.8	0.92		mg/Kg-dry	10	8/4/2017
Copper	93	2.3		mg/Kg-dry	10	8/4/2017
Iron	35000	28		mg/Kg-dry	10	8/4/2017

Qualifiers:

ND - Not Detected at the Reporting Limit

J - Analyte detected below quantitation limits

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5A

Work Order: 17080126 Revision 2

Collection Date: 8/3/2017 10:55:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080126-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/4/2017		Analyst: JG	
Lead	210	0.46		mg/Kg-dry	10	8/4/2017
Magnesium	31000	28		mg/Kg-dry	10	8/4/2017
Manganese	470	0.92		mg/Kg-dry	10	8/4/2017
Nickel	21	0.92		mg/Kg-dry	10	8/4/2017
Potassium	440	28		mg/Kg-dry	10	8/4/2017
Selenium	1.1	0.92		mg/Kg-dry	10	8/4/2017
Silver	ND	0.92		mg/Kg-dry	10	8/4/2017
Sodium	180	55		mg/Kg-dry	10	8/4/2017
Thallium	ND	0.92		mg/Kg-dry	10	8/4/2017
Vanadium	17	0.92		mg/Kg-dry	10	8/4/2017
Zinc	750	4.6		mg/Kg-dry	10	8/4/2017
TCLP Metals by ICP/MS	SW1311/6020A (SW3005A)		Prep Date: 11/21/2017		Analyst: JG	
Iron	2.4	0.25		mg/L	5	11/22/2017
Mercury	SW7471A		Prep Date: 8/4/2017		Analyst: LB	
Mercury	0.15	0.017		mg/Kg-dry	1	8/7/2017
Cyanide, Total	SW9012A		Prep Date: 8/8/2017		Analyst: MD	
Cyanide	ND	0.26		mg/Kg-dry	1	8/8/2017
pH (25 °C)	SW9045C		Prep Date: 8/4/2017		Analyst: VA	
pH	7.89			pH Units	1	8/4/2017
Percent Moisture	D2974		Prep Date: 8/4/2017		Analyst: KKA	
Percent Moisture	5.2	0.2	*	wt%	1	8/5/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

Company: Ameri Factor Wheeler
 Project Number: 3205-17-1606 Client Tracking No.:
 Project Name: CITY of Chicago- JPSTA
 Project Location: Chicago, IL
 Sampler(s): Andrew Heathcote
 Report To: Maryjank Phone: 773-693-6030
Andrew E Heathcote Fax: -
 QC Level: 1 2 3 4

Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab	Preserv.	No. of Containers
ESB-5A	8/17/17	1055	Soil	X	F	F	4
ESB-5B	8/17/17	1105	Soil	X	F	F	4
ESB-5C	8/17/17	1115	Soil	X	A		1

Additional Information:	Lab No.:
HOLD	002
	003

X TEL (SRP App A)

Quote No.:
 P.O. No.:
 Turn Around Time (Days):
 1 2 3 4 5 10
 Results Needed:
 Additional Information:
 Laboratory Work Order No.: 17080726
 Received on Ice: Yes No
 Temperature: 4.6 °C

Comments:
 Relinquished by: (Signature) [Signature] Date/Time: 8/17/1605
 Received by: (Signature) [Signature] Date/Time: 8/17/1605
 Relinquished by: (Signature) _____ Date/Time: _____
 Received by: (Signature) _____ Date/Time: _____
 Relinquished by: (Signature) _____ Date/Time: _____
 Received by: (Signature) _____ Date/Time: _____

Preservation Code: A = None B = HNO₃ C = NaOH
 D = H₂SO₄ E = HCl F = 5035/EpCore G = Other

Sample Receipt Checklist

Client Name AMEC
Work Order Number 17080126

Date and Time Received: 8/3/2017 4:05:00 PM
Received by: JNW

Checklist completed by: _____
Signature  Date 8/3/17

Reviewed by: MK _____
Initials Date 8/3/17

Matrix: _____ Carrier name Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature 4.6 °C
- Water - VOA vials have zero headspace? No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: _____
- Water - Samples properly preserved? Yes No pH Adjusted? _____

Any No response must be detailed in the comments section below.

Comments: Report trichlorofluoromethane per Mary Zank verbal 8/22/17.

Client / Person contacted: _____ Date contacted: _____ Contacted by: _____

Response: _____

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Monday, November 20, 2017 3:47 PM
To: Craig Chawla; Frank Capoccia
Subject: Additional Testing -

Please perform additional leaching procedure testing (TCLP or SPLP) for the following metals on the identified samples:

B-18A – chromium and manganese your sample # 17080321-011

B-6B – chromium your sample #17080265-014

ESB-2A – cobalt, iron – your sample #17080088-001

ESB-4A – iron your sample #17080223-001

ESB-5A – iron your sample #17080126-001

ESB-6A – iron, manganese your sample #17080177-001

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

November 27, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17080177 Revision 2

RE: 3205171606, City of Chicago JPSTA, Chicago, IL

Dear Mary Jank:

STAT Analysis received 6 samples for the referenced project on 8/4/2017 4:45:00 PM. The analytical results are presented in the following report.

This report is revised to reflect additional analysis requested after the last report revision.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAP standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Martin Kucan

Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure**Project:** 3205171606, City of Chicago JPSTA, Chicago, IL**Work Order:** 17080177 Revision 2**Work Order Sample Summary**

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17080177-001A	ESB-6A		8/4/2017 11:30:00 AM	8/4/2017
17080177-001B	ESB-6A		8/4/2017 11:30:00 AM	8/4/2017
17080177-002A	ESB-6B		8/4/2017 11:35:00 AM	8/4/2017
17080177-002B	ESB-6B		8/4/2017 11:35:00 AM	8/4/2017
17080177-003A	B-17A		8/4/2017 1:40:00 PM	8/4/2017
17080177-004A	B-17B		8/4/2017 1:50:00 PM	8/4/2017
17080177-005A	B-14A		8/4/2017 3:05:00 PM	8/4/2017
17080177-006A	B-14B		8/4/2017 3:10:00 PM	8/4/2017

CLIENT: AMEC Foster Wheeler Environment & Infr
Project: 3205171606, City of Chicago JPSTA, Chicago, IL
Work Order: 17080177 Revision 2

CASE NARRATIVE

The VOC soil Laboratory Control Sample (LCS) analyzed 08/11/2017 had recovery of Chloromethane outside of control limits (64.0% recovery, QC limits 70-130%). Recovery in the Laboratory Control Sample Duplicate (LCSD) and Relative Percent Difference (RPD) between the LCS and LCSD were within control limits.

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr
Work Order: 17080177 Revision 2
Project: 3205171606, City of Chicago JPSTA, Chicago, IL
Lab ID: 17080177-001

Client Sample ID: ESB-6A
Collection Date: 8/4/2017 11:30:00 AM
Matrix: Soil

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS		SW5035/8260B		Prep Date: 8/7/2017		Analyst: ART
Acetone	ND	0.13		mg/Kg-dry	1	8/11/2017
Benzene	ND	0.0084		mg/Kg-dry	1	8/11/2017
Bromodichloromethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
Bromoform	ND	0.0084		mg/Kg-dry	1	8/11/2017
Bromomethane	ND	0.017		mg/Kg-dry	1	8/11/2017
2-Butanone	ND	0.13		mg/Kg-dry	1	8/11/2017
Carbon disulfide	ND	0.084		mg/Kg-dry	1	8/11/2017
Carbon tetrachloride	0.15	0.0084		mg/Kg-dry	1	8/11/2017
Chlorobenzene	ND	0.0084		mg/Kg-dry	1	8/11/2017
Chloroethane	ND	0.017		mg/Kg-dry	1	8/11/2017
Chloroform	0.034	0.0084		mg/Kg-dry	1	8/11/2017
Chloromethane	ND	0.017		mg/Kg-dry	1	8/11/2017
Dibromochloromethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,1-Dichloroethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,2-Dichloroethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,1-Dichloroethene	ND	0.0084		mg/Kg-dry	1	8/11/2017
cis-1,2-Dichloroethene	ND	0.0084		mg/Kg-dry	1	8/11/2017
trans-1,2-Dichloroethene	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,2-Dichloropropane	ND	0.0084		mg/Kg-dry	1	8/11/2017
cis-1,3-Dichloropropene	ND	0.0034		mg/Kg-dry	1	8/11/2017
trans-1,3-Dichloropropene	ND	0.0034		mg/Kg-dry	1	8/11/2017
Ethylbenzene	ND	0.0084		mg/Kg-dry	1	8/11/2017
2-Hexanone	ND	0.034		mg/Kg-dry	1	8/11/2017
4-Methyl-2-pentanone	ND	0.034		mg/Kg-dry	1	8/11/2017
Methylene chloride	ND	0.017		mg/Kg-dry	1	8/11/2017
Methyl tert-butyl ether	ND	0.0084		mg/Kg-dry	1	8/11/2017
Styrene	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,1,2,2-Tetrachloroethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
Tetrachloroethene	ND	0.0084		mg/Kg-dry	1	8/11/2017
Toluene	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,1,1-Trichloroethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
1,1,2-Trichloroethane	ND	0.0084		mg/Kg-dry	1	8/11/2017
Trichloroethene	ND	0.0084		mg/Kg-dry	1	8/11/2017
Vinyl chloride	ND	0.0084		mg/Kg-dry	1	8/11/2017
Xylenes, Total	ND	0.025		mg/Kg-dry	1	8/11/2017
Volatile Organic Compounds by GC/MS		SW5035/8260B		Prep Date: 8/7/2017		Analyst: ART
Trichlorofluoromethane	ND	0.0084		mg/Kg-dry	1	8/11/2017

Qualifiers: ND - Not Detected at the Reporting Limit
J - Analyte detected below quantitation limits
B - Analyte detected in the associated Method Blank
HT - Sample received past holding time
* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
S - Spike Recovery outside accepted recovery limits
R - RPD outside accepted recovery limits
E - Value above quantitation range
H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-6A

Work Order: 17080177 Revision 2

Collection Date: 8/4/2017 11:30:00 AM

Project: 3205171606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080177-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/8/2017		Analyst: DM	
Acenaphthene	ND	0.036		mg/Kg-dry	1	8/10/2017
Acenaphthylene	0.12	0.036		mg/Kg-dry	1	8/10/2017
Aniline	ND	0.36		mg/Kg-dry	1	8/10/2017
Anthracene	0.089	0.036		mg/Kg-dry	1	8/10/2017
Benz(a)anthracene	0.25	0.036		mg/Kg-dry	1	8/10/2017
Benztidine	ND	0.36		mg/Kg-dry	1	8/10/2017
Benzo(a)pyrene	0.26	0.036		mg/Kg-dry	1	8/10/2017
Benzo(b)fluoranthene	0.35	0.036		mg/Kg-dry	1	8/10/2017
Benzo(g,h,i)perylene	0.22	0.036		mg/Kg-dry	1	8/10/2017
Benzo(k)fluoranthene	0.25	0.036		mg/Kg-dry	1	8/10/2017
Benzoic acid	ND	0.89		mg/Kg-dry	1	8/10/2017
Benzyl alcohol	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-chloroethoxy)methane	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-chloroethyl)ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-ethylhexyl)phthalate	ND	0.89		mg/Kg-dry	1	8/10/2017
4-Bromophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Butyl benzyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Carbazole	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chloroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chloro-3-methylphenol	ND	0.36		mg/Kg-dry	1	8/10/2017
2-Chloronaphthalene	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Chlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chlorophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Chrysene	0.34	0.036		mg/Kg-dry	1	8/10/2017
Dibenz(a,h)anthracene	0.094	0.036		mg/Kg-dry	1	8/10/2017
Dibenzofuran	ND	0.18		mg/Kg-dry	1	8/10/2017
1,2-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
1,3-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
1,4-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
3,3'-Dichlorobenzidine	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4-Dichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Diethyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4-Dimethylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Dimethyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
4,6-Dinitro-2-methylphenol	ND	0.36		mg/Kg-dry	1	8/10/2017
2,4-Dinitrophenol	ND	0.89		mg/Kg-dry	1	8/10/2017
2,4-Dinitrotoluene	ND	0.036		mg/Kg-dry	1	8/10/2017
2,6-Dinitrotoluene	ND	0.036		mg/Kg-dry	1	8/10/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-6A

Work Order: 17080177 Revision 2

Collection Date: 8/4/2017 11:30:00 AM

Project: 3205171606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080177-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/8/2017		Analyst: DM	
Di-n-butyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Di-n-octyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Fluoranthene	0.52	0.036		mg/Kg-dry	1	8/10/2017
Fluorene	ND	0.036		mg/Kg-dry	1	8/10/2017
Hexachlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachlorobutadiene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachlorocyclopentadiene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachloroethane	ND	0.18		mg/Kg-dry	1	8/10/2017
Indeno(1,2,3-cd)pyrene	0.17	0.036		mg/Kg-dry	1	8/10/2017
Isophorone	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Methylnaphthalene	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Methylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Methylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Naphthalene	0.070	0.036		mg/Kg-dry	1	8/10/2017
2-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
3-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Nitrophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Nitrophenol	ND	0.36		mg/Kg-dry	1	8/10/2017
Nitrobenzene	ND	0.036		mg/Kg-dry	1	8/10/2017
N-Nitrosodi-n-propylamine	ND	0.036		mg/Kg-dry	1	8/10/2017
N-Nitrosodimethylamine	ND	0.18		mg/Kg-dry	1	8/10/2017
N-Nitrosodiphenylamine	ND	0.036		mg/Kg-dry	1	8/10/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.18		mg/Kg-dry	1	8/10/2017
Pentachlorophenol	ND	0.036		mg/Kg-dry	1	8/10/2017
Phenanthrene	0.45	0.036		mg/Kg-dry	1	8/10/2017
Phenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Pyrene	0.52	0.036		mg/Kg-dry	1	8/10/2017
Pyridine	ND	0.72		mg/Kg-dry	1	8/10/2017
1,2,4-Trichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4,5-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4,6-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
PCBs	SW8082 (SW3550B)		Prep Date: 8/5/2017		Analyst: GVC	
Aroclor 1016	ND	0.085		mg/Kg-dry	1	8/8/2017
Aroclor 1221	ND	0.085		mg/Kg-dry	1	8/8/2017
Aroclor 1232	ND	0.085		mg/Kg-dry	1	8/8/2017
Aroclor 1242	ND	0.085		mg/Kg-dry	1	8/8/2017
Aroclor 1248	ND	0.085		mg/Kg-dry	1	8/8/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-6A

Work Order: 17080177 Revision 2

Collection Date: 8/4/2017 11:30:00 AM

Project: 3205171606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080177-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)				Prep Date: 8/5/2017	Analyst: GVC
Aroclor 1254	ND	0.085		mg/Kg-dry	1	8/8/2017
Aroclor 1260	ND	0.085		mg/Kg-dry	1	8/8/2017
Pesticides	SW8081 (SW3550B)				Prep Date: 8/5/2017	Analyst: GVC
4,4'-DDD	0.042	0.0017		mg/Kg-dry	1	8/8/2017
4,4'-DDE	0.069	0.0017		mg/Kg-dry	1	8/8/2017
4,4'-DDT	0.042	0.0017		mg/Kg-dry	1	8/8/2017
Aldrin	ND	0.0017		mg/Kg-dry	1	8/8/2017
alpha-BHC	ND	0.0017		mg/Kg-dry	1	8/8/2017
alpha-Chlordane	ND	0.0017		mg/Kg-dry	1	8/8/2017
beta-BHC	ND	0.0017		mg/Kg-dry	1	8/8/2017
Chlordane	ND	0.017		mg/Kg-dry	1	8/8/2017
delta-BHC	ND	0.0017		mg/Kg-dry	1	8/8/2017
Dieldrin	ND	0.0017		mg/Kg-dry	1	8/8/2017
Endosulfan I	ND	0.0017		mg/Kg-dry	1	8/8/2017
Endosulfan II	ND	0.0017		mg/Kg-dry	1	8/8/2017
Endosulfan sulfate	ND	0.0017		mg/Kg-dry	1	8/8/2017
Endrin	ND	0.0017		mg/Kg-dry	1	8/8/2017
Endrin aldehyde	ND	0.0017		mg/Kg-dry	1	8/8/2017
Endrin ketone	ND	0.0017		mg/Kg-dry	1	8/8/2017
gamma-BHC	ND	0.0017		mg/Kg-dry	1	8/8/2017
gamma-Chlordane	ND	0.0017		mg/Kg-dry	1	8/8/2017
Heptachlor	ND	0.0017		mg/Kg-dry	1	8/8/2017
Heptachlor epoxide	ND	0.0017		mg/Kg-dry	1	8/8/2017
Methoxychlor	ND	0.0017		mg/Kg-dry	1	8/8/2017
Toxaphene	ND	0.035		mg/Kg-dry	1	8/8/2017
Herbicides in Soil	SW8321A (SW3550B)				Prep Date: 8/7/2017	Analyst: MEP
2,4,5-TP (Silvex)	ND	0.0036		mg/Kg-dry	1	8/8/2017
2,4-D	ND	0.0036		mg/Kg-dry	1	8/8/2017
Dalapon	ND	0.036		mg/Kg-dry	1	8/8/2017
Dinoseb	ND	0.0073		mg/Kg-dry	1	8/8/2017
Pentachlorophenol	ND	0.011	*	mg/Kg-dry	1	8/8/2017
Picloram	ND	0.0073	*	mg/Kg-dry	1	8/8/2017
Metals by ICP/MS	SW6020 (SW3050B)				Prep Date: 8/9/2017	Analyst: JG
Aluminum	4500	20		mg/Kg-dry	10	8/10/2017
Antimony	3.1	2.0		mg/Kg-dry	10	8/11/2017
Arsenic	18	0.98		mg/Kg-dry	10	8/10/2017
Barium	57	0.98		mg/Kg-dry	10	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-6A

Work Order: 17080177 Revision 2

Collection Date: 8/4/2017 11:30:00 AM

Project: 3205171606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080177-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/9/2017		Analyst: JG	
Beryllium	0.74	0.49		mg/Kg-dry	10	8/10/2017
Cadmium	1.7	0.49		mg/Kg-dry	10	8/10/2017
Calcium	49000	59		mg/Kg-dry	10	8/10/2017
Chromium	24	0.98		mg/Kg-dry	10	8/10/2017
Cobalt	7.1	0.98		mg/Kg-dry	10	8/10/2017
Copper	700	2.4		mg/Kg-dry	10	8/10/2017
Iron	39000	29		mg/Kg-dry	10	8/10/2017
Lead	420	0.49		mg/Kg-dry	10	8/10/2017
Magnesium	26000	29		mg/Kg-dry	10	8/10/2017
Manganese	1400	0.98		mg/Kg-dry	10	8/10/2017
Nickel	20	0.98		mg/Kg-dry	10	8/10/2017
Potassium	730	29		mg/Kg-dry	10	8/10/2017
Selenium	1.1	0.98		mg/Kg-dry	10	8/10/2017
Silver	ND	0.98		mg/Kg-dry	10	8/10/2017
Sodium	250	59		mg/Kg-dry	10	8/10/2017
Thallium	ND	0.98		mg/Kg-dry	10	8/10/2017
Vanadium	20	0.98		mg/Kg-dry	10	8/11/2017
Zinc	580	4.9		mg/Kg-dry	10	8/10/2017
SPLP Metals by ICP/MS	SW1312/6020A (SW3005A)		Prep Date: 11/24/2017		Analyst: JG	
Iron	0.86	0.10		mg/L	2	11/24/2017
Manganese	0.012	0.0040		mg/L	2	11/24/2017
Mercury	SW7471A		Prep Date: 8/10/2017		Analyst: LB	
Mercury	0.15	0.019		mg/Kg-dry	1	8/9/2017
Cyanide, Total	SW9012A		Prep Date: 8/8/2017		Analyst: MD	
Cyanide	ND	0.27		mg/Kg-dry	1	8/8/2017
pH (25 °C)	SW9045C		Prep Date: 8/7/2017		Analyst: RW	
pH	7.56			pH Units	1	8/7/2017
Percent Moisture	D2974		Prep Date: 8/7/2017		Analyst: KKA	
Percent Moisture	8.1	0.2	*	wt%	1	8/8/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-17A

Work Order: 17080177 Revision 2

Collection Date: 8/4/2017 1:40:00 PM

Project: 3205171606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080177-003

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS	SW8270C (SW3550B)				Prep Date: 8/8/2017	Analyst: DM
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/10/2017
Acenaphthylene	0.18	0.034		mg/Kg-dry	1	8/10/2017
Anthracene	0.089	0.034		mg/Kg-dry	1	8/10/2017
Benzo(a)anthracene	0.18	0.034		mg/Kg-dry	1	8/10/2017
Benzo(a)pyrene	0.17	0.034		mg/Kg-dry	1	8/10/2017
Benzo(b)fluoranthene	0.23	0.034		mg/Kg-dry	1	8/10/2017
Benzo(g,h,i)perylene	0.15	0.034		mg/Kg-dry	1	8/10/2017
Benzo(k)fluoranthene	0.15	0.034		mg/Kg-dry	1	8/10/2017
Chrysene	0.31	0.034		mg/Kg-dry	1	8/10/2017
Dibenz(a,h)anthracene	0.066	0.034		mg/Kg-dry	1	8/10/2017
Fluoranthene	0.34	0.034		mg/Kg-dry	1	8/10/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/10/2017
Indeno(1,2,3-cd)pyrene	0.11	0.034		mg/Kg-dry	1	8/10/2017
Naphthalene	ND	0.034		mg/Kg-dry	1	8/10/2017
Phenanthrene	0.34	0.034		mg/Kg-dry	1	8/10/2017
Pyrene	0.45	0.034		mg/Kg-dry	1	8/10/2017
Metals by ICP/MS	SW6020 (SW3050B)				Prep Date: 8/9/2017	Analyst: JG
Antimony	4.3	1.9		mg/Kg-dry	10	8/11/2017
Arsenic	34	0.95		mg/Kg-dry	10	8/10/2017
Beryllium	0.89	0.47		mg/Kg-dry	10	8/10/2017
Cadmium	1.9	0.47		mg/Kg-dry	10	8/11/2017
Chromium	18	0.95		mg/Kg-dry	10	8/10/2017
Copper	120	2.4		mg/Kg-dry	10	8/10/2017
Lead	300	0.47		mg/Kg-dry	10	8/10/2017
Nickel	24	0.95		mg/Kg-dry	10	8/10/2017
Selenium	2.0	0.95		mg/Kg-dry	10	8/10/2017
Silver	ND	0.95		mg/Kg-dry	10	8/10/2017
Thallium	ND	0.95		mg/Kg-dry	10	8/10/2017
Zinc	910	4.7		mg/Kg-dry	10	8/10/2017
Mercury	SW7471A				Prep Date: 8/10/2017	Analyst: LB
Mercury	0.097	0.020		mg/Kg-dry	1	8/9/2017
pH (25 °C)	SW9045C				Prep Date: 8/7/2017	Analyst: RW
pH	7.95			pH Units	1	8/7/2017
Percent Moisture	D2974				Prep Date: 8/7/2017	Analyst: KKA
Percent Moisture	5.7	0.2	*	wt%	1	8/8/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-14A

Work Order: 17080177 Revision 2

Collection Date: 8/4/2017 3:05:00 PM

Project: 3205171606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080177-005

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS SW8270C (SW3550B) Prep Date: 8/8/2017 Analyst: DM						
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/10/2017
Acenaphthylene	ND	0.035		mg/Kg-dry	1	8/10/2017
Anthracene	0.037	0.035		mg/Kg-dry	1	8/10/2017
Benzo(a)anthracene	0.15	0.035		mg/Kg-dry	1	8/10/2017
Benzo(a)pyrene	0.17	0.035		mg/Kg-dry	1	8/10/2017
Benzo(b)fluoranthene	0.18	0.035		mg/Kg-dry	1	8/10/2017
Benzo(g,h,i)perylene	0.14	0.035		mg/Kg-dry	1	8/10/2017
Benzo(k)fluoranthene	0.12	0.035		mg/Kg-dry	1	8/10/2017
Chrysene	0.25	0.035		mg/Kg-dry	1	8/10/2017
Dibenz(a,h)anthracene	0.063	0.035		mg/Kg-dry	1	8/10/2017
Fluoranthene	0.22	0.035		mg/Kg-dry	1	8/10/2017
Fluorene	ND	0.035		mg/Kg-dry	1	8/10/2017
Indeno(1,2,3-cd)pyrene	0.10	0.035		mg/Kg-dry	1	8/10/2017
Naphthalene	0.082	0.035		mg/Kg-dry	1	8/10/2017
Phenanthrene	0.38	0.035		mg/Kg-dry	1	8/10/2017
Pyrene	0.29	0.035		mg/Kg-dry	1	8/10/2017
Metals by ICP/MS SW6020 (SW3050B) Prep Date: 8/9/2017 Analyst: JG						
Antimony	ND	1.9		mg/Kg-dry	10	8/11/2017
Arsenic	11	0.96		mg/Kg-dry	10	8/10/2017
Beryllium	ND	0.48		mg/Kg-dry	10	8/10/2017
Cadmium	ND	0.48		mg/Kg-dry	10	8/10/2017
Chromium	7.2	0.96		mg/Kg-dry	10	8/10/2017
Copper	24	2.4		mg/Kg-dry	10	8/10/2017
Lead	53	0.48		mg/Kg-dry	10	8/10/2017
Nickel	11	0.96		mg/Kg-dry	10	8/10/2017
Selenium	ND	0.96		mg/Kg-dry	10	8/10/2017
Silver	ND	0.96		mg/Kg-dry	10	8/10/2017
Thallium	ND	0.96		mg/Kg-dry	10	8/10/2017
Zinc	80	4.8		mg/Kg-dry	10	8/10/2017
Mercury SW7471A Prep Date: 8/10/2017 Analyst: LB						
Mercury	0.091	0.021		mg/Kg-dry	1	8/9/2017
pH (25 °C) SW9045C Prep Date: 8/7/2017 Analyst: RW						
pH	7.21			pH Units	1	8/7/2017
Percent Moisture D2974 Prep Date: 8/7/2017 Analyst: KKA						
Percent Moisture	6.3	0.2	*	wt%	1	8/8/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

Company: AmeC Foster Wheeler Client Tracking No.: _____
 Project Number: 3205171606
 Project Name: City of Chicago JPSTA
 Project Location: Chicago IL
 Sampler(s): Craig Cabrera
 Report To: Mary Jank Phone: 7736936030
Andy Hastings Fax: _____
 QC Level: 1 2 3 4 e-mail: Mary.Jank@amec.fw.com

Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab	Preserv.	No. of Containers
ESB-6A	8/4/17	1130	Soil	X	X		5
ESB-6B	8/4/17	1135	Soil	X	X		4
B-17A	8/4/17	1340	Soil	X	X		1
B-17B	8/4/17	1350	Soil	X	X		1
B-14A	8/4/17	1505	Soil	X	X		1
B-14B	8/4/17	1510	Soil	X	X		1

w/PH
 Target Compounds
 PCBs
 PNHs
 Priority Pollutant Metals
 PH

Additional Information:	Lab No.:
Hold	001
Hold	002
Hold	003
Hold	004
Hold	005
Hold	006

Turn Around Time (Days):
 1 2 3 4 5-7 10

Results Needed: / / am/pm

Relinquished by: (Signature) Craig Cabrera Date/Time: 8/17 4:50 PM
 Received by: (Signature) Andy Hastings Date/Time: 8/17 2:15 PM
 Relinquished by: (Signature) _____ Date/Time: _____
 Received by: (Signature) _____ Date/Time: _____
 Relinquished by: (Signature) _____ Date/Time: _____
 Received by: (Signature) _____ Date/Time: _____

Comments: _____

Preservation Code: A = None B = HNO₃ C = NaOH
 D = H₂SO₄ E = HCl F = 5035/EnCore G = Other

Laboratory Work Order No.: 17989177
 Received on Ice: Yes No
 Temperature: 5°C

Sample Receipt Checklist

Client Name **AMEC**

Date and Time Received: **8/4/2017 4:45:00 PM**

Work Order Number **17080177**

Received by: **MGK**

Checklist completed by: Martin Ginn 8/4/17
Signature Date

Reviewed by: JOK 8/2/17
Initials Date

Matrix: Carrier name: Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature On Ice °C
- Water - VOA vials have zero headspace? No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: _____
- Water - Samples properly preserved? Yes No pH Adjusted? _____

Any No response must be detailed in the comments section below.

Comments: Report trichlorofluoromethane per Mary Jank verbal 8/2/17.

Client / Person contacted: _____ Date contacted: _____ Contacted by: _____

Response: _____

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Monday, November 20, 2017 3:47 PM
To: Craig Chawla; Frank Capoccia
Subject: Additional Testing -

Please perform additional leaching procedure testing (TCLP or SPLP) for the following metals on the identified samples:

B-18A – chromium and manganese your sample # 17080321-011

B-6B – chromium your sample #17080265-014

ESB-2A – cobalt, iron – your sample #17080088-001

ESB-4A – iron your sample #17080223-001

ESB-5A – iron your sample #17080126-001

ESB-6A – iron, manganese your sample #17080177-001

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

November 27, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17080223 Revision 2

RE: 3205171606, City Of Chicago JPSTA, Chicago, IL

Dear Mary Jank:

STAT Analysis received 9 samples for the referenced project on 8/7/2017 3:45:00 PM. The analytical results are presented in the following report.

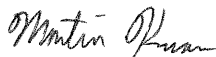
This report is revised to reflect additional analysis requested after the last report revision.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAP standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Martin Kucan

Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure**Project:** 3205171606, City Of Chicago JPSTA, Chicago, IL**Work Order:** 17080223 Revision 2**Work Order Sample Summary**

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17080223-001A	ESB-4A		8/7/2017 8:05:00 AM	8/7/2017
17080223-001B	ESB-4A		8/7/2017 8:05:00 AM	8/7/2017
17080223-002A	ESB-4B		8/7/2017 8:10:00 AM	8/7/2017
17080223-002B	ESB-4B		8/7/2017 8:10:00 AM	8/7/2017
17080223-003A	B-12 A		8/7/2017 10:10:00 AM	8/7/2017
17080223-004A	B-12 B		8/7/2017 10:15:00 AM	8/7/2017
17080223-005A	B-12 C		8/7/2017 10:18:00 AM	8/7/2017
17080223-006A	B-16 A		8/7/2017 11:45:00 AM	8/7/2017
17080223-007A	B-16 B		8/7/2017 11:50:00 AM	8/7/2017
17080223-008A	B-10 A		8/7/2017 2:05:00 PM	8/7/2017
17080223-009A	B-10 B		8/7/2017 2:10:00 PM	8/7/2017

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-4A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 8:05:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS		SW5035/8260B		Prep Date: 8/7/2017		Analyst: ERP
Acetone	0.15	0.11		mg/Kg-dry	1	8/14/2017
Benzene	ND	0.0075		mg/Kg-dry	1	8/14/2017
Bromodichloromethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
Bromoform	ND	0.0075		mg/Kg-dry	1	8/14/2017
Bromomethane	ND	0.015		mg/Kg-dry	1	8/14/2017
2-Butanone	ND	0.11		mg/Kg-dry	1	8/14/2017
Carbon disulfide	ND	0.075		mg/Kg-dry	1	8/14/2017
Carbon tetrachloride	ND	0.0075		mg/Kg-dry	1	8/14/2017
Chlorobenzene	ND	0.0075		mg/Kg-dry	1	8/14/2017
Chloroethane	ND	0.015		mg/Kg-dry	1	8/14/2017
Chloroform	ND	0.0075		mg/Kg-dry	1	8/14/2017
Chloromethane	ND	0.015		mg/Kg-dry	1	8/14/2017
Dibromochloromethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,1-Dichloroethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,2-Dichloroethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,1-Dichloroethene	ND	0.0075		mg/Kg-dry	1	8/14/2017
cis-1,2-Dichloroethene	ND	0.0075		mg/Kg-dry	1	8/14/2017
trans-1,2-Dichloroethene	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,2-Dichloropropane	ND	0.0075		mg/Kg-dry	1	8/14/2017
cis-1,3-Dichloropropene	ND	0.0030		mg/Kg-dry	1	8/14/2017
trans-1,3-Dichloropropene	ND	0.0030		mg/Kg-dry	1	8/14/2017
Ethylbenzene	ND	0.0075		mg/Kg-dry	1	8/14/2017
2-Hexanone	ND	0.030		mg/Kg-dry	1	8/14/2017
4-Methyl-2-pentanone	ND	0.030		mg/Kg-dry	1	8/14/2017
Methylene chloride	ND	0.015		mg/Kg-dry	1	8/14/2017
Methyl tert-butyl ether	ND	0.0075		mg/Kg-dry	1	8/14/2017
Styrene	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,1,2,2-Tetrachloroethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
Tetrachloroethene	ND	0.0075		mg/Kg-dry	1	8/14/2017
Toluene	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,1,1-Trichloroethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
1,1,2-Trichloroethane	ND	0.0075		mg/Kg-dry	1	8/14/2017
Trichloroethene	0.010	0.0075		mg/Kg-dry	1	8/14/2017
Vinyl chloride	ND	0.0075		mg/Kg-dry	1	8/14/2017
Xylenes, Total	ND	0.022		mg/Kg-dry	1	8/14/2017
Volatile Organic Compounds by GC/MS		SW5035/8260B		Prep Date: 8/7/2017		Analyst: ERP
Trichlorofluoromethane	ND	0.0075		mg/Kg-dry	1	8/14/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-4A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 8:05:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	0.41	0.035		mg/Kg-dry	1	8/10/2017
Acenaphthylene	0.11	0.035		mg/Kg-dry	1	8/10/2017
Aniline	ND	0.35		mg/Kg-dry	1	8/10/2017
Anthracene	1.3	0.035		mg/Kg-dry	1	8/10/2017
Benz(a)anthracene	3.1	0.035		mg/Kg-dry	1	8/10/2017
Benztidine	ND	0.35		mg/Kg-dry	1	8/10/2017
Benzo(a)pyrene	3.2	0.035		mg/Kg-dry	1	8/10/2017
Benzo(b)fluoranthene	3.3	0.035		mg/Kg-dry	1	8/10/2017
Benzo(g,h,i)perylene	1.9	0.035		mg/Kg-dry	1	8/10/2017
Benzo(k)fluoranthene	2.5	0.035		mg/Kg-dry	1	8/10/2017
Benzoic acid	ND	0.88		mg/Kg-dry	1	8/10/2017
Benzyl alcohol	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-chloroethoxy)methane	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-chloroethyl)ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Bis(2-ethylhexyl)phthalate	ND	0.88		mg/Kg-dry	1	8/10/2017
4-Bromophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Butyl benzyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Carbazole	0.75	0.18		mg/Kg-dry	1	8/10/2017
4-Chloroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chloro-3-methylphenol	ND	0.35		mg/Kg-dry	1	8/10/2017
2-Chloronaphthalene	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Chlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Chlorophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/10/2017
Chrysene	3.5	0.035		mg/Kg-dry	1	8/10/2017
Dibenz(a,h)anthracene	0.81	0.035		mg/Kg-dry	1	8/10/2017
Dibenzofuran	0.26	0.18		mg/Kg-dry	1	8/10/2017
1,2-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
1,3-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
1,4-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
3,3'-Dichlorobenzidine	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4-Dichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Diethyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4-Dimethylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Dimethyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
4,6-Dinitro-2-methylphenol	ND	0.35		mg/Kg-dry	1	8/10/2017
2,4-Dinitrophenol	ND	0.88		mg/Kg-dry	1	8/10/2017
2,4-Dinitrotoluene	ND	0.035		mg/Kg-dry	1	8/10/2017
2,6-Dinitrotoluene	ND	0.035		mg/Kg-dry	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-4A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 8:05:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Di-n-butyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Di-n-octyl phthalate	ND	0.18		mg/Kg-dry	1	8/10/2017
Fluoranthene	7.7	0.17		mg/Kg-dry	5	8/10/2017
Fluorene	0.46	0.035		mg/Kg-dry	1	8/10/2017
Hexachlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachlorobutadiene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachlorocyclopentadiene	ND	0.18		mg/Kg-dry	1	8/10/2017
Hexachloroethane	ND	0.18		mg/Kg-dry	1	8/10/2017
Indeno(1,2,3-cd)pyrene	1.7	0.035		mg/Kg-dry	1	8/10/2017
Isophorone	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Methylnaphthalene	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Methylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Methylphenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Naphthalene	0.088	0.035		mg/Kg-dry	1	8/10/2017
2-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
3-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/10/2017
2-Nitrophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
4-Nitrophenol	ND	0.35		mg/Kg-dry	1	8/10/2017
Nitrobenzene	ND	0.035		mg/Kg-dry	1	8/10/2017
N-Nitrosodi-n-propylamine	ND	0.035		mg/Kg-dry	1	8/10/2017
N-Nitrosodimethylamine	ND	0.18		mg/Kg-dry	1	8/10/2017
N-Nitrosodiphenylamine	ND	0.035		mg/Kg-dry	1	8/10/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.18		mg/Kg-dry	1	8/10/2017
Pentachlorophenol	ND	0.035		mg/Kg-dry	1	8/10/2017
Phenanthrene	5.7	0.17		mg/Kg-dry	5	8/10/2017
Phenol	ND	0.18		mg/Kg-dry	1	8/10/2017
Pyrene	6.3	0.17		mg/Kg-dry	5	8/10/2017
Pyridine	ND	0.71		mg/Kg-dry	1	8/10/2017
1,2,4-Trichlorobenzene	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4,5-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
2,4,6-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/10/2017
PCBs	SW8082 (SW3550B)		Prep Date: 8/8/2017		Analyst: GVC	
Aroclor 1016	ND	0.084		mg/Kg-dry	1	8/10/2017
Aroclor 1221	ND	0.084		mg/Kg-dry	1	8/10/2017
Aroclor 1232	ND	0.084		mg/Kg-dry	1	8/10/2017
Aroclor 1242	ND	0.084		mg/Kg-dry	1	8/10/2017
Aroclor 1248	ND	0.084		mg/Kg-dry	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-4A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 8:05:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)			Prep Date: 8/8/2017		Analyst: GVC
Aroclor 1254	ND	0.084		mg/Kg-dry	1	8/10/2017
Aroclor 1260	ND	0.084		mg/Kg-dry	1	8/10/2017
Pesticides	SW8081 (SW3550B)			Prep Date: 8/8/2017		Analyst: GVC
4,4'-DDD	ND	0.0017		mg/Kg-dry	1	8/10/2017
4,4'-DDE	ND	0.0017		mg/Kg-dry	1	8/10/2017
4,4'-DDT	ND	0.0017		mg/Kg-dry	1	8/10/2017
Aldrin	ND	0.0017		mg/Kg-dry	1	8/10/2017
alpha-BHC	ND	0.0017		mg/Kg-dry	1	8/10/2017
alpha-Chlordane	ND	0.0017		mg/Kg-dry	1	8/10/2017
beta-BHC	ND	0.0017		mg/Kg-dry	1	8/10/2017
Chlordane	ND	0.017		mg/Kg-dry	1	8/10/2017
delta-BHC	ND	0.0017		mg/Kg-dry	1	8/10/2017
Dieldrin	ND	0.0017		mg/Kg-dry	1	8/10/2017
Endosulfan I	ND	0.0017		mg/Kg-dry	1	8/10/2017
Endosulfan II	ND	0.0017		mg/Kg-dry	1	8/10/2017
Endosulfan sulfate	ND	0.0017		mg/Kg-dry	1	8/10/2017
Endrin	ND	0.0017		mg/Kg-dry	1	8/10/2017
Endrin aldehyde	ND	0.0017		mg/Kg-dry	1	8/10/2017
Endrin ketone	ND	0.0017		mg/Kg-dry	1	8/10/2017
gamma-BHC	ND	0.0017		mg/Kg-dry	1	8/10/2017
gamma-Chlordane	ND	0.0017		mg/Kg-dry	1	8/10/2017
Heptachlor	ND	0.0017		mg/Kg-dry	1	8/10/2017
Heptachlor epoxide	ND	0.0017		mg/Kg-dry	1	8/10/2017
Methoxychlor	ND	0.0017		mg/Kg-dry	1	8/10/2017
Toxaphene	ND	0.035		mg/Kg-dry	1	8/10/2017
Metals by ICP/MS	SW6020 (SW3050B)			Prep Date: 8/11/2017		Analyst: JG
Aluminum	3900	19		mg/Kg-dry	10	8/15/2017
Antimony	2.0	1.9		mg/Kg-dry	10	8/15/2017
Arsenic	13	0.97		mg/Kg-dry	10	8/15/2017
Barium	79	0.97		mg/Kg-dry	10	8/15/2017
Beryllium	0.69	0.48		mg/Kg-dry	10	8/15/2017
Cadmium	2.1	0.48		mg/Kg-dry	10	8/15/2017
Calcium	42000	58		mg/Kg-dry	10	8/15/2017
Chromium	18	0.97		mg/Kg-dry	10	8/15/2017
Cobalt	6.3	0.97		mg/Kg-dry	10	8/15/2017
Copper	78	2.4		mg/Kg-dry	10	8/15/2017
Iron	28000	29		mg/Kg-dry	10	8/15/2017

Qualifiers:

ND - Not Detected at the Reporting Limit

J - Analyte detected below quantitation limits

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-4A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 8:05:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/11/2017		Analyst: JG	
Lead	180	0.48		mg/Kg-dry	10	8/15/2017
Magnesium	23000	29		mg/Kg-dry	10	8/15/2017
Manganese	360	0.97		mg/Kg-dry	10	8/15/2017
Nickel	19	0.97		mg/Kg-dry	10	8/15/2017
Potassium	630	29		mg/Kg-dry	10	8/15/2017
Selenium	ND	0.97		mg/Kg-dry	10	8/15/2017
Silver	ND	0.97		mg/Kg-dry	10	8/15/2017
Sodium	150	58		mg/Kg-dry	10	8/15/2017
Thallium	ND	0.97		mg/Kg-dry	10	8/15/2017
Vanadium	18	0.97		mg/Kg-dry	10	8/15/2017
Zinc	690	4.8		mg/Kg-dry	10	8/15/2017
TCLP Metals by ICP/MS	SW1311/6020A (SW3005A)		Prep Date: 11/21/2017		Analyst: JG	
Iron	3.1	0.25		mg/L	5	11/22/2017
Mercury	SW7471A		Prep Date: 8/10/2017		Analyst: LB	
Mercury	0.14	0.021		mg/Kg-dry	1	8/10/2017
Cyanide, Total	SW9012A		Prep Date: 8/9/2017		Analyst: MD	
Cyanide	ND	0.27		mg/Kg-dry	1	8/12/2017
pH (25 °C)	SW9045C		Prep Date: 8/8/2017		Analyst: PBG	
pH	7.86			pH Units	1	8/8/2017
Percent Moisture	D2974		Prep Date: 8/8/2017		Analyst: KKA	
Percent Moisture	5.9	0.2	*	wt%	1	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-12 A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 10:10:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-003

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/11/2017
Acenaphthylene	0.11	0.034		mg/Kg-dry	1	8/11/2017
Anthracene	0.16	0.034		mg/Kg-dry	1	8/11/2017
Benzo(a)anthracene	0.73	0.034		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	0.91	0.034		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	0.63	0.034		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	0.66	0.034		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.65	0.034		mg/Kg-dry	1	8/11/2017
Chrysene	0.79	0.034		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	0.25	0.034		mg/Kg-dry	1	8/11/2017
Fluoranthene	1.1	0.034		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.49	0.034		mg/Kg-dry	1	8/11/2017
Naphthalene	ND	0.034		mg/Kg-dry	1	8/11/2017
Phenanthrene	0.48	0.034		mg/Kg-dry	1	8/11/2017
Pyrene	1.5	0.034		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/11/2017		Analyst: JG	
Antimony	ND	1.8		mg/Kg-dry	10	8/15/2017
Arsenic	7.2	0.90		mg/Kg-dry	10	8/15/2017
Beryllium	0.50	0.45		mg/Kg-dry	10	8/15/2017
Cadmium	0.60	0.45		mg/Kg-dry	10	8/15/2017
Chromium	12	0.90		mg/Kg-dry	10	8/15/2017
Copper	46	2.3		mg/Kg-dry	10	8/15/2017
Lead	86	0.45		mg/Kg-dry	10	8/15/2017
Nickel	15	0.90		mg/Kg-dry	10	8/15/2017
Selenium	ND	0.90		mg/Kg-dry	10	8/15/2017
Silver	ND	0.90		mg/Kg-dry	10	8/15/2017
Thallium	ND	0.90		mg/Kg-dry	10	8/15/2017
Zinc	160	4.5		mg/Kg-dry	10	8/15/2017
Mercury						
	SW7471A		Prep Date: 8/10/2017		Analyst: LB	
Mercury	0.32	0.018		mg/Kg-dry	1	8/10/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/8/2017		Analyst: PBG	
pH	7.81			pH Units	1	8/8/2017
Percent Moisture						
	D2974		Prep Date: 8/8/2017		Analyst: KKA	
Percent Moisture	5.2	0.2	*	wt%	1	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-16 A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 11:45:00 AM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-006

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/11/2017
Acenaphthylene	ND	0.034		mg/Kg-dry	1	8/11/2017
Anthracene	ND	0.034		mg/Kg-dry	1	8/11/2017
Benz(a)anthracene	0.058	0.034		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	0.089	0.034		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	0.11	0.034		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	0.071	0.034		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.081	0.034		mg/Kg-dry	1	8/11/2017
Chrysene	0.086	0.034		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	ND	0.034		mg/Kg-dry	1	8/11/2017
Fluoranthene	0.055	0.034		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.054	0.034		mg/Kg-dry	1	8/11/2017
Naphthalene	ND	0.034		mg/Kg-dry	1	8/11/2017
Phenanthrene	0.063	0.034		mg/Kg-dry	1	8/11/2017
Pyrene	0.096	0.034		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/11/2017		Analyst: JG	
Antimony	ND	1.9		mg/Kg-dry	10	8/15/2017
Arsenic	8.8	0.94		mg/Kg-dry	10	8/15/2017
Beryllium	ND	0.47		mg/Kg-dry	10	8/15/2017
Cadmium	0.96	0.47		mg/Kg-dry	10	8/15/2017
Chromium	13	0.94		mg/Kg-dry	10	8/15/2017
Copper	46	2.3		mg/Kg-dry	10	8/15/2017
Lead	110	0.47		mg/Kg-dry	10	8/15/2017
Nickel	13	0.94		mg/Kg-dry	10	8/15/2017
Selenium	ND	0.94		mg/Kg-dry	10	8/15/2017
Silver	ND	0.94		mg/Kg-dry	10	8/15/2017
Thallium	ND	0.94		mg/Kg-dry	10	8/15/2017
Zinc	260	4.7		mg/Kg-dry	10	8/15/2017
Mercury						
	SW7471A		Prep Date: 8/10/2017		Analyst: LB	
Mercury	0.075	0.021		mg/Kg-dry	1	8/10/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/8/2017		Analyst: PBG	
pH	8.36			pH Units	1	8/8/2017
Percent Moisture						
	D2974		Prep Date: 8/8/2017		Analyst: KKA	
Percent Moisture	3.0	0.2	*	wt%	1	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-10 A

Work Order: 17080223 Revision 2

Collection Date: 8/7/2017 2:05:00 PM

Project: 3205171606, City Of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080223-008

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS SW8270C (SW3550B)						
					Prep Date: 8/9/2017	Analyst: DM
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/11/2017
Acenaphthylene	0.12	0.035		mg/Kg-dry	1	8/11/2017
Anthracene	0.28	0.035		mg/Kg-dry	1	8/11/2017
Benzo(a)anthracene	0.25	0.035		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	0.31	0.035		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	0.41	0.035		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	0.51	0.035		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.29	0.035		mg/Kg-dry	1	8/11/2017
Chrysene	0.41	0.035		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	0.11	0.035		mg/Kg-dry	1	8/11/2017
Fluoranthene	0.39	0.035		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.035		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.30	0.035		mg/Kg-dry	1	8/11/2017
Naphthalene	0.064	0.035		mg/Kg-dry	1	8/11/2017
Phenanthrene	0.34	0.035		mg/Kg-dry	1	8/11/2017
Pyrene	0.40	0.035		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS SW6020 (SW3050B)						
					Prep Date: 8/11/2017	Analyst: JG
Antimony	4.1	1.9		mg/Kg-dry	10	8/15/2017
Arsenic	7.5	0.93		mg/Kg-dry	10	8/15/2017
Beryllium	ND	0.46		mg/Kg-dry	10	8/15/2017
Cadmium	0.96	0.46		mg/Kg-dry	10	8/15/2017
Chromium	12	0.93		mg/Kg-dry	10	8/15/2017
Copper	67	2.3		mg/Kg-dry	10	8/15/2017
Lead	130	0.46		mg/Kg-dry	10	8/15/2017
Nickel	16	0.93		mg/Kg-dry	10	8/15/2017
Selenium	ND	0.93		mg/Kg-dry	10	8/15/2017
Silver	ND	0.93		mg/Kg-dry	10	8/15/2017
Thallium	ND	0.93		mg/Kg-dry	10	8/15/2017
Zinc	200	4.6		mg/Kg-dry	10	8/15/2017
Mercury SW7471A						
					Prep Date: 8/10/2017	Analyst: LB
Mercury	0.20	0.020		mg/Kg-dry	1	8/10/2017
pH (25 °C) SW9045C						
					Prep Date: 8/8/2017	Analyst: PBG
pH	7.82			pH Units	1	8/8/2017
Percent Moisture D2974						
					Prep Date: 8/8/2017	Analyst: KKA
Percent Moisture	6.4	0.2	*	wt%	1	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

Company: Amec Foster Wheeler
 Project Number: 3205171606 Client Tracking No.:
 Project Name: city of Chicago JPSTA
 Project Location: Chicago IL
 Sampler(s): Craig Cabrera
 Report To: Mary Tank Phone: 7736936030
Andy Hastings Fax:
 QC Level: 1 2 3 4 e-mail: Mary.Tank@amec.fw

Client Sample Number/Description:	Date Taken	Time Taken	Matrix	Comp.	Grab	Preserv.	No. of Containers
ESB-4A	8/7/17	805	soil	X	X		4
ESB-4B	8/7/17	810	soil	X	X		4
B-12A	8/7/17	1010	soil	X	X		1
B-12B	8/7/17	1015	soil	X	X		1
B-12C	8/7/17	1018	soil	X	X		1
B-16A	8/7/17	1145	soil	X	X		1
B-16B	8/7/17	1150	soil	X	X		1
B-10A	8/7/17	1405	soil	X	X		1
B-10B	8/7/17	1410	soil	X	X		1

Quote No.:
 P.O. No.:
 Turn Around Time (Days): 1 2 3 4 5-7 10
 Results Needed:
 Additional Information:
 Lab No.:
 001
 002
 003
 004
 005
 006
 007
 008
 009

Target Compoundly: X
 PAKS: X X X
 Priority Cellulose: X X X
 H4

Laboratory Work Order No.: 17080223
 Received on Ice: Yes No
 Temperature: 4.4 °C

Comments:
 Date/Time: 8/7/17 3:45
 Date/Time: 8/7/17 15:45
 Date/Time:
 Date/Time:
 Date/Time:
 Date/Time:

Preservation Code: A = None B = HNO₃ C = NaOH
 D = H₂SO₄ E = HCl F = 5035/EnCore G = Other

Sample Receipt Checklist

Client Name AMEC

Date and Time Received: 8/7/2017 3:45:00 PM

Work Order Number 17080223

Received by: JNW

Checklist completed by:

[Handwritten Signature] 8/7/17
 Signature Date

Reviewed by:

MK 8/7/17
 Initials Date

Matrix:

Carrier name Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature 4.4 °C
- Water - VOA vials have zero headspace? No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: _____
- Water - Samples properly preserved? Yes No pH Adjusted? _____

Any No response must be detailed in the comments section below.

Comments: Report trichlorofluoromethane per Mary Jank verbal 8/22/17.

Client / Person contacted: _____ Date contacted: _____ Contacted by: _____

Response: _____

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Monday, November 20, 2017 3:47 PM
To: Craig Chawla; Frank Capoccia
Subject: Additional Testing -

Please perform additional leaching procedure testing (TCLP or SPLP) for the following metals on the identified samples:

B-18A – chromium and manganese your sample # 17080321-011

B-6B – chromium your sample #17080265-014

ESB-2A – cobalt, iron – your sample #17080088-001

ESB-4A – iron your sample #17080223-001

ESB-5A – iron your sample #17080126-001

ESB-6A – iron, manganese your sample #17080177-001

Mary E. Jank

Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

November 27, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17080265 Revision 2

RE: 3205-17-1606, City of Chicago-JPSTA, 4301 W Chicago, Chicago, IL

Dear Mary Jank:

STAT Analysis received 15 samples for the referenced project on 8/8/2017 4:00:00 PM. The analytical results are presented in the following report.

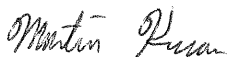
This report is revised to reflect additional analysis requested after the last report revision.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAP standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Martin Kucan

Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure
Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Chica **Work Order Sample Summary**
Work Order: 17080265 Revision 2

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17080265-001A	B-11A		8/8/2017 8:05:00 AM	8/8/2017
17080265-001B	B-11A		8/8/2017 8:05:00 AM	8/8/2017
17080265-002A	B-11B		8/8/2017 8:10:00 AM	8/8/2017
17080265-002B	B-11B		8/8/2017 8:10:00 AM	8/8/2017
17080265-003A	B-11C		8/8/2017 8:15:00 AM	8/8/2017
17080265-004A	B-15A		8/8/2017 9:00:00 AM	8/8/2017
17080265-005A	B-15B		8/8/2017 9:05:00 AM	8/8/2017
17080265-006A	B-15C		8/8/2017 9:20:00 AM	8/8/2017
17080265-007A	B-9A		8/8/2017 10:15:00 AM	8/8/2017
17080265-008A	B-9B		8/8/2017 10:25:00 AM	8/8/2017
17080265-009A	B-9C		8/8/2017 10:35:00 AM	8/8/2017
17080265-010A	B-3A		8/8/2017 2:05:00 PM	8/8/2017
17080265-011A	B-3B		8/8/2017 2:20:00 PM	8/8/2017
17080265-011B	B-3B		8/8/2017 2:20:00 PM	8/8/2017
17080265-012A	B-3C		8/8/2017 2:25:00 PM	8/8/2017
17080265-012B	B-3C		8/8/2017 2:25:00 PM	8/8/2017
17080265-013A	B-6A		8/8/2017 12:10:00 PM	8/8/2017
17080265-014A	B-6B		8/8/2017 12:30:00 PM	8/8/2017
17080265-015A	B-6C		8/8/2017 12:40:00 PM	8/8/2017

CLIENT: AMEC Foster Wheeler Environment & Infr

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Chicago, Ch

CASE NARRATIVE

Work Order: 17080265 Revision 2

Due to sample matrix, the PNA extract for sample B-9A (17080265-007) was concentrated to a final volume of 10mL, resulting in a 10 fold increase in reporting limits.

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-11A

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 8:05:00 AM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/9/2017		Analyst: JNM	
Acetone	ND	0.074		mg/Kg-dry	1	8/16/2017
Benzene	ND	0.0050		mg/Kg-dry	1	8/16/2017
Bromodichloromethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
Bromoform	ND	0.0050		mg/Kg-dry	1	8/16/2017
Bromomethane	ND	0.0099		mg/Kg-dry	1	8/16/2017
2-Butanone	ND	0.074		mg/Kg-dry	1	8/16/2017
Carbon disulfide	ND	0.050		mg/Kg-dry	1	8/16/2017
Carbon tetrachloride	ND	0.0050		mg/Kg-dry	1	8/16/2017
Chlorobenzene	ND	0.0050		mg/Kg-dry	1	8/16/2017
Chloroethane	ND	0.0099		mg/Kg-dry	1	8/16/2017
Chloroform	ND	0.0050		mg/Kg-dry	1	8/16/2017
Chloromethane	ND	0.0099		mg/Kg-dry	1	8/16/2017
Dibromochloromethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,1-Dichloroethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,2-Dichloroethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,1-Dichloroethene	ND	0.0050		mg/Kg-dry	1	8/16/2017
cis-1,2-Dichloroethene	ND	0.0050		mg/Kg-dry	1	8/16/2017
trans-1,2-Dichloroethene	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,2-Dichloropropane	ND	0.0050		mg/Kg-dry	1	8/16/2017
cis-1,3-Dichloropropene	ND	0.0020		mg/Kg-dry	1	8/16/2017
trans-1,3-Dichloropropene	ND	0.0020		mg/Kg-dry	1	8/16/2017
Ethylbenzene	ND	0.0050		mg/Kg-dry	1	8/16/2017
2-Hexanone	ND	0.020		mg/Kg-dry	1	8/16/2017
4-Methyl-2-pentanone	ND	0.020		mg/Kg-dry	1	8/16/2017
Methylene chloride	ND	0.0099		mg/Kg-dry	1	8/16/2017
Methyl tert-butyl ether	ND	0.0050		mg/Kg-dry	1	8/16/2017
Styrene	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,1,2,2-Tetrachloroethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
Tetrachloroethene	ND	0.0050		mg/Kg-dry	1	8/16/2017
Toluene	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,1,1-Trichloroethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
1,1,2-Trichloroethane	ND	0.0050		mg/Kg-dry	1	8/16/2017
Trichloroethene	ND	0.0050		mg/Kg-dry	1	8/16/2017
Vinyl chloride	ND	0.0050		mg/Kg-dry	1	8/16/2017
Xylenes, Total	ND	0.015		mg/Kg-dry	1	8/16/2017
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/9/2017		Analyst: JNM	
Trichlorofluoromethane	ND	0.0050		mg/Kg-dry	1	8/16/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-11A

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 8:05:00 AM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	ND	0.039		mg/Kg-dry	1	8/11/2017
Acenaphthylene	ND	0.039		mg/Kg-dry	1	8/11/2017
Anthracene	0.066	0.039		mg/Kg-dry	1	8/11/2017
Benzo(a)anthracene	0.19	0.039		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	0.18	0.039		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	0.18	0.039		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	0.12	0.039		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.16	0.039		mg/Kg-dry	1	8/11/2017
Chrysene	0.21	0.039		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	0.066	0.039		mg/Kg-dry	1	8/11/2017
Fluoranthene	0.34	0.039		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.039		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.098	0.039		mg/Kg-dry	1	8/11/2017
Naphthalene	0.046	0.039		mg/Kg-dry	1	8/11/2017
Phenanthrene	0.19	0.039		mg/Kg-dry	1	8/11/2017
Pyrene	0.29	0.039		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/14/2017		Analyst: JG	
Antimony	ND	2.0		mg/Kg-dry	10	8/16/2017
Arsenic	8.6	0.99		mg/Kg-dry	10	8/16/2017
Beryllium	0.78	0.50		mg/Kg-dry	10	8/16/2017
Cadmium	ND	0.50		mg/Kg-dry	10	8/16/2017
Chromium	20	0.99		mg/Kg-dry	10	8/16/2017
Copper	35	2.5		mg/Kg-dry	10	8/16/2017
Lead	38	0.50		mg/Kg-dry	10	8/16/2017
Nickel	31	0.99		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.99		mg/Kg-dry	10	8/16/2017
Silver	ND	0.99		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.99		mg/Kg-dry	10	8/16/2017
Zinc	67	5.0		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A		Prep Date: 8/14/2017		Analyst: LB	
Mercury	0.033	0.022		mg/Kg-dry	1	8/14/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/9/2017		Analyst: PBG	
pH	7.97			pH Units	1	8/9/2017
Percent Moisture						
	D2974		Prep Date: 8/9/2017		Analyst: KKA	
Percent Moisture	15.4	0.2	*	wt%	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-15A

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 9:00:00 AM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-004

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)				Prep Date: 8/9/2017	Analyst: DM
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/11/2017
Acenaphthylene	ND	0.035		mg/Kg-dry	1	8/11/2017
Anthracene	0.11	0.035		mg/Kg-dry	1	8/11/2017
Benzo(a)anthracene	0.24	0.035		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	0.22	0.035		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	0.23	0.035		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	0.20	0.035		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.16	0.035		mg/Kg-dry	1	8/11/2017
Chrysene	0.30	0.035		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	0.050	0.035		mg/Kg-dry	1	8/11/2017
Fluoranthene	0.33	0.035		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.035		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.13	0.035		mg/Kg-dry	1	8/11/2017
Naphthalene	0.079	0.035		mg/Kg-dry	1	8/11/2017
Phenanthrene	0.90	0.035		mg/Kg-dry	1	8/11/2017
Pyrene	0.35	0.035		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS						
	SW6020 (SW3050B)				Prep Date: 8/14/2017	Analyst: JG
Antimony	3.3	1.9		mg/Kg-dry	10	8/16/2017
Arsenic	11	0.96		mg/Kg-dry	10	8/16/2017
Beryllium	0.77	0.48		mg/Kg-dry	10	8/16/2017
Cadmium	0.80	0.48		mg/Kg-dry	10	8/16/2017
Chromium	11	0.96		mg/Kg-dry	10	8/16/2017
Copper	66	2.4		mg/Kg-dry	10	8/16/2017
Lead	170	0.48		mg/Kg-dry	10	8/16/2017
Nickel	15	0.96		mg/Kg-dry	10	8/16/2017
Selenium	1.3	0.96		mg/Kg-dry	10	8/16/2017
Silver	ND	0.96		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.96		mg/Kg-dry	10	8/16/2017
Zinc	210	4.8		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A				Prep Date: 8/14/2017	Analyst: LB
Mercury	0.090	0.019		mg/Kg-dry	1	8/14/2017
pH (25 °C)						
	SW9045C				Prep Date: 8/9/2017	Analyst: PBG
pH	7.49			pH Units	1	8/9/2017
Percent Moisture						
	D2974				Prep Date: 8/9/2017	Analyst: KKA
Percent Moisture	7.7	0.2	*	wt%	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-9A

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 10:15:00 AM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Ct

Matrix: Soil

Lab ID: 17080265-007

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	ND	0.37		mg/Kg-dry	1	8/11/2017
Acenaphthylene	ND	0.37		mg/Kg-dry	1	8/11/2017
Anthracene	0.57	0.37		mg/Kg-dry	1	8/11/2017
Benzo(a)anthracene	1.3	0.37		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	1.2	0.37		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	1.0	0.37		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	2.0	0.37		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.38	0.37		mg/Kg-dry	1	8/11/2017
Chrysene	2.8	0.37		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	0.52	0.37		mg/Kg-dry	1	8/11/2017
Fluoranthene	1.2	0.37		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.37		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.73	0.37		mg/Kg-dry	1	8/11/2017
Naphthalene	1.2	0.37		mg/Kg-dry	1	8/11/2017
Phenanthrene	5.7	0.37		mg/Kg-dry	1	8/11/2017
Pyrene	2.8	0.37		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/14/2017		Analyst: JG	
Antimony	8.0	1.9		mg/Kg-dry	10	8/16/2017
Arsenic	14	0.97		mg/Kg-dry	10	8/16/2017
Beryllium	0.56	0.49		mg/Kg-dry	10	8/16/2017
Cadmium	1.3	0.49		mg/Kg-dry	10	8/16/2017
Chromium	17	0.97		mg/Kg-dry	10	8/16/2017
Copper	90	2.4		mg/Kg-dry	10	8/16/2017
Lead	320	0.49		mg/Kg-dry	10	8/16/2017
Nickel	19	0.97		mg/Kg-dry	10	8/16/2017
Selenium	1.2	0.97		mg/Kg-dry	10	8/16/2017
Silver	ND	0.97		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.97		mg/Kg-dry	10	8/16/2017
Zinc	370	4.9		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A		Prep Date: 8/14/2017		Analyst: LB	
Mercury	0.22	0.018		mg/Kg-dry	1	8/14/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/9/2017		Analyst: PBG	
pH	7.74			pH Units	1	8/9/2017
Percent Moisture						
	D2974		Prep Date: 8/9/2017		Analyst: KKA	
Percent Moisture	10.6	0.2	*	wt%	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-3A

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 2:05:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-010

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/11/2017
Acenaphthylene	ND	0.035		mg/Kg-dry	1	8/11/2017
Anthracene	ND	0.035		mg/Kg-dry	1	8/11/2017
Benzo(a)anthracene	0.11	0.035		mg/Kg-dry	1	8/11/2017
Benzo(a)pyrene	0.13	0.035		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	0.11	0.035		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	0.097	0.035		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	0.096	0.035		mg/Kg-dry	1	8/11/2017
Chrysene	0.13	0.035		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	ND	0.035		mg/Kg-dry	1	8/11/2017
Fluoranthene	0.16	0.035		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.035		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	0.075	0.035		mg/Kg-dry	1	8/11/2017
Naphthalene	ND	0.035		mg/Kg-dry	1	8/11/2017
Phenanthrene	0.088	0.035		mg/Kg-dry	1	8/11/2017
Pyrene	0.18	0.035		mg/Kg-dry	1	8/11/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/14/2017		Analyst: JG	
Antimony	ND	1.9		mg/Kg-dry	10	8/16/2017
Arsenic	4.2	0.96		mg/Kg-dry	10	8/16/2017
Beryllium	ND	0.48		mg/Kg-dry	10	8/16/2017
Cadmium	ND	0.48		mg/Kg-dry	10	8/16/2017
Chromium	9.5	0.96		mg/Kg-dry	10	8/16/2017
Copper	18	2.4		mg/Kg-dry	10	8/16/2017
Lead	29	0.48		mg/Kg-dry	10	8/16/2017
Nickel	12	0.96		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.96		mg/Kg-dry	10	8/16/2017
Silver	ND	0.96		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.96		mg/Kg-dry	10	8/16/2017
Zinc	59	4.8		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A		Prep Date: 8/14/2017		Analyst: LB	
Mercury	0.075	0.016		mg/Kg-dry	1	8/14/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/9/2017		Analyst: PBG	
pH	7.77			pH Units	1	8/9/2017
Percent Moisture						
	D2974		Prep Date: 8/9/2017		Analyst: KKA	
Percent Moisture	5.7	0.2	*	wt%	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-3B

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 2:20:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/9/2017		Analyst: JNM	
Acetone	ND	0.081		mg/Kg-dry	1	8/16/2017
Benzene	ND	0.0054		mg/Kg-dry	1	8/16/2017
Bromodichloromethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
Bromoform	ND	0.0054		mg/Kg-dry	1	8/16/2017
Bromomethane	ND	0.011		mg/Kg-dry	1	8/16/2017
2-Butanone	ND	0.081		mg/Kg-dry	1	8/16/2017
Carbon disulfide	ND	0.054		mg/Kg-dry	1	8/16/2017
Carbon tetrachloride	ND	0.0054		mg/Kg-dry	1	8/16/2017
Chlorobenzene	ND	0.0054		mg/Kg-dry	1	8/16/2017
Chloroethane	ND	0.011		mg/Kg-dry	1	8/16/2017
Chloroform	ND	0.0054		mg/Kg-dry	1	8/16/2017
Chloromethane	ND	0.011		mg/Kg-dry	1	8/16/2017
Dibromochloromethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,1-Dichloroethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,2-Dichloroethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,1-Dichloroethene	ND	0.0054		mg/Kg-dry	1	8/16/2017
cis-1,2-Dichloroethene	ND	0.0054		mg/Kg-dry	1	8/16/2017
trans-1,2-Dichloroethene	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,2-Dichloropropane	ND	0.0054		mg/Kg-dry	1	8/16/2017
cis-1,3-Dichloropropene	ND	0.0022		mg/Kg-dry	1	8/16/2017
trans-1,3-Dichloropropene	ND	0.0022		mg/Kg-dry	1	8/16/2017
Ethylbenzene	ND	0.0054		mg/Kg-dry	1	8/16/2017
2-Hexanone	ND	0.022		mg/Kg-dry	1	8/16/2017
4-Methyl-2-pentanone	ND	0.022		mg/Kg-dry	1	8/16/2017
Methylene chloride	ND	0.011		mg/Kg-dry	1	8/16/2017
Methyl tert-butyl ether	ND	0.0054		mg/Kg-dry	1	8/16/2017
Styrene	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,1,2,2-Tetrachloroethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
Tetrachloroethene	ND	0.0054		mg/Kg-dry	1	8/16/2017
Toluene	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,1,1-Trichloroethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
1,1,2-Trichloroethane	ND	0.0054		mg/Kg-dry	1	8/16/2017
Trichloroethene	ND	0.0054		mg/Kg-dry	1	8/16/2017
Vinyl chloride	ND	0.0054		mg/Kg-dry	1	8/16/2017
Xylenes, Total	ND	0.016		mg/Kg-dry	1	8/16/2017
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/9/2017		Analyst: JNM	
Trichlorofluoromethane	ND	0.0054		mg/Kg-dry	1	8/16/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-3B

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 2:20:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Ct

Matrix: Soil

Lab ID: 17080265-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: DM	
Acenaphthene	ND	0.036		mg/Kg-dry	1	8/11/2017
Acenaphthylene	ND	0.036		mg/Kg-dry	1	8/11/2017
Aniline	ND	0.36		mg/Kg-dry	1	8/11/2017
Anthracene	ND	0.036		mg/Kg-dry	1	8/11/2017
Benz(a)anthracene	ND	0.036		mg/Kg-dry	1	8/11/2017
Benzo(b)fluoranthene	ND	0.036		mg/Kg-dry	1	8/11/2017
Benzo(g,h,i)perylene	ND	0.036		mg/Kg-dry	1	8/11/2017
Benzo(k)fluoranthene	ND	0.036		mg/Kg-dry	1	8/11/2017
Benzoic acid	ND	0.90		mg/Kg-dry	1	8/11/2017
Benzyl alcohol	ND	0.18		mg/Kg-dry	1	8/11/2017
Bis(2-chloroethoxy)methane	ND	0.18		mg/Kg-dry	1	8/11/2017
Bis(2-chloroethyl)ether	ND	0.18		mg/Kg-dry	1	8/11/2017
Bis(2-ethylhexyl)phthalate	ND	0.90		mg/Kg-dry	1	8/11/2017
4-Bromophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/11/2017
Butyl benzyl phthalate	ND	0.18		mg/Kg-dry	1	8/11/2017
Carbazole	ND	0.18		mg/Kg-dry	1	8/11/2017
4-Chloroaniline	ND	0.18		mg/Kg-dry	1	8/11/2017
4-Chloro-3-methylphenol	ND	0.36		mg/Kg-dry	1	8/11/2017
2-Chloronaphthalene	ND	0.18		mg/Kg-dry	1	8/11/2017
2-Chlorophenol	ND	0.18		mg/Kg-dry	1	8/11/2017
4-Chlorophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/11/2017
Chrysene	ND	0.036		mg/Kg-dry	1	8/11/2017
Dibenz(a,h)anthracene	ND	0.036		mg/Kg-dry	1	8/11/2017
Dibenzofuran	ND	0.18		mg/Kg-dry	1	8/11/2017
1,2-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/11/2017
1,3-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/11/2017
1,4-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/11/2017
3,3'-Dichlorobenzidine	ND	0.18		mg/Kg-dry	1	8/11/2017
2,4-Dichlorophenol	ND	0.18		mg/Kg-dry	1	8/11/2017
Diethyl phthalate	ND	0.18		mg/Kg-dry	1	8/11/2017
2,4-Dimethylphenol	ND	0.18		mg/Kg-dry	1	8/11/2017
Dimethyl phthalate	ND	0.18		mg/Kg-dry	1	8/11/2017
4,6-Dinitro-2-methylphenol	ND	0.36		mg/Kg-dry	1	8/11/2017
2,4-Dinitrophenol	ND	0.90		mg/Kg-dry	1	8/11/2017
2,4-Dinitrotoluene	ND	0.036		mg/Kg-dry	1	8/11/2017
2,6-Dinitrotoluene	ND	0.036		mg/Kg-dry	1	8/11/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-3B

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 2:20:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Ct

Matrix: Soil

Lab ID: 17080265-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
----------	--------	----	-----------	-------	----	---------------

Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/9/2017	Analyst: DM		
---	-------------------	--	---------------------	-------------	--	--

Di-n-butyl phthalate	ND	0.18		mg/Kg-dry	1	8/11/2017
Di-n-octyl phthalate	ND	0.18		mg/Kg-dry	1	8/11/2017
Fluoranthene	0.040	0.036		mg/Kg-dry	1	8/11/2017
Fluorene	ND	0.036		mg/Kg-dry	1	8/11/2017
Hexachlorobenzene	ND	0.18		mg/Kg-dry	1	8/11/2017
Hexachlorobutadiene	ND	0.18		mg/Kg-dry	1	8/11/2017
Hexachlorocyclopentadiene	ND	0.18		mg/Kg-dry	1	8/11/2017
Hexachloroethane	ND	0.18		mg/Kg-dry	1	8/11/2017
Indeno(1,2,3-cd)pyrene	ND	0.036		mg/Kg-dry	1	8/11/2017
Isophorone	ND	0.18		mg/Kg-dry	1	8/11/2017
2-Methylnaphthalene	ND	0.18		mg/Kg-dry	1	8/11/2017
2-Methylphenol	ND	0.18		mg/Kg-dry	1	8/11/2017
4-Methylphenol	ND	0.18		mg/Kg-dry	1	8/11/2017
Naphthalene	ND	0.036		mg/Kg-dry	1	8/11/2017
2-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/11/2017
3-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/11/2017
4-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/11/2017
2-Nitrophenol	ND	0.18		mg/Kg-dry	1	8/11/2017
4-Nitrophenol	ND	0.36		mg/Kg-dry	1	8/11/2017
Nitrobenzene	ND	0.036		mg/Kg-dry	1	8/11/2017
N-Nitrosodi-n-propylamine	ND	0.036		mg/Kg-dry	1	8/11/2017
N-Nitrosodimethylamine	ND	0.18		mg/Kg-dry	1	8/11/2017
N-Nitrosodiphenylamine	ND	0.036		mg/Kg-dry	1	8/11/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.18		mg/Kg-dry	1	8/11/2017
Pentachlorophenol	ND	0.036		mg/Kg-dry	1	8/11/2017
Phenanthrene	ND	0.036		mg/Kg-dry	1	8/11/2017
Phenol	ND	0.18		mg/Kg-dry	1	8/11/2017
Pyrene	0.043	0.036		mg/Kg-dry	1	8/11/2017
Pyridine	ND	0.73		mg/Kg-dry	1	8/11/2017
1,2,4-Trichlorobenzene	ND	0.18		mg/Kg-dry	1	8/11/2017
2,4,5-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/11/2017
2,4,6-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/11/2017

PCBs	SW8082 (SW3550B)		Prep Date: 8/9/2017	Analyst: GVC		
------	------------------	--	---------------------	--------------	--	--

Aroclor 1016	ND	0.087		mg/Kg-dry	1	8/9/2017
Aroclor 1221	ND	0.087		mg/Kg-dry	1	8/9/2017
Aroclor 1232	ND	0.087		mg/Kg-dry	1	8/9/2017
Aroclor 1242	ND	0.087		mg/Kg-dry	1	8/9/2017
Aroclor 1248	ND	0.087		mg/Kg-dry	1	8/9/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-3B

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 2:20:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)			Prep Date: 8/9/2017		Analyst: GVC
Aroclor 1254	ND	0.087		mg/Kg-dry	1	8/9/2017
Aroclor 1260	ND	0.087		mg/Kg-dry	1	8/9/2017
Pesticides	SW8081 (SW3550B)			Prep Date: 8/9/2017		Analyst: GVC
4,4'-DDD	ND	0.0017		mg/Kg-dry	1	8/9/2017
4,4'-DDE	ND	0.0017		mg/Kg-dry	1	8/9/2017
4,4'-DDT	ND	0.0017		mg/Kg-dry	1	8/9/2017
Aldrin	ND	0.0017		mg/Kg-dry	1	8/9/2017
alpha-BHC	ND	0.0017		mg/Kg-dry	1	8/9/2017
alpha-Chlordane	ND	0.0017		mg/Kg-dry	1	8/9/2017
beta-BHC	ND	0.0017		mg/Kg-dry	1	8/9/2017
Chlordane	ND	0.017		mg/Kg-dry	1	8/9/2017
delta-BHC	ND	0.0017		mg/Kg-dry	1	8/9/2017
Dieldrin	ND	0.0017		mg/Kg-dry	1	8/9/2017
Endosulfan I	ND	0.0017		mg/Kg-dry	1	8/9/2017
Endosulfan II	ND	0.0017		mg/Kg-dry	1	8/9/2017
Endosulfan sulfate	ND	0.0017		mg/Kg-dry	1	8/9/2017
Endrin	ND	0.0017		mg/Kg-dry	1	8/9/2017
Endrin aldehyde	ND	0.0017		mg/Kg-dry	1	8/9/2017
Endrin ketone	ND	0.0017		mg/Kg-dry	1	8/9/2017
gamma-BHC	ND	0.0017		mg/Kg-dry	1	8/9/2017
gamma-Chlordane	ND	0.0017		mg/Kg-dry	1	8/9/2017
Heptachlor	ND	0.0017		mg/Kg-dry	1	8/9/2017
Heptachlor epoxide	ND	0.0017		mg/Kg-dry	1	8/9/2017
Methoxychlor	ND	0.0017		mg/Kg-dry	1	8/9/2017
Toxaphene	ND	0.036		mg/Kg-dry	1	8/9/2017
Metals by ICP/MS	SW6020 (SW3050B)			Prep Date: 8/14/2017		Analyst: JG
Aluminum	2600	20		mg/Kg-dry	10	8/16/2017
Antimony	ND	2.0		mg/Kg-dry	10	8/16/2017
Arsenic	2.7	0.98		mg/Kg-dry	10	8/16/2017
Barium	13	0.98		mg/Kg-dry	10	8/16/2017
Beryllium	ND	0.49		mg/Kg-dry	10	8/16/2017
Cadmium	ND	0.49		mg/Kg-dry	10	8/16/2017
Calcium	50000	59		mg/Kg-dry	10	8/16/2017
Chromium	6.7	0.98		mg/Kg-dry	10	8/16/2017
Cobalt	3.1	0.98		mg/Kg-dry	10	8/16/2017
Copper	7.7	2.5		mg/Kg-dry	10	8/16/2017
Iron	7600	29		mg/Kg-dry	10	8/16/2017

Qualifiers:

ND - Not Detected at the Reporting Limit

J - Analyte detected below quantitation limits

B - Analyte detected in the associated Method Blank

HT - Sample received past holding time

* - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis

S - Spike Recovery outside accepted recovery limits

R - RPD outside accepted recovery limits

E - Value above quantitation range

H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-3B

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 2:20:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/14/2017		Analyst: JG	
Lead	6.4	0.49		mg/Kg-dry	10	8/16/2017
Magnesium	26000	29		mg/Kg-dry	10	8/16/2017
Manganese	200	0.98		mg/Kg-dry	10	8/16/2017
Nickel	7.4	0.98		mg/Kg-dry	10	8/16/2017
Potassium	440	29		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.98		mg/Kg-dry	10	8/16/2017
Silver	ND	0.98		mg/Kg-dry	10	8/16/2017
Sodium	95	59		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.98		mg/Kg-dry	10	8/16/2017
Vanadium	12	0.98		mg/Kg-dry	10	8/16/2017
Zinc	25	4.9		mg/Kg-dry	10	8/16/2017
Mercury	SW7471A		Prep Date: 8/14/2017		Analyst: LB	
Mercury	0.047	0.021		mg/Kg-dry	1	8/14/2017
Cyanide, Total	SW9012A		Prep Date: 8/11/2017		Analyst: MD	
Cyanide	ND	0.27		mg/Kg-dry	1	8/15/2017
pH (25 °C)	SW9045C		Prep Date: 8/9/2017		Analyst: PBG	
pH	8.04			pH Units	1	8/9/2017
Percent Moisture	D2974		Prep Date: 8/9/2017		Analyst: KKA	
Percent Moisture	8.2	0.2	*	wt%	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-6A

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 12:10:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Cl

Matrix: Soil

Lab ID: 17080265-013

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS SW8270C (SW3550B)						
					Prep Date: 8/9/2017	Analyst: MEP
Acenaphthene	0.32	0.038		mg/Kg-dry	1	8/13/2017
Acenaphthylene	0.085	0.038		mg/Kg-dry	1	8/13/2017
Anthracene	2.0	0.038		mg/Kg-dry	1	8/13/2017
Benzo(a)anthracene	4.9	0.38		mg/Kg-dry	10	8/15/2017
Benzo(a)pyrene	3.9	0.38		mg/Kg-dry	10	8/15/2017
Benzo(b)fluoranthene	3.5	0.038		mg/Kg-dry	1	8/13/2017
Benzo(g,h,i)perylene	3.3	0.038		mg/Kg-dry	1	8/13/2017
Benzo(k)fluoranthene	3.2	0.038		mg/Kg-dry	1	8/13/2017
Chrysene	5.1	0.38		mg/Kg-dry	10	8/15/2017
Dibenz(a,h)anthracene	1.1	0.038		mg/Kg-dry	1	8/13/2017
Fluoranthene	9.8	0.38		mg/Kg-dry	10	8/15/2017
Fluorene	0.46	0.038		mg/Kg-dry	1	8/13/2017
Indeno(1,2,3-cd)pyrene	2.5	0.038		mg/Kg-dry	1	8/13/2017
Naphthalene	0.061	0.038		mg/Kg-dry	1	8/13/2017
Phenanthrene	6.5	0.38		mg/Kg-dry	10	8/15/2017
Pyrene	13	0.38		mg/Kg-dry	10	8/15/2017
Metals by ICP/MS SW6020 (SW3050B)						
					Prep Date: 8/14/2017	Analyst: JG
Antimony	ND	2.0		mg/Kg-dry	10	8/16/2017
Arsenic	6.8	0.98		mg/Kg-dry	10	8/16/2017
Beryllium	0.56	0.49		mg/Kg-dry	10	8/16/2017
Cadmium	ND	0.49		mg/Kg-dry	10	8/16/2017
Chromium	20	0.98		mg/Kg-dry	10	8/16/2017
Copper	41	2.4		mg/Kg-dry	10	8/16/2017
Lead	66	0.49		mg/Kg-dry	10	8/16/2017
Nickel	29	0.98		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.98		mg/Kg-dry	10	8/16/2017
Silver	ND	0.98		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.98		mg/Kg-dry	10	8/16/2017
Zinc	100	4.9		mg/Kg-dry	10	8/16/2017
Mercury SW7471A						
					Prep Date: 8/14/2017	Analyst: LB
Mercury	0.077	0.022		mg/Kg-dry	1	8/14/2017
pH (25 °C) SW9045C						
					Prep Date: 8/9/2017	Analyst: PBG
pH	9.92			pH Units	1	8/9/2017
Percent Moisture D2974						
					Prep Date: 8/9/2017	Analyst: KKA
Percent Moisture	14.3	0.2	*	wt%	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-6B

Work Order: 17080265 Revision 2

Collection Date: 8/8/2017 12:30:00 PM

Project: 3205-17-1606, City of Chicago-JPSTA, 4301 W Ct

Matrix: Soil

Lab ID: 17080265-014

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS	SW8270C (SW3550B)		Prep Date: 8/9/2017		Analyst: MEP	
Acenaphthene	ND	0.040		mg/Kg-dry	1	8/13/2017
Acenaphthylene	0.10	0.040		mg/Kg-dry	1	8/13/2017
Anthracene	0.25	0.040		mg/Kg-dry	1	8/13/2017
Benzo(a)anthracene	0.64	0.040		mg/Kg-dry	1	8/13/2017
Benzo(a)pyrene	0.68	0.040		mg/Kg-dry	1	8/13/2017
Benzo(b)fluoranthene	0.53	0.040		mg/Kg-dry	1	8/13/2017
Benzo(g,h,i)perylene	0.65	0.040		mg/Kg-dry	1	8/13/2017
Benzo(k)fluoranthene	0.67	0.040		mg/Kg-dry	1	8/13/2017
Chrysene	0.89	0.040		mg/Kg-dry	1	8/13/2017
Dibenz(a,h)anthracene	0.25	0.040		mg/Kg-dry	1	8/13/2017
Fluoranthene	0.97	0.040		mg/Kg-dry	1	8/13/2017
Fluorene	0.067	0.040		mg/Kg-dry	1	8/13/2017
Indeno(1,2,3-cd)pyrene	0.51	0.040		mg/Kg-dry	1	8/13/2017
Naphthalene	0.20	0.040		mg/Kg-dry	1	8/13/2017
Phenanthrene	0.91	0.040		mg/Kg-dry	1	8/13/2017
Pyrene	1.2	0.040		mg/Kg-dry	1	8/13/2017
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/14/2017		Analyst: JG	
Antimony	3.4	2.2		mg/Kg-dry	10	8/16/2017
Arsenic	13	1.1		mg/Kg-dry	10	8/16/2017
Beryllium	0.57	0.54		mg/Kg-dry	10	8/16/2017
Cadmium	2.7	0.54		mg/Kg-dry	10	8/16/2017
Chromium	29	1.1		mg/Kg-dry	10	8/16/2017
Copper	170	2.7		mg/Kg-dry	10	8/16/2017
Lead	240	0.54		mg/Kg-dry	10	8/16/2017
Nickel	31	1.1		mg/Kg-dry	10	8/16/2017
Selenium	1.2	1.1		mg/Kg-dry	10	8/16/2017
Silver	ND	1.1		mg/Kg-dry	10	8/16/2017
Thallium	ND	1.1		mg/Kg-dry	10	8/16/2017
Zinc	650	5.4		mg/Kg-dry	10	8/16/2017
SPLP Metals by ICP/MS	SW1312/6020A (SW3005A)		Prep Date: 11/24/2017		Analyst: JG	
Chromium	ND	0.0040		mg/L	2	11/24/2017
Mercury	SW7471A		Prep Date: 8/14/2017		Analyst: LB	
Mercury	0.24	0.023		mg/Kg-dry	1	8/14/2017
pH (25 °C)	SW9045C		Prep Date: 8/9/2017		Analyst: PBG	
pH	8.22			pH Units	1	8/9/2017
Percent Moisture	D2974		Prep Date: 8/9/2017		Analyst: KKA	

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: November 27, 2017

ANALYTICAL RESULTS

Date Printed: November 27, 2017

Client:	AMEC Foster Wheeler Environment & Infr	Client Sample ID:	B-6B
Work Order:	17080265 Revision 2	Collection Date:	8/8/2017 12:30:00 PM
Project:	3205-17-1606, City of Chicago-JPSTA, 4301 W Cl	Matrix:	Soil
Lab ID:	17080265-014		

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Percent Moisture	D2974				Prep Date: 8/9/2017	Analyst: KKA
Percent Moisture	18.8	0.2	*	wt%	1	8/10/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

Company: AMES FESER WHEELER
 Project Number: 3205-17-1606 Client Tracking No.:
 Project Name: CITY OF CHICAGO - JPSTA
 Project Location: 4301 W CHICAGO, CHICAGO, IL
 Sampler(s): ERIC WALKERWALL
 Report To: MARY JANK Phone: 773-693-6630
 Fax:

Quote No.:
 P.O. No.:
 Turn Around Time (Days): STAT (M)
 1 2 3 4 5-7 10
 Results Needed:
 Additional Information:
 Lab No.:

QC Level	1	2	3	4	Time Taken	Date Taken	Matrix	Comp	Grab	Preserv	No. of Containers
B-11A					8:05	8-8-17	Soil		A/P		4
B-11B					8:10				A/P		4
B-11C					8:15				A		1
B-15A					9:00				A		1
B-15B					9:05				A		1
B-15C					9:20				A		1
B-9A					10:15				A		1
B-9B					10:25				A		1
B-9C					10:35				A		1
B-3A					14:05				A		1
B-3B					14:20				A/P		4
B-3C					14:25				A/P		4
B-6A					12:10						
B-6B					12:30						
B-6C					12:40						

Matrix	Comp	Grab	Preserv	No. of Containers
DMAS	X			
PRIORITY POLYAROMATIC METAS	X			
PH	X			
VOCs	X			
TAL (SRP Target Analyte)	X			

Relinquished by: (Signature) _____ Date/Time: 8-8-17 16:00
 Received by: (Signature) _____ Date/Time: 8/8/17 16:00
 Relinquished by: (Signature) _____ Date/Time: _____
 Received by: (Signature) _____ Date/Time: _____
 Relinquished by: (Signature) _____ Date/Time: _____
 Received by: (Signature) _____ Date/Time: _____

Comments: _____

Preservation Code: A = None B = HNO₃ C = NaOH
 D = H₂SO₄ E = HCl F = 5035/EnCore G = Other

Laboratory Work Order No.: 17080265
 Received on Ice: Yes No
 Temperature: 41 °C

Sample Receipt Checklist

Client Name **AMEC**

Date and Time Received: **8/8/2017 4:00:00 PM**

Work Order Number **17080265**

Received by: **JNW**

Checklist completed by:

[Handwritten Signature]
Signature

[Handwritten Date: 8/8/17]
Date

Reviewed by:

[Handwritten Initials: MK]
Initials

[Handwritten Date: 8/8/17]
Date

Matrix:

Carrier name Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature **4.1 °C**
- Water - VOA vials have zero headspace? Yes No No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: _____
- Water - Samples properly preserved? Yes No pH Adjusted? _____

Any No response must be detailed in the comments section below.

Comments: Report trichlorofluoromethane per Mary Task verbal 8/22/17.

Client / Person contacted: _____ Date contacted: _____ Contacted by: _____

Response: _____

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Monday, November 20, 2017 3:47 PM
To: Craig Chawla; Frank Capoccia
Subject: Additional Testing -

Please perform additional leaching procedure testing (TCLP or SPLP) for the following metals on the identified samples:

B-18A – chromium and manganese your sample # 17080321-011

B-6B – chromium your sample #17080265-014

ESB-2A – cobalt, iron – your sample #17080088-001

ESB-4A – iron your sample #17080223-001

ESB-5A – iron your sample #17080126-001

ESB-6A – iron, manganese your sample #17080177-001

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

December 08, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17080321 Revision 3

RE: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Dear Mary Jank:

STAT Analysis received 13 samples for the referenced project on 8/9/2017 3:50:00 PM. The analytical results are presented in the following report.

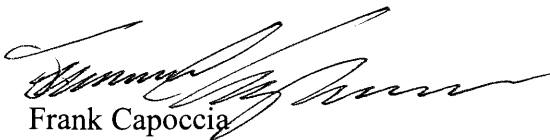
This report is revised to reflect additional analysis requested after the last report revision.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAP standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Frank Capoccia

Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure**Project:** 3205-17-1606, City of Chicago JPSTA, Chicago, IL**Work Order:** 17080321 Revision 3**Work Order Sample Summary**

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17080321-001A	ESB-5		8/9/2017 8:45:00 AM	8/9/2017
17080321-001B	ESB-5		8/9/2017 8:45:00 AM	8/9/2017
17080321-001C	ESB-5		8/9/2017 8:45:00 AM	8/9/2017
17080321-001D	ESB-5		8/9/2017 8:45:00 AM	8/9/2017
17080321-002A	ESB-6		8/9/2017 10:30:00 AM	8/9/2017
17080321-002B	ESB-6		8/9/2017 10:30:00 AM	8/9/2017
17080321-003A	B-2A		8/9/2017 7:50:00 AM	8/9/2017
17080321-004A	B-2B		8/9/2017 8:00:00 AM	8/9/2017
17080321-005A	ESB-1A		8/9/2017 9:30:00 AM	8/9/2017
17080321-006A	ESB-1B		8/9/2017 9:50:00 AM	8/9/2017
17080321-007A	ESB-1C		8/9/2017 9:55:00 AM	8/9/2017
17080321-008A	B-1A		8/9/2017 10:45:00 AM	8/9/2017
17080321-009A	B-1B		8/9/2017 11:00:00 AM	8/9/2017
17080321-010A	B-1C		8/9/2017 11:10:00 AM	8/9/2017
17080321-011A	B-18A		8/9/2017 12:25:00 PM	8/9/2017
17080321-011B	B-18A		8/9/2017 12:25:00 PM	8/9/2017
17080321-012A	B-18B		8/9/2017 12:30:00 PM	8/9/2017
17080321-013A	B-18C		8/9/2017 12:35:00 PM	8/9/2017

CLIENT: AMEC Foster Wheeler Environment & Infr
Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL
Work Order: 17080321 Revision 3

CASE NARRATIVE

At the customers request, sample ESB-6 (17080321-002) was prepared for VOC analysis from the unpreserved 1 L Amber Glass jar. The hold time was exceeded based on 7 day hold time for unpreserved sample. The request for analysis was made after the hold time expired. Methylene chloride present in the sample ESB-6 (17080321-002) is lab artifact.

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 8:45:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW8260B (SW5030B)		Prep Date:	Analyst: ERP		
Acetone	ND	0.020		mg/L	1	8/13/2017
Benzene	ND	0.0050		mg/L	1	8/13/2017
Bromodichloromethane	ND	0.0050		mg/L	1	8/13/2017
Bromoform	ND	0.0050		mg/L	1	8/13/2017
Bromomethane	ND	0.010		mg/L	1	8/13/2017
2-Butanone	ND	0.020		mg/L	1	8/13/2017
Carbon disulfide	ND	0.010		mg/L	1	8/13/2017
Carbon tetrachloride	ND	0.0050		mg/L	1	8/13/2017
Chlorobenzene	ND	0.0050		mg/L	1	8/13/2017
Chloroethane	ND	0.010		mg/L	1	8/13/2017
Chloroform	ND	0.0050		mg/L	1	8/13/2017
Chloromethane	ND	0.010		mg/L	1	8/13/2017
Dibromochloromethane	ND	0.0050		mg/L	1	8/13/2017
1,1-Dichloroethane	ND	0.0050		mg/L	1	8/13/2017
1,2-Dichloroethane	ND	0.0050		mg/L	1	8/13/2017
1,1-Dichloroethene	ND	0.0050		mg/L	1	8/13/2017
cis-1,2-Dichloroethene	ND	0.0050		mg/L	1	8/13/2017
trans-1,2-Dichloroethene	ND	0.0050		mg/L	1	8/13/2017
1,2-Dichloropropane	ND	0.0050		mg/L	1	8/13/2017
cis-1,3-Dichloropropene	ND	0.0010		mg/L	1	8/13/2017
trans-1,3-Dichloropropene	ND	0.0010		mg/L	1	8/13/2017
Ethylbenzene	ND	0.0050		mg/L	1	8/13/2017
2-Hexanone	ND	0.020		mg/L	1	8/13/2017
4-Methyl-2-pentanone	ND	0.020		mg/L	1	8/13/2017
Methylene chloride	ND	0.0050		mg/L	1	8/13/2017
Methyl tert-butyl ether	ND	0.0050		mg/L	1	8/13/2017
Styrene	ND	0.0050		mg/L	1	8/13/2017
1,1,2,2-Tetrachloroethane	ND	0.0050		mg/L	1	8/13/2017
Tetrachloroethene	ND	0.0050		mg/L	1	8/13/2017
Toluene	ND	0.0050		mg/L	1	8/13/2017
1,1,1-Trichloroethane	ND	0.0050		mg/L	1	8/13/2017
1,1,2-Trichloroethane	ND	0.0050		mg/L	1	8/13/2017
Trichloroethene	ND	0.0050		mg/L	1	8/13/2017
Vinyl chloride	ND	0.0020		mg/L	1	8/13/2017
Xylenes, Total	ND	0.015		mg/L	1	8/13/2017
Semivolatile Organic Compounds by GC/MS	SW8270C-SIM (SW3510C)		Prep Date: 8/10/2017	Analyst: TMB		
Acenaphthene	ND	0.0010		mg/L	1	8/14/2017
Acenaphthylene	ND	0.0010		mg/L	1	8/14/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 8:45:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C-SIM (SW3510C)				Prep Date: 8/10/2017	Analyst: TMB
Anthracene	ND	0.0010		mg/L	1	8/14/2017
Benz(a)anthracene	ND	0.00010		mg/L	1	8/14/2017
Benzo(a)pyrene	ND	0.00010		mg/L	1	8/14/2017
Benzo(b)fluoranthene	ND	0.00010		mg/L	1	8/14/2017
Benzo(g,h,i)perylene	ND	0.0010		mg/L	1	8/14/2017
Benzo(k)fluoranthene	ND	0.00010		mg/L	1	8/14/2017
Chrysene	ND	0.00010		mg/L	1	8/14/2017
Dibenz(a,h)anthracene	ND	0.00010		mg/L	1	8/14/2017
Fluoranthene	ND	0.0010		mg/L	1	8/14/2017
Fluorene	ND	0.0010		mg/L	1	8/14/2017
Indeno(1,2,3-cd)pyrene	ND	0.00010		mg/L	1	8/14/2017
Naphthalene	ND	0.0010		mg/L	1	8/14/2017
Phenanthrene	ND	0.0010		mg/L	1	8/14/2017
Pyrene	ND	0.0010		mg/L	1	8/14/2017
Carbazole	ND	0.00010		mg/L	1	8/14/2017
2,4-Dinitrotoluene	ND	0.00010		mg/L	1	8/14/2017
2,6-Dinitrotoluene	ND	0.00010		mg/L	1	8/14/2017
N-Nitrosodi-n-propylamine	ND	0.00010		mg/L	1	8/14/2017
Nitrobenzene	ND	0.0010		mg/L	1	8/14/2017
Pentachlorophenol	ND	0.00050		mg/L	1	8/14/2017
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3510C)				Prep Date: 8/10/2017	Analyst: TMB
Aniline	ND	0.0050		mg/L	1	8/14/2017
Benzidine	ND	0.0050		mg/L	1	8/14/2017
Benzoic acid	ND	0.025		mg/L	1	8/14/2017
Benzyl alcohol	ND	0.0050		mg/L	1	8/14/2017
Bis(2-chloroethoxy)methane	ND	0.0050		mg/L	1	8/14/2017
Bis(2-chloroethyl)ether	ND	0.0050		mg/L	1	8/14/2017
Bis(2-ethylhexyl)phthalate	ND	0.0050		mg/L	1	8/14/2017
4-Bromophenyl phenyl ether	ND	0.0050		mg/L	1	8/14/2017
Butyl benzyl phthalate	ND	0.0050		mg/L	1	8/14/2017
4-Chloroaniline	ND	0.0050		mg/L	1	8/14/2017
4-Chloro-3-methylphenol	ND	0.0050		mg/L	1	8/14/2017
2-Chloronaphthalene	ND	0.0050		mg/L	1	8/14/2017
2-Chlorophenol	ND	0.0050		mg/L	1	8/14/2017
4-Chlorophenyl phenyl ether	ND	0.0050		mg/L	1	8/14/2017
Dibenzofuran	ND	0.0050		mg/L	1	8/14/2017
1,2-Dichlorobenzene	ND	0.0050		mg/L	1	8/14/2017
1,3-Dichlorobenzene	ND	0.0050		mg/L	1	8/14/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 8:45:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3510C)		Prep Date: 8/10/2017		Analyst: TMB	
1,4-Dichlorobenzene	ND	0.0050		mg/L	1	8/14/2017
3,3'-Dichlorobenzidine	ND	0.010		mg/L	1	8/14/2017
2,4-Dichlorophenol	ND	0.0050		mg/L	1	8/14/2017
Diethyl phthalate	ND	0.0050		mg/L	1	8/14/2017
2,4-Dimethylphenol	ND	0.0050		mg/L	1	8/14/2017
Dimethyl phthalate	ND	0.0050		mg/L	1	8/14/2017
4,6-Dinitro-2-methylphenol	ND	0.025		mg/L	1	8/14/2017
2,4-Dinitrophenol	ND	0.025		mg/L	1	8/14/2017
Di-n-butyl phthalate	ND	0.0050		mg/L	1	8/14/2017
Di-n-octyl phthalate	ND	0.0050		mg/L	1	8/14/2017
Hexachlorobenzene	ND	0.0050		mg/L	1	8/14/2017
Hexachlorobutadiene	ND	0.0050		mg/L	1	8/14/2017
Hexachlorocyclopentadiene	ND	0.0050		mg/L	1	8/14/2017
Hexachloroethane	ND	0.0050		mg/L	1	8/14/2017
Isophorone	ND	0.0050		mg/L	1	8/14/2017
2-Methylnaphthalene	ND	0.0050		mg/L	1	8/14/2017
2-Methylphenol	ND	0.0050		mg/L	1	8/14/2017
4-Methylphenol	ND	0.0050		mg/L	1	8/14/2017
2-Nitroaniline	ND	0.025		mg/L	1	8/14/2017
3-Nitroaniline	ND	0.025		mg/L	1	8/14/2017
4-Nitroaniline	ND	0.025		mg/L	1	8/14/2017
2-Nitrophenol	ND	0.0050		mg/L	1	8/14/2017
4-Nitrophenol	ND	0.025		mg/L	1	8/14/2017
N-Nitrosodimethylamine	ND	0.0050		mg/L	1	8/14/2017
N-Nitrosodiphenylamine	ND	0.0050		mg/L	1	8/14/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.0050		mg/L	1	8/14/2017
Phenol	ND	0.0050		mg/L	1	8/14/2017
Pyridine	ND	0.0050		mg/L	1	8/14/2017
1,2,4-Trichlorobenzene	ND	0.0050		mg/L	1	8/14/2017
2,4,5-Trichlorophenol	ND	0.010		mg/L	1	8/14/2017
2,4,6-Trichlorophenol	ND	0.0050		mg/L	1	8/14/2017
PCBs	SW8082 (SW3510C)		Prep Date: 8/10/2017		Analyst: GVC	
Aroclor 1016	ND	0.00050		mg/L	1	8/10/2017
Aroclor 1221	ND	0.00050		mg/L	1	8/10/2017
Aroclor 1232	ND	0.00050		mg/L	1	8/10/2017
Aroclor 1242	ND	0.00050		mg/L	1	8/10/2017
Aroclor 1248	ND	0.00050		mg/L	1	8/10/2017
Aroclor 1254	ND	0.00050		mg/L	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 8:45:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3510C)				Prep Date: 8/10/2017	Analyst: GVC
Aroclor 1260	ND	0.00050		mg/L	1	8/10/2017
Pesticides	SW8081 (SW3510C)				Prep Date: 8/10/2017	Analyst: GVC
4,4'-DDD	ND	0.000050		mg/L	1	8/10/2017
4,4'-DDE	ND	0.000050		mg/L	1	8/10/2017
4,4'-DDT	ND	0.000050		mg/L	1	8/10/2017
Aldrin	ND	0.000050		mg/L	1	8/10/2017
alpha-BHC	ND	0.000050		mg/L	1	8/10/2017
alpha-Chlordane	ND	0.000050		mg/L	1	8/10/2017
beta-BHC	ND	0.000050		mg/L	1	8/10/2017
Chlordane	ND	0.0010		mg/L	1	8/10/2017
delta-BHC	ND	0.000050		mg/L	1	8/10/2017
Dieldrin	ND	0.000050		mg/L	1	8/10/2017
Endosulfan I	ND	0.000050		mg/L	1	8/10/2017
Endosulfan II	ND	0.000050		mg/L	1	8/10/2017
Endosulfan sulfate	ND	0.000050		mg/L	1	8/10/2017
Endrin	ND	0.000050		mg/L	1	8/10/2017
Endrin aldehyde	ND	0.000050		mg/L	1	8/10/2017
Endrin ketone	ND	0.000050		mg/L	1	8/10/2017
gamma-BHC	ND	0.000050		mg/L	1	8/10/2017
gamma-Chlordane	ND	0.000050		mg/L	1	8/10/2017
Heptachlor	ND	0.000050		mg/L	1	8/10/2017
Heptachlor epoxide	ND	0.000050		mg/L	1	8/10/2017
Methoxychlor	ND	0.000050		mg/L	1	8/10/2017
Toxaphene	ND	0.0010		mg/L	1	8/10/2017
Metals by ICP/MS	SW6020 (SW3005A)				Prep Date: 8/18/2017	Analyst: JG
Aluminum	ND	0.040		mg/L	2	8/19/2017
Antimony	ND	0.0060		mg/L	2	8/19/2017
Arsenic	0.0074	0.0040		mg/L	2	8/19/2017
Barium	0.079	0.0040		mg/L	2	8/19/2017
Beryllium	ND	0.0020		mg/L	2	8/19/2017
Cadmium	ND	0.0020		mg/L	2	8/19/2017
Calcium	84	0.20		mg/L	2	8/19/2017
Chromium	ND	0.0040		mg/L	2	8/19/2017
Cobalt	ND	0.0040		mg/L	2	8/19/2017
Copper	ND	0.010		mg/L	2	8/19/2017
Iron	1.4	0.10		mg/L	2	8/19/2017
Lead	ND	0.0020		mg/L	2	8/19/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-5

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 8:45:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3005A)				Prep Date: 8/18/2017	Analyst: JG
Magnesium	28	0.10		mg/L	2	8/19/2017
Manganese	0.43	0.0040		mg/L	2	8/19/2017
Nickel	ND	0.0040		mg/L	2	8/19/2017
Potassium	3.6	0.10		mg/L	2	8/19/2017
Selenium	ND	0.0040		mg/L	2	8/19/2017
Silver	ND	0.0040		mg/L	2	8/19/2017
Sodium	9.6	0.30		mg/L	2	8/19/2017
Thallium	ND	0.0020		mg/L	2	8/19/2017
Vanadium	ND	0.0040		mg/L	2	8/19/2017
Zinc	0.040	0.020		mg/L	2	8/19/2017
Mercury	SW7470A				Prep Date: 8/9/2017	Analyst: LB
Mercury	ND	0.00020		mg/L	1	8/10/2017
Cyanide, Total	SW9012A				Prep Date: 8/17/2017	Analyst: MD
Cyanide	0.0055	0.0050		mg/L	1	8/17/2017
pH	E150.1				Prep Date: 8/9/2017	Analyst: RW
pH	7.3		HT*	pH units	1	8/9/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-6

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 10:30:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-002

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
----------	--------	----	-----------	-------	----	---------------

Volatile Organic Compounds by GC/MS**SW8260B (SW5030B)**

Prep Date:

Analyst: ART

Acetone	ND	0.020	H	mg/L	1	8/22/2017
Benzene	ND	0.0050	H	mg/L	1	8/22/2017
Bromodichloromethane	ND	0.0050	H	mg/L	1	8/22/2017
Bromoform	ND	0.0050	H	mg/L	1	8/22/2017
Bromomethane	ND	0.010	H	mg/L	1	8/22/2017
2-Butanone	ND	0.020	H	mg/L	1	8/22/2017
Carbon disulfide	ND	0.010	H	mg/L	1	8/22/2017
Carbon tetrachloride	ND	0.0050	H	mg/L	1	8/22/2017
Chlorobenzene	ND	0.0050	H	mg/L	1	8/22/2017
Chloroethane	ND	0.010	H	mg/L	1	8/22/2017
Chloroform	ND	0.0050	H	mg/L	1	8/22/2017
Chloromethane	ND	0.010	H	mg/L	1	8/22/2017
Dibromochloromethane	ND	0.0050	H	mg/L	1	8/22/2017
1,1-Dichloroethane	ND	0.0050	H	mg/L	1	8/22/2017
1,2-Dichloroethane	ND	0.0050	H	mg/L	1	8/22/2017
1,1-Dichloroethene	ND	0.0050	H	mg/L	1	8/22/2017
cis-1,2-Dichloroethene	ND	0.0050	H	mg/L	1	8/22/2017
trans-1,2-Dichloroethene	ND	0.0050	H	mg/L	1	8/22/2017
1,2-Dichloropropane	ND	0.0050	H	mg/L	1	8/22/2017
cis-1,3-Dichloropropene	ND	0.0010	H	mg/L	1	8/22/2017
trans-1,3-Dichloropropene	ND	0.0010	H	mg/L	1	8/22/2017
Ethylbenzene	ND	0.0050	H	mg/L	1	8/22/2017
2-Hexanone	ND	0.020	H	mg/L	1	8/22/2017
4-Methyl-2-pentanone	ND	0.020	H	mg/L	1	8/22/2017
Methylene chloride	0.13	0.0050	H	mg/L	1	8/22/2017
Methyl tert-butyl ether	ND	0.0050	H	mg/L	1	8/22/2017
Styrene	ND	0.0050	H	mg/L	1	8/22/2017
1,1,2,2-Tetrachloroethane	ND	0.0050	H	mg/L	1	8/22/2017
Tetrachloroethene	ND	0.0050	H	mg/L	1	8/22/2017
Toluene	ND	0.0050	H	mg/L	1	8/22/2017
1,1,1-Trichloroethane	ND	0.0050	H	mg/L	1	8/22/2017
1,1,2-Trichloroethane	ND	0.0050	H	mg/L	1	8/22/2017
Trichloroethene	ND	0.0050	H	mg/L	1	8/22/2017
Vinyl chloride	ND	0.0020	H	mg/L	1	8/22/2017
Xylenes, Total	ND	0.015	H	mg/L	1	8/22/2017

Polynuclear Aromatic Hydrocarbons by GC/MS**SW8270C-SIM (SW3510C)**

Prep Date: 8/10/2017

Analyst: TMB

Acenaphthene	ND	0.0010		mg/L	1	8/14/2017
Acenaphthylene	ND	0.0010		mg/L	1	8/14/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-6

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 10:30:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17080321-002

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS	SW8270C-SIM (SW3510C)				Prep Date: 8/10/2017	Analyst: TMB
Anthracene	ND	0.0010		mg/L	1	8/14/2017
Benzo(a)anthracene	ND	0.00010		mg/L	1	8/14/2017
Benzo(a)pyrene	ND	0.00010		mg/L	1	8/14/2017
Benzo(b)fluoranthene	ND	0.00010		mg/L	1	8/14/2017
Benzo(g,h,i)perylene	ND	0.0010		mg/L	1	8/14/2017
Benzo(k)fluoranthene	ND	0.00010		mg/L	1	8/14/2017
Chrysene	ND	0.00010		mg/L	1	8/14/2017
Dibenz(a,h)anthracene	ND	0.00010		mg/L	1	8/14/2017
Fluoranthene	ND	0.0010		mg/L	1	8/14/2017
Fluorene	ND	0.0010		mg/L	1	8/14/2017
Indeno(1,2,3-cd)pyrene	ND	0.00010		mg/L	1	8/14/2017
Naphthalene	ND	0.0010		mg/L	1	8/14/2017
Phenanthrene	ND	0.0010		mg/L	1	8/14/2017
Pyrene	ND	0.0010		mg/L	1	8/14/2017
Metals by ICP/MS	SW6020 (SW3005A)				Prep Date: 8/18/2017	Analyst: JG
Antimony	ND	0.0060		mg/L	2	8/19/2017
Arsenic	ND	0.0040		mg/L	2	8/19/2017
Beryllium	ND	0.0020		mg/L	2	8/19/2017
Cadmium	ND	0.0020		mg/L	2	8/19/2017
Chromium	ND	0.0040		mg/L	2	8/19/2017
Copper	ND	0.010		mg/L	2	8/19/2017
Lead	ND	0.0020		mg/L	2	8/19/2017
Nickel	ND	0.0040		mg/L	2	8/19/2017
Selenium	ND	0.0040		mg/L	2	8/19/2017
Silver	ND	0.0040		mg/L	2	8/19/2017
Thallium	ND	0.0020		mg/L	2	8/19/2017
Zinc	0.037	0.020		mg/L	2	8/19/2017
Mercury	SW7470A				Prep Date: 8/9/2017	Analyst: LB
Mercury	ND	0.00020		mg/L	1	8/10/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-2A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 7:50:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-003

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/11/2017		Analyst: DM	
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/15/2017
Acenaphthylene	ND	0.035		mg/Kg-dry	1	8/15/2017
Anthracene	0.045	0.035		mg/Kg-dry	1	8/15/2017
Benzo(a)anthracene	0.16	0.035		mg/Kg-dry	1	8/15/2017
Benzo(a)pyrene	0.16	0.035		mg/Kg-dry	1	8/15/2017
Benzo(b)fluoranthene	0.15	0.035		mg/Kg-dry	1	8/15/2017
Benzo(g,h,i)perylene	0.13	0.035		mg/Kg-dry	1	8/15/2017
Benzo(k)fluoranthene	0.14	0.035		mg/Kg-dry	1	8/15/2017
Chrysene	0.19	0.035		mg/Kg-dry	1	8/15/2017
Dibenz(a,h)anthracene	0.064	0.035		mg/Kg-dry	1	8/15/2017
Fluoranthene	0.26	0.035		mg/Kg-dry	1	8/15/2017
Fluorene	ND	0.035		mg/Kg-dry	1	8/15/2017
Indeno(1,2,3-cd)pyrene	0.11	0.035		mg/Kg-dry	1	8/15/2017
Naphthalene	ND	0.035		mg/Kg-dry	1	8/15/2017
Phenanthrene	0.16	0.035		mg/Kg-dry	1	8/15/2017
Pyrene	0.22	0.035		mg/Kg-dry	1	8/15/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/15/2017		Analyst: JG	
Antimony	ND	1.9		mg/Kg-dry	10	8/16/2017
Arsenic	12	0.96		mg/Kg-dry	10	8/16/2017
Beryllium	0.60	0.48		mg/Kg-dry	10	8/16/2017
Cadmium	0.76	0.48		mg/Kg-dry	10	8/16/2017
Chromium	18	0.96		mg/Kg-dry	10	8/16/2017
Copper	58	2.4		mg/Kg-dry	10	8/16/2017
Lead	85	0.48		mg/Kg-dry	10	8/16/2017
Nickel	29	0.96		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.96		mg/Kg-dry	10	8/16/2017
Silver	ND	0.96		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.96		mg/Kg-dry	10	8/16/2017
Zinc	180	4.8		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A		Prep Date: 8/15/2017		Analyst: LB	
Mercury	0.061	0.019		mg/Kg-dry	1	8/15/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/15/2017		Analyst: PBG	
pH	7.92			pH Units	1	8/15/2017
Percent Moisture						
	D2974		Prep Date: 8/14/2017		Analyst: KKA	
Percent Moisture	5.9	0.2	*	wt%	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-1A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 9:30:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-005

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/11/2017		Analyst: DM	
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Acenaphthylene	ND	0.034		mg/Kg-dry	1	8/15/2017
Anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benz(a)anthracene	0.084	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)pyrene	0.074	0.034		mg/Kg-dry	1	8/15/2017
Benzo(b)fluoranthene	0.070	0.034		mg/Kg-dry	1	8/15/2017
Benzo(g,h,i)perylene	0.071	0.034		mg/Kg-dry	1	8/15/2017
Benzo(k)fluoranthene	0.066	0.034		mg/Kg-dry	1	8/15/2017
Chrysene	0.11	0.034		mg/Kg-dry	1	8/15/2017
Dibenz(a,h)anthracene	0.035	0.034		mg/Kg-dry	1	8/15/2017
Fluoranthene	0.13	0.034		mg/Kg-dry	1	8/15/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/15/2017
Indeno(1,2,3-cd)pyrene	0.057	0.034		mg/Kg-dry	1	8/15/2017
Naphthalene	ND	0.034		mg/Kg-dry	1	8/15/2017
Phenanthrene	0.13	0.034		mg/Kg-dry	1	8/15/2017
Pyrene	0.13	0.034		mg/Kg-dry	1	8/15/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/15/2017		Analyst: JG	
Antimony	ND	1.8		mg/Kg-dry	10	8/16/2017
Arsenic	8.6	0.92		mg/Kg-dry	10	8/16/2017
Beryllium	0.53	0.46		mg/Kg-dry	10	8/16/2017
Cadmium	0.48	0.46		mg/Kg-dry	10	8/16/2017
Chromium	16	0.92		mg/Kg-dry	10	8/16/2017
Copper	39	2.3		mg/Kg-dry	10	8/16/2017
Lead	51	0.46		mg/Kg-dry	10	8/16/2017
Nickel	24	0.92		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.92		mg/Kg-dry	10	8/16/2017
Silver	ND	0.92		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.92		mg/Kg-dry	10	8/16/2017
Zinc	110	4.6		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A		Prep Date: 8/15/2017		Analyst: LB	
Mercury	0.043	0.019		mg/Kg-dry	1	8/15/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/15/2017		Analyst: PBG	
pH	8.05			pH Units	1	8/15/2017
Percent Moisture						
	D2974		Prep Date: 8/14/2017		Analyst: KKA	
Percent Moisture	4.4	0.2	*	wt%	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: ESB-1C

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 9:55:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-007

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS	SW8270C (SW3550B)				Prep Date: 8/11/2017	Analyst: DM
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Acenaphthylene	ND	0.034		mg/Kg-dry	1	8/15/2017
Anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)pyrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(b)fluoranthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(g,h,i)perylene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(k)fluoranthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Chrysene	ND	0.034		mg/Kg-dry	1	8/15/2017
Dibenz(a,h)anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Fluoranthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/15/2017
Indeno(1,2,3-cd)pyrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Naphthalene	ND	0.034		mg/Kg-dry	1	8/15/2017
Phenanthrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Pyrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Percent Moisture	D2974				Prep Date: 8/14/2017	Analyst: KKA
Percent Moisture	4.0	0.2	*	wt%	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-1A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 10:45:00 AM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-008

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS						
	SW8270C (SW3550B)		Prep Date: 8/11/2017		Analyst: DM	
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Acenaphthylene	ND	0.034		mg/Kg-dry	1	8/15/2017
Anthracene	0.085	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)anthracene	0.21	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)pyrene	0.20	0.034		mg/Kg-dry	1	8/15/2017
Benzo(b)fluoranthene	0.18	0.034		mg/Kg-dry	1	8/15/2017
Benzo(g,h,i)perylene	0.19	0.034		mg/Kg-dry	1	8/15/2017
Benzo(k)fluoranthene	0.16	0.034		mg/Kg-dry	1	8/15/2017
Chrysene	0.27	0.034		mg/Kg-dry	1	8/15/2017
Dibenz(a,h)anthracene	0.076	0.034		mg/Kg-dry	1	8/15/2017
Fluoranthene	0.34	0.034		mg/Kg-dry	1	8/15/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/15/2017
Indeno(1,2,3-cd)pyrene	0.14	0.034		mg/Kg-dry	1	8/15/2017
Naphthalene	0.051	0.034		mg/Kg-dry	1	8/15/2017
Phenanthrene	0.37	0.034		mg/Kg-dry	1	8/15/2017
Pyrene	0.34	0.034		mg/Kg-dry	1	8/15/2017
Metals by ICP/MS						
	SW6020 (SW3050B)		Prep Date: 8/15/2017		Analyst: JG	
Antimony	ND	1.8		mg/Kg-dry	10	8/16/2017
Arsenic	6.2	0.91		mg/Kg-dry	10	8/16/2017
Beryllium	ND	0.45		mg/Kg-dry	10	8/16/2017
Cadmium	0.47	0.45		mg/Kg-dry	10	8/16/2017
Chromium	16	0.91		mg/Kg-dry	10	8/16/2017
Copper	27	2.3		mg/Kg-dry	10	8/16/2017
Lead	75	0.45		mg/Kg-dry	10	8/16/2017
Nickel	10	0.91		mg/Kg-dry	10	8/16/2017
Selenium	ND	0.91		mg/Kg-dry	10	8/16/2017
Silver	ND	0.91		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.91		mg/Kg-dry	10	8/16/2017
Zinc	93	4.5		mg/Kg-dry	10	8/16/2017
Mercury						
	SW7471A		Prep Date: 8/15/2017		Analyst: LB	
Mercury	0.073	0.020		mg/Kg-dry	1	8/15/2017
pH (25 °C)						
	SW9045C		Prep Date: 8/15/2017		Analyst: PBG	
pH	8.07			pH Units	1	8/15/2017
Percent Moisture						
	D2974		Prep Date: 8/14/2017		Analyst: KKA	
Percent Moisture	3.0	0.2	*	wt%	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-18A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 12:25:00 PM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/10/2017		Analyst: ART	
Acetone	ND	0.11		mg/Kg-dry	1	8/17/2017
Benzene	ND	0.0071		mg/Kg-dry	1	8/17/2017
Bromodichloromethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
Bromoform	ND	0.0071		mg/Kg-dry	1	8/17/2017
Bromomethane	ND	0.014		mg/Kg-dry	1	8/17/2017
2-Butanone	ND	0.11		mg/Kg-dry	1	8/17/2017
Carbon disulfide	ND	0.071		mg/Kg-dry	1	8/17/2017
Carbon tetrachloride	ND	0.0071		mg/Kg-dry	1	8/17/2017
Chlorobenzene	ND	0.0071		mg/Kg-dry	1	8/17/2017
Chloroethane	ND	0.014		mg/Kg-dry	1	8/17/2017
Chloroform	ND	0.0071		mg/Kg-dry	1	8/17/2017
Chloromethane	ND	0.014		mg/Kg-dry	1	8/17/2017
Dibromochloromethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,1-Dichloroethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,2-Dichloroethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,1-Dichloroethene	ND	0.0071		mg/Kg-dry	1	8/17/2017
cis-1,2-Dichloroethene	ND	0.0071		mg/Kg-dry	1	8/17/2017
trans-1,2-Dichloroethene	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,2-Dichloropropane	ND	0.0071		mg/Kg-dry	1	8/17/2017
cis-1,3-Dichloropropene	ND	0.0029		mg/Kg-dry	1	8/17/2017
trans-1,3-Dichloropropene	ND	0.0029		mg/Kg-dry	1	8/17/2017
Ethylbenzene	ND	0.0071		mg/Kg-dry	1	8/17/2017
2-Hexanone	ND	0.029		mg/Kg-dry	1	8/17/2017
4-Methyl-2-pentanone	ND	0.029		mg/Kg-dry	1	8/17/2017
Methylene chloride	ND	0.014		mg/Kg-dry	1	8/17/2017
Methyl tert-butyl ether	ND	0.0071		mg/Kg-dry	1	8/17/2017
Styrene	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,1,2,2-Tetrachloroethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
Tetrachloroethene	ND	0.0071		mg/Kg-dry	1	8/17/2017
Toluene	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,1,1-Trichloroethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
1,1,2-Trichloroethane	ND	0.0071		mg/Kg-dry	1	8/17/2017
Trichloroethene	ND	0.0071		mg/Kg-dry	1	8/17/2017
Vinyl chloride	ND	0.0071		mg/Kg-dry	1	8/17/2017
Xylenes, Total	ND	0.021		mg/Kg-dry	1	8/17/2017
Volatile Organic Compounds by GC/MS	SW5035/8260B		Prep Date: 8/10/2017		Analyst: ART	
Trichlorofluoromethane	ND	0.0071		mg/Kg-dry	1	8/17/2017

Qualifiers:	ND - Not Detected at the Reporting Limit	RL - Reporting / Quantitation Limit for the analysis
	J - Analyte detected below quantitation limits	S - Spike Recovery outside accepted recovery limits
	B - Analyte detected in the associated Method Blank	R - RPD outside accepted recovery limits
	HT - Sample received past holding time	E - Value above quantitation range
	* - Non-accredited parameter	H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-18A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 12:25:00 PM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/11/2017		Analyst: DM	
Acenaphthene	ND	0.035		mg/Kg-dry	1	8/15/2017
Acenaphthylene	ND	0.035		mg/Kg-dry	1	8/15/2017
Aniline	ND	0.35		mg/Kg-dry	1	8/15/2017
Anthracene	0.061	0.035		mg/Kg-dry	1	8/15/2017
Benz(a)anthracene	0.16	0.035		mg/Kg-dry	1	8/15/2017
Benzdine	ND	0.35		mg/Kg-dry	1	8/15/2017
Benzo(a)pyrene	0.11	0.035		mg/Kg-dry	1	8/15/2017
Benzo(b)fluoranthene	0.14	0.035		mg/Kg-dry	1	8/15/2017
Benzo(g,h,i)perylene	0.13	0.035		mg/Kg-dry	1	8/15/2017
Benzo(k)fluoranthene	0.095	0.035		mg/Kg-dry	1	8/15/2017
Benzoic acid	ND	0.87		mg/Kg-dry	1	8/15/2017
Benzyl alcohol	ND	0.18		mg/Kg-dry	1	8/15/2017
Bis(2-chloroethoxy)methane	ND	0.18		mg/Kg-dry	1	8/15/2017
Bis(2-chloroethyl)ether	ND	0.18		mg/Kg-dry	1	8/15/2017
Bis(2-ethylhexyl)phthalate	ND	0.87		mg/Kg-dry	1	8/15/2017
4-Bromophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/15/2017
Butyl benzyl phthalate	ND	0.18		mg/Kg-dry	1	8/15/2017
Carbazole	ND	0.18		mg/Kg-dry	1	8/15/2017
4-Chloroaniline	ND	0.18		mg/Kg-dry	1	8/15/2017
4-Chloro-3-methylphenol	ND	0.35		mg/Kg-dry	1	8/15/2017
2-Chloronaphthalene	ND	0.18		mg/Kg-dry	1	8/15/2017
2-Chlorophenol	ND	0.18		mg/Kg-dry	1	8/15/2017
4-Chlorophenyl phenyl ether	ND	0.18		mg/Kg-dry	1	8/15/2017
Chrysene	0.25	0.035		mg/Kg-dry	1	8/15/2017
Dibenz(a,h)anthracene	0.064	0.035		mg/Kg-dry	1	8/15/2017
Dibenzofuran	ND	0.18		mg/Kg-dry	1	8/15/2017
1,2-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/15/2017
1,3-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/15/2017
1,4-Dichlorobenzene	ND	0.18		mg/Kg-dry	1	8/15/2017
3,3'-Dichlorobenzidine	ND	0.18		mg/Kg-dry	1	8/15/2017
2,4-Dichlorophenol	ND	0.18		mg/Kg-dry	1	8/15/2017
Diethyl phthalate	ND	0.18		mg/Kg-dry	1	8/15/2017
2,4-Dimethylphenol	ND	0.18		mg/Kg-dry	1	8/15/2017
Dimethyl phthalate	ND	0.18		mg/Kg-dry	1	8/15/2017
4,6-Dinitro-2-methylphenol	ND	0.35		mg/Kg-dry	1	8/15/2017
2,4-Dinitrophenol	ND	0.87		mg/Kg-dry	1	8/15/2017
2,4-Dinitrotoluene	ND	0.035		mg/Kg-dry	1	8/15/2017
2,6-Dinitrotoluene	ND	0.035		mg/Kg-dry	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-18A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 12:25:00 PM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
----------	--------	----	-----------	-------	----	---------------

Semivolatile Organic Compounds by GC/MS	SW8270C (SW3550B)		Prep Date: 8/11/2017	Analyst: DM		
---	-------------------	--	----------------------	-------------	--	--

Di-n-butyl phthalate	ND	0.18		mg/Kg-dry	1	8/15/2017
Di-n-octyl phthalate	ND	0.18		mg/Kg-dry	1	8/15/2017
Fluoranthene	0.26	0.035		mg/Kg-dry	1	8/15/2017
Fluorene	ND	0.035		mg/Kg-dry	1	8/15/2017
Hexachlorobenzene	ND	0.18		mg/Kg-dry	1	8/15/2017
Hexachlorobutadiene	ND	0.18		mg/Kg-dry	1	8/15/2017
Hexachlorocyclopentadiene	ND	0.18		mg/Kg-dry	1	8/15/2017
Hexachloroethane	ND	0.18		mg/Kg-dry	1	8/15/2017
Indeno(1,2,3-cd)pyrene	0.092	0.035		mg/Kg-dry	1	8/15/2017
Isophorone	ND	0.18		mg/Kg-dry	1	8/15/2017
2-Methylnaphthalene	0.18	0.18		mg/Kg-dry	1	8/15/2017
2-Methylphenol	ND	0.18		mg/Kg-dry	1	8/15/2017
4-Methylphenol	ND	0.18		mg/Kg-dry	1	8/15/2017
Naphthalene	0.10	0.035		mg/Kg-dry	1	8/15/2017
2-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/15/2017
3-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/15/2017
4-Nitroaniline	ND	0.18		mg/Kg-dry	1	8/15/2017
2-Nitrophenol	ND	0.18		mg/Kg-dry	1	8/15/2017
4-Nitrophenol	ND	0.35		mg/Kg-dry	1	8/15/2017
Nitrobenzene	ND	0.035		mg/Kg-dry	1	8/15/2017
N-Nitrosodi-n-propylamine	ND	0.035		mg/Kg-dry	1	8/15/2017
N-Nitrosodimethylamine	ND	0.18		mg/Kg-dry	1	8/15/2017
N-Nitrosodiphenylamine	ND	0.035		mg/Kg-dry	1	8/15/2017
2, 2'-oxybis(1-Chloropropane)	ND	0.18		mg/Kg-dry	1	8/15/2017
Pentachlorophenol	ND	0.035		mg/Kg-dry	1	8/15/2017
Phenanthrene	0.48	0.035		mg/Kg-dry	1	8/15/2017
Phenol	ND	0.18		mg/Kg-dry	1	8/15/2017
Pyrene	0.25	0.035		mg/Kg-dry	1	8/15/2017
Pyridine	ND	0.70		mg/Kg-dry	1	8/15/2017
1,2,4-Trichlorobenzene	ND	0.18		mg/Kg-dry	1	8/15/2017
2,4,5-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/15/2017
2,4,6-Trichlorophenol	ND	0.18		mg/Kg-dry	1	8/15/2017

PCBs	SW8082 (SW3550B)		Prep Date: 8/11/2017	Analyst: GVC		
------	------------------	--	----------------------	--------------	--	--

Aroclor 1016	ND	0.084		mg/Kg-dry	1	8/12/2017
Aroclor 1221	ND	0.084		mg/Kg-dry	1	8/12/2017
Aroclor 1232	ND	0.084		mg/Kg-dry	1	8/12/2017
Aroclor 1242	ND	0.084		mg/Kg-dry	1	8/12/2017
Aroclor 1248	ND	0.084		mg/Kg-dry	1	8/12/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-18A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 12:25:00 PM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
PCBs	SW8082 (SW3550B)		Prep Date: 8/11/2017		Analyst: GVC	
Aroclor 1254	ND	0.084		mg/Kg-dry	1	8/12/2017
Aroclor 1260	ND	0.084		mg/Kg-dry	1	8/12/2017
Pesticides	SW8081 (SW3550B)		Prep Date: 8/11/2017		Analyst: GVC	
4,4'-DDD	ND	0.0017		mg/Kg-dry	1	8/12/2017
4,4'-DDE	ND	0.0017		mg/Kg-dry	1	8/12/2017
4,4'-DDT	ND	0.0017		mg/Kg-dry	1	8/12/2017
Aldrin	ND	0.0017		mg/Kg-dry	1	8/12/2017
alpha-BHC	ND	0.0017		mg/Kg-dry	1	8/12/2017
alpha-Chlordane	ND	0.0017		mg/Kg-dry	1	8/12/2017
beta-BHC	ND	0.0017		mg/Kg-dry	1	8/12/2017
Chlordane	ND	0.017		mg/Kg-dry	1	8/12/2017
delta-BHC	ND	0.0017		mg/Kg-dry	1	8/12/2017
Dieldrin	ND	0.0017		mg/Kg-dry	1	8/12/2017
Endosulfan I	ND	0.0017		mg/Kg-dry	1	8/12/2017
Endosulfan II	ND	0.0017		mg/Kg-dry	1	8/12/2017
Endosulfan sulfate	ND	0.0017		mg/Kg-dry	1	8/12/2017
Endrin	ND	0.0017		mg/Kg-dry	1	8/12/2017
Endrin aldehyde	ND	0.0017		mg/Kg-dry	1	8/12/2017
Endrin ketone	ND	0.0017		mg/Kg-dry	1	8/12/2017
gamma-BHC	ND	0.0017		mg/Kg-dry	1	8/12/2017
gamma-Chlordane	ND	0.0017		mg/Kg-dry	1	8/12/2017
Heptachlor	ND	0.0017		mg/Kg-dry	1	8/12/2017
Heptachlor epoxide	ND	0.0017		mg/Kg-dry	1	8/12/2017
Methoxychlor	ND	0.0017		mg/Kg-dry	1	8/12/2017
Toxaphene	ND	0.035		mg/Kg-dry	1	8/12/2017
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/15/2017		Analyst: JG	
Aluminum	3500	19		mg/Kg-dry	10	8/16/2017
Antimony	3.0	1.9		mg/Kg-dry	10	8/16/2017
Arsenic	20	0.94		mg/Kg-dry	10	8/16/2017
Barium	99	0.94		mg/Kg-dry	10	8/16/2017
Beryllium	0.70	0.47		mg/Kg-dry	10	8/16/2017
Cadmium	3.1	0.47		mg/Kg-dry	10	8/16/2017
Calcium	19000	56		mg/Kg-dry	10	8/16/2017
Chromium	61	0.94		mg/Kg-dry	10	8/16/2017
Cobalt	7.7	0.94		mg/Kg-dry	10	8/16/2017
Copper	210	2.4		mg/Kg-dry	10	8/16/2017
Iron	64000	28		mg/Kg-dry	10	8/16/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-18A

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 12:25:00 PM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-011

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Metals by ICP/MS	SW6020 (SW3050B)		Prep Date: 8/15/2017		Analyst: JG	
Lead	280	0.47		mg/Kg-dry	10	8/16/2017
Magnesium	9000	28		mg/Kg-dry	10	8/16/2017
Manganese	750	0.94		mg/Kg-dry	10	8/16/2017
Nickel	41	0.94		mg/Kg-dry	10	8/16/2017
Potassium	360	28		mg/Kg-dry	10	8/16/2017
Selenium	0.97	0.94		mg/Kg-dry	10	8/16/2017
Silver	ND	0.94		mg/Kg-dry	10	8/16/2017
Sodium	180	56		mg/Kg-dry	10	8/16/2017
Thallium	ND	0.94		mg/Kg-dry	10	8/16/2017
Vanadium	19	0.94		mg/Kg-dry	10	8/16/2017
Zinc	500	4.7		mg/Kg-dry	10	8/16/2017
SPLP Metals by ICP/MS	SW1312/6020A (SW3005A)		Prep Date: 11/24/2017		Analyst: JG	
Chromium	0.0060	0.0040		mg/L	2	11/24/2017
Iron	2.8	0.10		mg/L	2	11/24/2017
Manganese	0.038	0.0040		mg/L	2	11/24/2017
Mercury	SW7471A		Prep Date: 8/15/2017		Analyst: LB	
Mercury	0.25	0.020		mg/Kg-dry	1	8/15/2017
Cyanide, Total	SW9012A		Prep Date: 8/15/2017		Analyst: RLB	
Cyanide	0.27	0.26		mg/Kg-dry	1	8/16/2017
pH (25 °C)	SW9045C		Prep Date: 8/15/2017		Analyst: PBG	
pH	7.65			pH Units	1	8/15/2017
Percent Moisture	D2974		Prep Date: 8/14/2017		Analyst: KKA	
Percent Moisture	4.8	0.2	*	wt%	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: December 08, 2017

ANALYTICAL RESULTS

Date Printed: December 08, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: B-18B

Work Order: 17080321 Revision 3

Collection Date: 8/9/2017 12:30:00 PM

Project: 3205-17-1606, City of Chicago JPSTA, Chicago, IL

Matrix: Soil

Lab ID: 17080321-012

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Polynuclear Aromatic Hydrocarbons by GC/MS	SW8270C (SW3550B)				Prep Date: 8/11/2017	Analyst: DM
Acenaphthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Acenaphthylene	ND	0.034		mg/Kg-dry	1	8/15/2017
Anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(a)pyrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(b)fluoranthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(g,h,i)perylene	ND	0.034		mg/Kg-dry	1	8/15/2017
Benzo(k)fluoranthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Chrysene	ND	0.034		mg/Kg-dry	1	8/15/2017
Dibenz(a,h)anthracene	ND	0.034		mg/Kg-dry	1	8/15/2017
Fluoranthene	ND	0.034		mg/Kg-dry	1	8/15/2017
Fluorene	ND	0.034		mg/Kg-dry	1	8/15/2017
Indeno(1,2,3-cd)pyrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Naphthalene	ND	0.034		mg/Kg-dry	1	8/15/2017
Phenanthrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Pyrene	ND	0.034		mg/Kg-dry	1	8/15/2017
Percent Moisture	D2974				Prep Date: 8/14/2017	Analyst: KKA
Percent Moisture	3.7	0.2	*	wt%	1	8/15/2017

Qualifiers:
 ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

Sample Receipt Checklist

Client Name AMEC

Date and Time Received: 8/9/2017 3:50:00 PM

Work Order Number 17080321

Received by: JNW

Checklist completed by:

[Signature] 8/9/17
Signature Date

Reviewed by:

MK 8/9/17
Initials Date

Matrix:

Carrier name Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature 4.4 °C
- Water - VOA vials have zero headspace? No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: J.W.
- Water - Samples properly preserved? Yes No pH Adjusted? No

Any No response must be detailed in the comments section below.

Comments: Sample ESB-5 was received past hold time for pH of water analysis.
Additional analysis per Mary Jank verbal 8/22/17.

Client / Person contacted: _____ Date contacted: _____ Contacted by: _____

Response: _____

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Monday, November 20, 2017 3:47 PM
To: Craig Chawla; Frank Capoccia
Subject: Additional Testing -

Please perform additional leaching procedure testing (TCLP or SPLP) for the following metals on the identified samples:

B-18A – chromium and manganese your sample # 17080321-011

B-6B – chromium your sample #17080265-014

ESB-2A – cobalt, iron – your sample #17080088-001

ESB-4A – iron your sample #17080223-001

ESB-5A – iron your sample #17080126-001

ESB-6A – iron, manganese your sample #17080177-001

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

Craig Chawla

From: Jank, Mary E [mary.jank@woodplc.com]
Sent: Thursday, December 07, 2017 6:48 PM
To: Craig Chawla; Frank Capoccia
Subject: More TCLP/SPLP for JPSTA

Please run TCLP/SPLP for the following samples for the listed metals:

B-18A – Iron your sample #17080321-011 – chromium and manganese were already done
ESB-3A – Iron - your sample #17080088-004

Thank you

Mary E. Jank
Senior Associate
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, IL

D 773-693-6030, ext. 8742
M 312-617-8342
mary.jank@amecfw.com
amecfw.com

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

September 01, 2017

AMEC Foster Wheeler Environment & Infrastructure
550 Warrenville Road
Lisle, IL 60532

Telephone: (630) 724-8517

Fax: (630) 724-8518

Analytical Report for STAT Work Order: 17081066 Revision 0

RE: 3205-17-1606, Chicago JPSTA, Chicago, IL

Dear Mary Jank:

STAT Analysis received 2 samples for the referenced project on 8/29/2017 7:25:00 PM. The analytical results are presented in the following report.

All analyses were performed in accordance with the requirements of 35 IAC Part 186 / NELAC standards. Analyses were performed in accordance with methods as referenced on the analytical report. Those analytical results expressed on a dry weight basis are also noted on the analytical report.

All analyses were performed within established holding time criteria, and all Quality Control criteria met EPA or laboratory specifications except when noted in the Case Narrative or Analytical Report. If required, an estimate of uncertainty for the analyses can be provided. A listing of accredited methods/parameters can also be provided.

Thank you for the opportunity to serve you and I look forward to working with you in the future. If you have any questions regarding the enclosed materials, please contact me at (312) 733-0551.

Sincerely,



Justice Kwateng
Project Manager

The information contained in this report and any attachments is confidential information intended only for the use of the individual or entities named above. The results of this report relate only to the samples tested. If you have received this report in error, please notify us immediately by phone. This report shall not be reproduced, except in its entirety, unless written approval has been obtained from the laboratory. This analytical report shall become property of the Customer upon payment in full. Otherwise, STAT will be under no obligation to support, defend or discuss the analytical report.

Client: AMEC Foster Wheeler Environment & Infrastructure**Project:** 3205-17-1606, Chicago JPSTA, Chicago, IL**Work Order:** 17081066 Revision 0**Work Order Sample Summary**

Lab Sample ID	Client Sample ID	Tag Number	Collection Date	Date Received
17081066-001A	Well I		8/29/2017 11:50:00 AM	8/29/2017
17081066-002A	Well C		8/29/2017 2:45:00 PM	8/29/2017

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: September 01, 2017

ANALYTICAL RESULTS

Date Printed: September 01, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: Well I

Work Order: 17081066 Revision 0

Collection Date: 8/29/2017 11:50:00 AM

Project: 3205-17-1606, Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17081066-001

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW8260B (SW5030B)		Prep Date:	Analyst: RRS		
Acetone	ND	0.020		mg/L	1	8/31/2017
Benzene	ND	0.0050		mg/L	1	8/31/2017
Bromodichloromethane	ND	0.0050		mg/L	1	8/31/2017
Bromoform	ND	0.0050		mg/L	1	8/31/2017
Bromomethane	ND	0.010		mg/L	1	8/31/2017
2-Butanone	ND	0.020		mg/L	1	8/31/2017
Carbon disulfide	ND	0.010		mg/L	1	8/31/2017
Carbon tetrachloride	ND	0.0050		mg/L	1	8/31/2017
Chlorobenzene	ND	0.0050		mg/L	1	8/31/2017
Chloroethane	ND	0.010		mg/L	1	8/31/2017
Chloroform	ND	0.0050		mg/L	1	8/31/2017
Chloromethane	ND	0.010		mg/L	1	8/31/2017
Dibromochloromethane	ND	0.0050		mg/L	1	8/31/2017
1,1-Dichloroethane	ND	0.0050		mg/L	1	8/31/2017
1,2-Dichloroethane	ND	0.0050		mg/L	1	8/31/2017
1,1-Dichloroethene	ND	0.0050		mg/L	1	8/31/2017
cis-1,2-Dichloroethene	ND	0.0050		mg/L	1	8/31/2017
trans-1,2-Dichloroethene	ND	0.0050		mg/L	1	8/31/2017
1,2-Dichloropropane	ND	0.0050		mg/L	1	8/31/2017
cis-1,3-Dichloropropene	ND	0.0010		mg/L	1	8/31/2017
trans-1,3-Dichloropropene	ND	0.0010		mg/L	1	8/31/2017
Ethylbenzene	ND	0.0050		mg/L	1	8/31/2017
2-Hexanone	ND	0.020		mg/L	1	8/31/2017
4-Methyl-2-pentanone	ND	0.020		mg/L	1	8/31/2017
Methylene chloride	ND	0.0050		mg/L	1	8/31/2017
Methyl tert-butyl ether	ND	0.0050		mg/L	1	8/31/2017
Naphthalene	ND	0.015		mg/L	1	8/31/2017
Styrene	ND	0.0050		mg/L	1	8/31/2017
1,1,2,2-Tetrachloroethane	ND	0.0050		mg/L	1	8/31/2017
Tetrachloroethene	ND	0.0050		mg/L	1	8/31/2017
Toluene	ND	0.0050		mg/L	1	8/31/2017
1,1,1-Trichloroethane	ND	0.0050		mg/L	1	8/31/2017
1,1,2-Trichloroethane	ND	0.0050		mg/L	1	8/31/2017
Trichloroethene	ND	0.0050		mg/L	1	8/31/2017
Vinyl chloride	ND	0.0020		mg/L	1	8/31/2017
Xylenes, Total	ND	0.015		mg/L	1	8/31/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

STAT Analysis Corporation

2242 West Harrison St., Suite 200, Chicago, IL 60612-3766

Tel: (312) 733-0551 Fax: (312) 733-2386 STATinfo@STATAnalysis.com

Accreditations: IEPA ELAP 100445; ORELAP IL300001; AIHA-LAP, LLC 101160; NVLAP LabCode 101202-0

Date Reported: September 01, 2017

ANALYTICAL RESULTS

Date Printed: September 01, 2017

Client: AMEC Foster Wheeler Environment & Infr

Client Sample ID: Well C

Work Order: 17081066 Revision 0

Collection Date: 8/29/2017 2:45:00 PM

Project: 3205-17-1606, Chicago JPSTA, Chicago, IL

Matrix: Aqueous

Lab ID: 17081066-002

Analyses	Result	RL	Qualifier	Units	DF	Date Analyzed
Volatile Organic Compounds by GC/MS	SW8260B (SW5030B)		Prep Date:	Analyst: RRS		
Acetone	ND	0.020		mg/L	1	8/31/2017
Benzene	ND	0.0050		mg/L	1	8/31/2017
Bromodichloromethane	ND	0.0050		mg/L	1	8/31/2017
Bromoform	ND	0.0050		mg/L	1	8/31/2017
Bromomethane	ND	0.010		mg/L	1	8/31/2017
2-Butanone	ND	0.020		mg/L	1	8/31/2017
Carbon disulfide	ND	0.010		mg/L	1	8/31/2017
Carbon tetrachloride	ND	0.0050		mg/L	1	8/31/2017
Chlorobenzene	ND	0.0050		mg/L	1	8/31/2017
Chloroethane	ND	0.010		mg/L	1	8/31/2017
Chloroform	ND	0.0050		mg/L	1	8/31/2017
Chloromethane	ND	0.010		mg/L	1	8/31/2017
Dibromochloromethane	ND	0.0050		mg/L	1	8/31/2017
1,1-Dichloroethane	ND	0.0050		mg/L	1	8/31/2017
1,2-Dichloroethane	ND	0.0050		mg/L	1	8/31/2017
1,1-Dichloroethene	ND	0.0050		mg/L	1	8/31/2017
cis-1,2-Dichloroethene	ND	0.0050		mg/L	1	8/31/2017
trans-1,2-Dichloroethene	ND	0.0050		mg/L	1	8/31/2017
1,2-Dichloropropane	ND	0.0050		mg/L	1	8/31/2017
cis-1,3-Dichloropropene	ND	0.0010		mg/L	1	8/31/2017
trans-1,3-Dichloropropene	ND	0.0010		mg/L	1	8/31/2017
Ethylbenzene	ND	0.0050		mg/L	1	8/31/2017
2-Hexanone	ND	0.020		mg/L	1	8/31/2017
4-Methyl-2-pentanone	ND	0.020		mg/L	1	8/31/2017
Methylene chloride	ND	0.0050		mg/L	1	8/31/2017
Methyl tert-butyl ether	ND	0.0050		mg/L	1	8/31/2017
Naphthalene	ND	0.015		mg/L	1	8/31/2017
Styrene	ND	0.0050		mg/L	1	8/31/2017
1,1,2,2-Tetrachloroethane	ND	0.0050		mg/L	1	8/31/2017
Tetrachloroethene	ND	0.0050		mg/L	1	8/31/2017
Toluene	ND	0.0050		mg/L	1	8/31/2017
1,1,1-Trichloroethane	ND	0.0050		mg/L	1	8/31/2017
1,1,2-Trichloroethane	ND	0.0050		mg/L	1	8/31/2017
Trichloroethene	ND	0.0050		mg/L	1	8/31/2017
Vinyl chloride	ND	0.0020		mg/L	1	8/31/2017
Xylenes, Total	ND	0.015		mg/L	1	8/31/2017

Qualifiers: ND - Not Detected at the Reporting Limit
 J - Analyte detected below quantitation limits
 B - Analyte detected in the associated Method Blank
 HT - Sample received past holding time
 * - Non-accredited parameter

RL - Reporting / Quantitation Limit for the analysis
 S - Spike Recovery outside accepted recovery limits
 R - RPD outside accepted recovery limits
 E - Value above quantitation range
 H - Holding time exceeded

Sample Receipt Checklist

Client Name AMEC

Date and Time Received: 8/29/2017 7:25:00 PM

Work Order Number 17081066

Received by: MGK

Checklist completed by:

[Signature] 8/29/17
Signature Date

Reviewed by:

JOK 8/30/17
Initials Date

Matrix: Carrier name Client Delivered

- Shipping container/cooler in good condition? Yes No Not Present
- Custody seals intact on shipping container/cooler? Yes No Not Present
- Custody seals intact on sample bottles? Yes No Not Present
- Chain of custody present? Yes No
- Chain of custody signed when relinquished and received? Yes No
- Chain of custody agrees with sample labels/containers? Yes No
- Samples in proper container/bottle? Yes No
- Sample containers intact? Yes No
- Sufficient sample volume for indicated test? Yes No
- All samples received within holding time? Yes No
- Container or Temp Blank temperature in compliance? Yes No Temperature 4.9 °C
- Water - VOA vials have zero headspace? No VOA vials submitted Yes No
- Water - Samples pH checked? Yes No Checked by: _____
- Water - Samples properly preserved? Yes No pH Adjusted? _____

Any No response must be detailed in the comments section below.

Comments: _____

Client / Person contacted: _____ Date contacted: _____ Contacted by: _____

Response: _____



APPENDIX D

Field Logs

7th / 28 / 17

①

900 AEH onsite. Have performed perimeter recon in vehicle. Walk-in entrance to site located along Kilbourn on south end Chicago Avenue on north. Tire tracks/ruts indicate a vehicle access point off Kostner just before CTA bus fenced entrance. Street parking appears legal on Chicago Ave north of site but not on Kilbourn or Kostner adjacent to the site.

MSET being locate folks expected to arrive ~9:00 am.

915 MSET onsite.

930 MSET truck up on to berm onsite via vehicle path off Kostner. Berm slope down to site is steep, will probably try with truck but not until drill rig onsite to help if needed.

950 B-7 (first marked) complete
10' accuracy

(2)

7/28/17 cont

1200 Layout of all borings complete.

Painted stakes & ribbon around.

1220 MSET (Bill W. & helper) depart site

1300 AEH departs



Andre & Harding 7/28/17

8/2/17

(3)

800 AEH exits, meet Geoff Tutty (Driller) on Kilbourn near SW entrance to site (barricaded).

810 AEH & Geoff drive around site to access path entrance near NE corner.

830 Review access point at NE, Ron Groff able to get down and up in Jeep.

840 Ron moves to evaluate parking situation and get drill rig to NE part of site.

845 Bill W. of MSET says Greg to arrive shortly to log borings for Geotech and to bringing well materials. Plan to start with env borings on south end because haven't had their locations revised. However Ron brought 2 1/4" auger today which he can't run with work with wells and wells are planned (to 20') for two Env borings on south.

945 Barrier open, prep work started at ESB-2 & ESB-3. South-center env borings. Barrier pulled in ward to site. Must replace at end of work at site.

(4)

8/2/17 (cont.)

1000 AEH stuck on conc pile (reel),
drill rig must pull free.

1020 Setting up at ESB-2, 1st
borings.

1035 Start ESB-2, 0-2' split screen.

1120 Done at ESB-2, moving to set up at
ESB-3.

1245 Done at ESB-2 on south berm.
Soon decide which borings next, possibly
Geotech.

1310 Setting up at Geotech B-7.
(SW corner of planned building 1)

1355 Continuation B-7, now geotech after
16' (not 8' cont), Ev 2.5' to 2.5',
then vary 5' 2.5-4.0'.
AEH still logging/observing.

1400 Bill Wyzgala (MSET) has been
on site repositioning round borings.
Leaves site, task complete.

Note - Site stinks awful today. Plants?
Weird because no well noted on Friday.
last week.

Note - Groff brought 2' (4" ID) augers today, mean
no 2" well possible unless hole stays open on own
and no Shelby tube possible.

8/2/17 (cont.)

(5)

1445 Done drilling at 40' B-7 hole. Must
pull augers, etc.

1500 Augers pulled, cuttings going down hole.

1525 Set to drill at B-4 (interim building, boring, 30')

1620 Drilling complete at B-4 and for
day. Clearing up cuttings.

1645 Drilling driving around debris
pile to knock down vegetation
for future GPR visit.

1700 AEH & MSET depart site. AEH at
camp on Kilbourn. Groff Loading ATV
on trailer. Barriers to remain open
during work.

1715 AEH & Groff depart site.

Chris V 8/2/17

8/3/17

- 900 AEH and MSET onsite for day 2 of drilling.
- 935 Grotf arrives onsite, well unload off trailer.
- 1000 Grotf unloaded and carefully moving to ESB-5 (target for temp well env). New catoper at south end of site.
- 1020 Setting up at ESB-5.
- 1025 AEH tells dollars that they can leave rig at the site overnight but it is at their risk and city client advises against.
- 1050 Set to drill, hold dds, safety talk, review and signoff on plans, new Grotf help. Review site hazards, contamination, and PPE.
- 1130 Byin buildings will at ESB-5.
- 1300 Well complete, moving to Building 1 geotech boring (out of sand & chips, so can't do more wells).
- 1310 Setting up on B-8. (No sample location)
- 1415 Done drilling at B-8, pulling assessor.
- 1435 Begins to rain.
- 1440 Thunder heard.

8/3/17 (cont.)

27

- 945 Waiting in vehicles on rain/thunder.
- 1500 End day. Thunder & rain continue.
- 1515 All depart site, AEH remains finishing Cox. Heavy rain and thunder. Sam start planned tomorrow.
- 1535 AEH departs site

Amel E. Harts 8/3/17

⑧ 8/4/17 Friday

40
16
26
24
106 Total

8/17/17 Monday

⑨

850 Craig Cabrera on site

Met with:

Tim - Groff

847-450-9701

Greg - Midland Standard Eng
Ford Geotech Supplies

Kevin - Groff (Drillers)

- 1st B5 - Geotech (No sample)
then Env. Boring - well Setup

Discussed scope & safety issues

805 arrived at B5 waiting for
driller to setup

845 Driller start boring

1000 Completed B5 to 40' bgs.

1050 Began setup at ESB6 for
well install

1310 Departed ESB6 to setup for B11

1545 Completed last Boring for day
B-14

1600 Departed Site to STAT for Sample
drop off

720 CTC on site; Met w/ Drivers
+ Greg from Midland

750 1st Location ESB-4 start

8:00 Mike from Work Smart arrived.
Coordinated parking & meetup.

8:30 Mike viewed area & said
he could not scan over the
debris pile. Just the area
around it that was flattened.

840 Midland working w/ driller to
set well @ 16 ft bgs

915 Work Smart called to say they were
done and they marked suspect pipe at
location of survey.

950 Mobilized to B12. Driller
cleared vegetation & began setup

1140 Started 3rd boring - B16

(10)

3-7-17

1210 left Boring B16 @ 14' bgs
to help Andy Survey

1235 Returned to B16 - already
completed & Demobbing

1250 Started B13 - No soil sample to
be collected.

1355 Mobilized B10

1455 Finished B10

Totals	ESB-4	- 16 ft
	B12	- 24 ft
	B16	- 25 ft
	B13	- 26 ft
	B10	- 24
	<hr/>	
	115	

3-8-17

(11)

700 ~~ESB~~ E-WALKWAY ON THE (AMC FW)

TIM & KEVIN (GEO) ON THE

GREG (MSOT) ON THE

WEATHER: CLEAR HIGH TO 82°/5 TODAY

705 MOBILIZE @ B-11

CONDUCT TAILGATE SAFETY MEET-C

750 RECALIBRATE MINIRAE 3000 PFD MONITOR

w/ 100 ppm IS BUTYLENE - LOT # 4616768

S/N 592-920041

EXP DATE = 6/2019

POST CALIBRATION READING = 100.2 ppm (OK)

755-830 BORING B-11 TO 250'

855 MOBILIZE TO BORING B-15

855-940 BORING B-15 TO 250'

GREG INDICATED THAT HE HAD LAISSEZ

B-16 & B-15 DIFFERENTIALLY THAN FIGURE

(SHAPED), WILL TALK HIM TO SLIGHTLY THEM

1010 MOVE TO B-9

1015-1115 BORING B-9 TO 35'

MOVE TO B-6

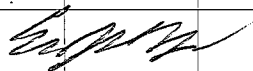
3-8-17

(12)

8-3-17

8/9/17

- 1205-1300 Break B-6 to 30'
- 1400-1500 Break B-3 to 39.5'
- 1515 E. LAUKOMAN catch up in progress
 DISCUSS w/ MSET ON HYDRAULIC CONDUCTIVITY
 ALREADY SAMPLED. GREG INDICATED SAMPLE
 WAS COLLECTED FROM CLAY NATIVE.
 HIGH CENTRIFUGED NATIVE FILL (PERCHED ZONE)
 PREFERRED.
- 1530 E. TW OFFSITE
 GREG & MSET FINISHING FOR DAY
- 1600 DROP OFF SAMPLES @ STAT ANALYSIS.
 COC# 906943
- 1710 DROP OFF TRUCK / FIELD NOTES AT
 NIGGAS OFFICE
- 700 ESW onsite
- 715 AEH onsite
- 720 Driller getting set for drilling at B-2,
 north side of site up on berm.
- 730 AEH meet w/ driller after
 equipment xfer w/ Eric. Eric
 doing low flow sampling at
 ESB-5 (1st for TCh) and
 ESB-6 (2nd for PParticls & PNA).
- 740 Drilling at B-2 proceeds.
 ASEP review in field before
 start.
- 900 Drop at B-2, positioning at
 ESB-1 further up slope and
 into trees a bit from B-2.
- 915 Dr. to tra cam shifting ESB-1
 ~15' south. Still on berm, just not
 in tra line.
- 925 Start drilling ESB-1
- 1015 Done at ESB-1 AEH runs and chambers
 EDC. Almost done with well samples at
 ESB-6.
- 1035 Set to start at ~~ESB~~^{AEH}-B-1.



8/9/17 (cont.)

1100 ESW water sampling complete.
Departs site after refueling
bottles & equipment. Drills at
B-1 entrance.

1240 Drilling & sampling complete. Driller
cleaning up at B-18, last hole.
Still must conduct initial tests, pull
temp wells (2), fill all holes,
and pull barrier back in way
at SW entrance.

1315 Both temp wells (ESB-5 & ESB-6)
successfully pulled. Greg of MSET to
take all materials with Ben to site down
hole. MSET (Greg) conducting infiltration
test, Driller to load rig (or close to it)
and will fill existing holes across site.

1320 AEH has located all but 2 of 11
existing wells shown on survey of site.

1400 Spent ~30 minutes solely trying to find SE
most well, south of nearby well park, with
no success. Giving up.

1402 Measuring well pair:

Well	DTW (ft TOC)	DTB (ft TOC)
Well B (NW pair)	29.15	51.28
Well C (SE pair)	10.03	15.09

Well	DTW (ft)	DTB (ft)
Well D (NE pair)	25.96	44.27
Well A (SW pair)	26.26	44.04

1425 All ready to depart site, must
close barricade preventing vehicle
access.

1430 MSET offsite. AEH on Kilbourn
near entrance. Graft crew trying
to get barrier closed with jeep.

1450 Barricade looks good. Graft driller
in jeep will finish hole filling,
est 30-60 min more. Graft
drill rig on trailer offsite.

1500 AEH departs site for Lds.

Andrews 8/9/17

8/11/17

800 AEH onsite. Plan today is
to load survey wells onsite and
1 mee. DEW/OTB in wells and get
not measured (about half).

826 Jake Nordell: arrive for survey

830 Rain H&S in tailgate.

840 Begin survey.

Survey shots recorded on separate notes.

1230 Lunch and cool down break.

1330 Survey onsite resumes.

1600 Survey complete. Two circular transits
completed, all but 2 points included
in transits that tie back in.

AEH + JN depart site for day.

Archie S. Harts 8/11/17



GROUNDWATER SAMPLING FORM

Job Name CITY OF CHICAGO JPSTA
 Job Number 320517066
 Recorded By E. WALKERMAN
 (signature)

Well No. ESB-5
 Well Type Monitor Extraction Other TEMP
 Well Material PVC St. Steel Other _____
 Date 8-9-17 Time 8:45
 Sampled By EW
 (initials)

WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches) 10" SCREEN TUBING @ MIDPOINT
 2-inch 4-inch 6-inch Other _____
 Total Depth of Casing (TD in feet BTOC) 20.44
 Water Level Depth (WL in feet BTOC) 9.65
 Number of Well volumes to be purged (# Vols) 4.38 STICK W
 3 4 5 10 Other _____

PURGE METHOD

Baller - Type _____
 Submersible Centrifugal Bladder; Pump No. _____
 Other - Type PERSISTENT

PUMP INTAKE SETTING

Near Bottom Near Top Other MIDPOINT
 Depth in feet (BTOC) 20.44 Screen Interval in Feet (BTOC)
 from 10.00 to 20.00

PURGE VOLUME CALCULATION

$$\left(\frac{20.44}{\text{TD (feet)}} - \frac{9.65}{\text{WL (feet)}} \right) \times \frac{2^2}{\text{D (inches)}} \times \frac{1 \text{ (min)}}{\text{\# Vols}} \times 0.0408 = \frac{1.76 \text{ GAL}}{\text{Calculated Purge Volume}} \text{ gallons}$$

PURGE TIME

8:04 Start 8:42 Stop 38 Elapsed Initial _____ gpm Final _____ gpm

PURGE RATE

ACTUAL PURGE VOLUME

_____ gallons

FIELD PARAMETER MEASUREMENT

6 Th

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T <input checked="" type="checkbox"/> °C <input type="checkbox"/> °F	Other
0 <u>3:04</u>	<u>7.03</u>	<u>632</u>	<u>23.42</u>	<u>-32 / 1.50 / 124</u>
<u>1.70</u>	<u>7.72</u>	<u>555</u>	<u>24.40</u>	<u>-75 / 0.07 / 2.9</u>
<u>4.70</u>	<u>7.21</u>	<u>554</u>	<u>24.46</u>	<u>-75 / 0.00 / 2.9</u>
<u>7.70</u>	<u>7.22</u>	<u>553</u>	<u>24.47</u>	<u>-77 / 0.00 / 2.9</u>

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T <input type="checkbox"/> °C <input type="checkbox"/> °F	Other

Observations During Purging (Well Condition, Turbidity, Color, Odor) CLEAR

Discharge Water Disposal: Sanitary Sewer Storm Sewer Other _____

WELL SAMPLING

SAMPLING METHOD

Baller - Type PERSISTENT Same as Above
 Submersible Centrifugal Bladder; Pump No. _____ Grab - Type _____
 Other - Type _____

SAMPLING DISTRIBUTION

Sample Series _____

Sample No.	Volume/Cont.	Analysis Requested	Preservatives	Lab	Comments
<u>ESB-5</u>		<u>TARGET ANALYTE LIST</u>	<u>(1) 500 mL PE w/ HCl</u>	<u>HNC3</u>	
			<u>(3) 1 L AMBER NO PRESERV</u>		
			<u>(1) 250 mL PE w/ NaOH</u>		
			<u>(3) 90 mL VOA w/ HCl</u>		

QUALITY CONTROL SAMPLES

Duplicate Samples	
Original Sample No.	Duplicate Sample No.

Blank Samples	
Type	Sample No.

Other Samples	
Type	Sample No.



GROUNDWATER SAMPLING FORM

Job Name CITY OF CHICAGO JASTA
 Job Number 3205170606
 Recorded By E. Walkowitz
 (signature)

Well No. ESB-6
 Well Type Monitor Extraction Other TEMP
 Well Material PVC St. Steel Other
 Date 8-5-17 Time 10:30
 Sampled By ESW
 (initials)

WELL PURGING

PURGE VOLUME
 Casing Diameter (D In Inches) 3.00' STICKUP
 2-Inch 4-Inch 6-Inch Other
 Total Depth of Casing (TD In feet BTOC) 17.02 (17.5M)
 Water Level Depth (WL In feet BTOC) 10.67
 Number of Well volumes to be purged (# Vols) 1 MIN
 3 4 5 10 Other

PURGE METHOD
 Bailer - Type
 Submersible Centrifugal Bladder; Pump No.
 Other - Type PERISTALTIC PUMP

PUMP INTAKE SETTING
 Near Bottom Near Top Other MID PUMP
 Depth in feet (BTOC) _____ Screen Interval in Feet (BTOC) from 7 to 17

PURGE VOLUME CALCULATION

$$\left(\frac{17.02 - 10.67}{\text{TD (feet)}} \right) \times \frac{2^2}{\text{D (inches)}} \times \frac{1}{\text{\# Vols}} \times 0.0408 = \frac{1.03}{\text{Calculated Purge Volume}} \text{ gallons}$$

PURGE TIME Start _____ Stop _____ Elapsed _____ Initial _____ gpm Final _____ gpm
PURGE RATE _____
ACTUAL PURGE VOLUME _____ gallons

FIELD PARAMETER MEASUREMENT

Minutes Since Pumping Began	pH	Cond. (umhos/cm)	T <input checked="" type="checkbox"/> °C <input type="checkbox"/> °F	Other
10:67 9:40	6.99	364	26.64	27 7.60 343
10:87 10:00	7.01	341	25.16	-9 0.64 337
10:88 10:05	7.01	341	25.21	-20 0.18 209
10:89 10:12	6.99	344	25.37	-21 0.00 114
10:90 10:18	6.99	344	25.48	-24 0.00 77

Minutes Since Pumping Began	pH	Cond. (umhos/cm)	T <input checked="" type="checkbox"/> °C <input type="checkbox"/> °F	Other
10:23 2.8 GAL	6.98	342	25.55	-26 0.00 694 10.90
10:28 3.2 GAL	6.99	344	25.57	-26 0.00 78.3 10.90
SAMPLE @ 10:30				
Meter Nos.				

Observations During Purging (Well Condition, Turbidity, Color, Odor) CLEAR TO CLEAN AND SAMPLING
 Discharge Water Disposal: Sanitary Sewer Storm Sewer Other

WELL SAMPLING

SAMPLING METHOD
 Bailer - Type PERISTALTIC PUMP Same as Above
 Submersible Centrifugal Bladder; Pump No. Grab - Type
 Other - Type

SAMPLING DISTRIBUTION Sample Series _____

Sample No.	Volume/Cont.	Analysis Requested	Preservatives	Lab	Comments
ESB-6	1L Ambient 500 mL PE	PAHs PP METALS	None		

QUALITY CONTROL SAMPLES

Duplicate Samples		Blank Samples		Other Samples	
Original Sample No.	Duplicate Sample No.	Type	Sample No.	Type	Sample No.
/		/		/	



GROUNDWATER SAMPLING FORM

Job Name Chicago JPSTA
 Job Number 3205-17-1606
 Recorded By Andr. H. Hester
 (signature)

Well No. Well "I"
 Well Type Monitor Extraction Other _____
 Well Material PVC St. Steel Other _____
 Date 8/29/17 Time 1150
 Sampled By AEH
 (initials)

WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches)
 2-inch 4-inch 6-inch Other _____
 Total Depth of Casing (TD in feet BTOC) 47.80 (meas 8/11/17)
 Water Level Depth (WL in feet BTOC) 30.46 (at start)
 Number of Well volumes to be purged (# Vols)
 3 4 5 10 Other _____

PURGE METHOD

Bailer - Type _____
 Submersible Centrifugal Bladder; Pump No. _____
 Other - Type _____

PUMP INTAKE SETTING

Near Bottom Near Top Other _____
 Depth in feet (BTOC) 8/11/17 DTG=30.85 Screen Interval in Feet (BTOC) _____
 from _____ to _____
DTB=47.80
(MW-4)

PURGE VOLUME CALCULATION

$$\left(\text{TD (feet)} - \text{WL (feet)} \right) \times \text{D (inches)}^2 \times \text{\# Vols} \times 0.0408 = \text{Calculated Purge Volume (gallons)}$$

PURGE TIME

1030 Start 1035 Stop _____ Elapsed _____

PURGE RATE

Initial _____ gpm Final _____ gpm

ACTUAL PURGE VOLUME

_____ gallons

FIELD PARAMETER MEASUREMENT

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T <input checked="" type="checkbox"/> °C <input type="checkbox"/> °F	Other Turb
<u>5</u>	<u>6.58</u>	<u>1.20 mS/cm</u>	<u>18.96</u>	<u>649 NTU</u>
<u>10</u>	<u>6.64</u>	<u>1.21</u>	<u>18.07</u>	<u>555</u>
<u>15</u> (1045)	<u>6.54</u>	<u>1.23</u>	<u>18.39</u>	<u>415</u>
<u>20</u>	<u>6.53</u>	<u>1.23</u>	<u>18.72</u>	<u>312</u>
<u>25</u>	<u>6.54</u>	<u>1.23</u>	<u>18.73</u>	<u>314</u>

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T <input checked="" type="checkbox"/> °C <input type="checkbox"/> °F	Other Turb
<u>32.50</u> 30 (1100)	<u>6.56</u>	<u>1.23</u>	<u>18.70</u>	<u>313</u>
<u>35</u> (raining)	<u>6.59</u>	<u>1.22</u>	<u>18.57</u>	<u>294</u>
<u>40</u>	<u>6.60</u>	<u>1.23</u>	<u>18.49</u>	<u>251</u>
<u>45</u>	<u>6.61</u>	<u>1.23</u>	<u>18.32</u>	<u>215</u>
Meter Nos.	<u>Horiuba U-52 (# J7X4CT4E)</u> <u>USEnv</u> <u>Manufact Jan 2015</u>			

Observations During Purging (Well Condition, Turbidity, Color, Odor) clear at start or sl turbid

Discharge Water Disposal: Sanitary Sewer Storm Sewer Other Discharge to ground surface away from well

WELL SAMPLING

SAMPLING METHOD

Bailer - Type _____
 Submersible Centrifugal Bladder; Pump No. _____
 Same as Above Grab - Type _____
 Other - Type _____

SAMPLING DISTRIBUTION

Sample Series _____

ORP readings 1.0 at 20 min

Sample No.	Volume/Cont.	Analysis Requested	Preservatives	Lab	Comments
	<u>3 40mL vials</u>	<u>VOC + Naph.</u>	<u>HCl</u>	<u>STAT</u>	

QUALITY CONTROL SAMPLES

Duplicate Samples	
Original Sample No.	Duplicate Sample No.

Blank Samples	
Type	Sample No.

Other Samples	
Type	Sample No.

Readings cont.

<u>DTW</u>	<u>Min Since start pumping</u>	<u>pH</u>	<u>cond</u>	<u>Temp</u>	<u>Turb</u>
	50 (1120 raining)	6.68	1.23 mS/cm	18.15 °C	189
32.90'	55	6.69	1.22	18.05	169
	60 (1130 raining)	6.72	1.23	17.99	133
	65	6.90	1.23	17.91	132
	70	6.92	1.23	17.80	129
33.20'	75 (1145 Light rain)	6.94	1.23	17.75	124

Sample @ 1150 8/29/17



GROUNDWATER SAMPLING FORM

Job Name Chicago JPSTA
 Job Number 3205-17-1606
 Recorded By Chris E. [Signature]
 (signature)

Well No. Well "C"
 Well Type Monitor Extraction Other
 Well Material PVC St. Steel Other
 Date 8/29/17 Time 1445
 Sampled By AELH
 (initials)

WELL PURGING

PURGE VOLUME
 Casing Diameter (D in inches)
 2-inch 4-inch 6-inch Other
 Total Depth of Casing (TD in feet BTOC) 15.09 (8/17/17)
 Water Level Depth (WL in feet BTOC) 10.00 start
 Number of Well volumes to be purged (# Vols)
 3 4 5 10 Other

PURGE METHOD
 Bailer - Type
 Submersible Centrifugal Bladder; Pump No. _____
 Other - Type

PUMP INTAKE SETTING
 Near Bottom Near Top Other
 Depth in feet (BTOC) _____ Screen Interval in Feet (BTOC) _____
 from _____ to _____
8/9/17 = DTW = 10.03'
DTB = 15.09'
SE part of well B/will c pair

PURGE VOLUME CALCULATION
 $(TD \text{ (feet)} - WL \text{ (feet)}) \times D \text{ (inches)}^2 \times \# \text{ Vols} \times 0.0408 = \text{Calculated Purge Volume}$ gallons

PURGE TIME 1405 Start _____ Stop _____ Elapsed _____ Initial _____ gpm Final _____ gpm
PURGE RATE _____ gpm
ACTUAL PURGE VOLUME _____ gallons

FIELD PARAMETER MEASUREMENT

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T <input type="checkbox"/> °C <input type="checkbox"/> °F	Other <u>Turb</u>
<u>0 (1405)</u>	<u>6.95</u>	<u>0.689</u>	<u>18.60</u>	<u>65.6</u>
<u>5</u>	<u>6.96</u>	<u>0.704</u>	<u>18.48</u>	<u>41.6</u>
<u>10</u>	<u>6.93</u>	<u>0.707</u>	<u>18.46</u>	<u>16.7</u>
<u>15</u>	<u>6.92</u>	<u>0.714</u>	<u>18.34</u>	<u>12.6</u>
<u>20</u>	<u>6.93</u>	<u>0.719</u>	<u>18.47</u>	<u>8.3</u>

Minutes Since Pumping Began	pH	Cond. (µmhos/cm)	T <input type="checkbox"/> °C <input type="checkbox"/> °F	Other <u>Turb</u>
<u>25</u>	<u>6.92</u>	<u>0.717</u>	<u>18.47</u>	<u>8.1</u>
<u>30</u>	<u>6.93</u>	<u>0.708</u>	<u>18.72</u>	<u>3.6</u>
<u>35</u>	<u>6.93</u>	<u>0.707</u>	<u>18.70</u>	<u>3.4</u>
Meter Nos. <u>Horiba U-52</u>				

Observations During Purging (Well Condition, Turbidity, Color, Odor) clear to sl turbid throughout
 Discharge Water Disposal: Sanitary Sewer Storm Sewer Other ground away from well

WELL SAMPLING

SAMPLING METHOD concentric down then swirl sample
 Bailer - Type
 Submersible Centrifugal Bladder; Pump No. Yes
 Same as Above
 Grab - Type
 Other - Type

SAMPLING DISTRIBUTION Sample Series _____

Sample No.	Volume/Cont.	Analysis Requested	Preservatives	Lab	Comments
<u>3</u>	<u>40 mL vials</u>	<u>VOC + Neph</u>	<u>HCl</u>	<u>STAT</u>	

QUALITY CONTROL SAMPLES

Duplicate Samples	
Original Sample No.	Duplicate Sample No.

Blank Samples	
Type	Sample No.

Other Samples	
Type	Sample No.



APPENDIX E

Averaging Input and Results

		Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_benzo(b)fluoranthene	Dibenzo(a,h)anthracene	D_Dibenzo(a,h)anthracene	Arsenic	D_Arsenic
SB1-1	1-3	0.14	1	0.25	1	0.26	1	0.044	1	8.84	1
SB2-1	1-3	0.093	1	0.094	1	0.13	1	0.017	1	13	1
SB3-1	1-3	0.47	1	0.48	1	0.13	1	0.071	1	12.2	1
SB4-1	1-3	0.004	1	0.0051	1	0.0077	1	0.00092	1	3.38	1
SB5-1	1-3	0.14	1	0.14	1	0.22	1	0.023	1	4.51	1
SB6-1	1-3	0.014	1	0.016	1	0.034	1	0.0017	0	3.53	1
SB8-1	1-3	0.027	1	0.033	1	0.051	1	0.0054	1	2.09	1
SB10-1	1-3	0.025	1	0.026	1	0.064	1	0.0007	0	5.45	1
GP-1A	0-2	0.78	1	0.9	1	1.9	1	0.31	1	7.9	1
GP-2B	2-4	0.59	1	0.55	1	1	1	0.13	1	8.5	1
GP-3A	0-2	7	1	6.3	1	8.7	1	1.7	1	4	1
GP-4B	2-4	1.2	1	1.1	1	1.5	1	0.18	1	5.2	1
GP-5A	0-2	0.092	1	0.072	1	0.16	1	0.057	0	6.8	1
GP-6A	0-2	0.099	1	0.086	1	0.18	1	0.056	0	7.7	1
GP-8A	0-2									5.8	1
GP-9B	2-4									5.5	1
GP-10B	2-4									3.4	1
GP-11B	2-4	0.067	1	0.056	0	0.07	1	0.056	0	9.2	1
GP-13A	0-2	0.2	1	0.16	1	0.29	1	0.075	1	8.1	1
GP-14B	2-4									3.9	1
GP-15A	0-2									12	1
GP-16B	2-4	0.052	0	0.052	0	0.052	0	0.052	0	2.6	1
GP-17A	0-2									18	1
GP-18B	2-4									2.4	1
GP-19A	0-2									5.4	1
ESB-1A	0-2	0.084	1	0.074	1	0.07	1	0.035	1	8.6	1
ESB-2A	1.5-2.5	0.045	1	0.038	0	0.038	0	0.038	0	8.6	1
ESB-3A	1-4	2.4	1	0.84	1	0.35	0	0.35	0	6.4	1
ESB-4A	0.5-1.5	3.1	1	3.2	1	3.3	1	0.81	1	13	1
ESB-5A	0-1	0.16	1	0.13	1	0.18	1	0.062	1	12	1
ESB-6A	2-4	0.25	1	0.26	1	0.35	1	0.094	1	18	1
B-1A	2-4	0.21	1	0.2	1	0.18	1	0.076	1	6.2	1
B-2A	0-2	0.16	1	0.16	1	0.15	1	0.064	1	12	1
B-3A	0-2	0.11	1	0.13	1	0.11	1	0.035	0	4.2	1
B-4A	0-2	0.75	1	0.71	1	0.56	1	0.27	1	12	1
B-6A	1-3	4.9	1	3.9	1	3.5	1	1.1	1	6.8	1
B-7A	0-2	0.17	1	0.039	0	0.042	1	0.14	1	12	1
B-9A	1-3	1.3	1	1.2	1	1	1	0.52	1	14	1
B-10A	0-1	0.25	1	0.31	1	0.41	1	0.11	1	7.5	1
B-11A	1-2	0.19	1	0.18	1	0.18	1	0.066	1	8.6	1
B-12A	0-2	0.73	1	0.91	1	0.63	1	0.25	1	7.2	1
B-14A	1-2	0.15	1	0.17	1	0.18	1	0.063	1	11	1
B-15A	1.5-3	0.24	1	0.22	1	0.23	1	0.05	1	11	1
B-16A	1-2	0.058	1	0.089	1	0.11	1	0.034	0	8.8	1
B-17A	0-2	0.18	1	0.17	1	0.23	1	0.066	1	34	1
B-18A	0-2	0.16	1	0.11	1	0.14	1	0.064	1	20	1

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/13/2017 4:03:55 PM
From File	Average Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	60	Number of Distinct Observations	49
		Number of Missing Observations	10
Number of Detects	51	Number of Non-Detects	9
Number of Distinct Detects	43	Number of Distinct Non-Detects	6
Minimum Detect	5.6000E-4	Minimum Non-Detect	6.0000E-4
Maximum Detect	6.1	Maximum Non-Detect	0.054
Variance Detects	1.603	Percent Non-Detects	15%
Mean Detects	0.675	SD Detects	1.266
Median Detects	0.16	CV Detects	1.875
Skewness Detects	2.784	Kurtosis Detects	8.077
Mean of Logged Detects	-2.006	SD of Logged Detects	2.159

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.578	Normal GOF Test on Detected Observations Only
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	Lilliefors GOF Test
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.575	KM Standard Error of Mean	0.154
KM SD	1.18	95% KM (BCA) UCL	0.864
95% KM (t) UCL	0.832	95% KM (Percentile Bootstrap) UCL	0.843
95% KM (z) UCL	0.828	95% KM Bootstrap t UCL	0.974
90% KM Chebyshev UCL	1.037	95% KM Chebyshev UCL	1.246
97.5% KM Chebyshev UCL	1.536	99% KM Chebyshev UCL	2.106

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.306	Anderson-Darling GOF Test
5% A-D Critical Value	0.837	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.133	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only			
k hat (MLE)	0.407	k star (bias corrected MLE)	0.396
Theta hat (MLE)	1.66	Theta star (bias corrected MLE)	1.705
nu hat (MLE)	41.5	nu star (bias corrected)	40.39
Mean (detects)	0.675		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	5.6000E-4	Mean	0.576
Maximum	6.1	Median	0.14
SD	1.19	CV	2.068
k hat (MLE)	0.363	k star (bias corrected MLE)	0.356
Theta hat (MLE)	1.587	Theta star (bias corrected MLE)	1.618
nu hat (MLE)	43.53	nu star (bias corrected)	42.68
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (42.68, α)	28.71	Adjusted Chi Square Value (42.68, β)	28.42
95% Gamma Approximate UCL (use when $n \geq 50$)	0.856	95% Gamma Adjusted UCL (use when $n < 50$)	0.864
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.575	SD (KM)	1.18
Variance (KM)	1.393	SE of Mean (KM)	0.154
k hat (KM)	0.237	k star (KM)	0.237
nu hat (KM)	28.5	nu star (KM)	28.4
theta hat (KM)	2.422	theta star (KM)	2.43
80% gamma percentile (KM)	0.818	90% gamma percentile (KM)	1.732
95% gamma percentile (KM)	2.829	99% gamma percentile (KM)	5.771
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (28.40, α)	17.24	Adjusted Chi Square Value (28.40, β)	17.03
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.947	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.959
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Approximate Test Statistic	0.953	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	0.0741	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.119	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.123	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			

Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.575	Mean in Log Scale	-2.539
SD in Original Scale	1.19	SD in Log Scale	2.397
95% t UCL (assumes normality of ROS data)	0.832	95% Percentile Bootstrap UCL	0.84
95% BCA Bootstrap UCL	0.919	95% Bootstrap t UCL	1.008
95% H-UCL (Log ROS)	6.01		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.628	KM Geo Mean	0.0722
KM SD (logged)	2.538	95% Critical H Value (KM-Log)	4.988
KM Standard Error of Mean (logged)	0.339	95% H-UCL (KM -Log)	9.39
KM SD (logged)	2.538	95% Critical H Value (KM-Log)	4.988
KM Standard Error of Mean (logged)	0.339		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.576	Mean in Log Scale	-2.496
SD in Original Scale	1.19	SD in Log Scale	2.44
95% t UCL (Assumes normality)	0.833	95% H-Stat UCL	7.364
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	1.246		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Benzo(a)pyrene			
General Statistics			
Total Number of Observations	60	Number of Distinct Observations	53
		Number of Missing Observations	10
Number of Detects	47	Number of Non-Detects	13
Number of Distinct Detects	43	Number of Distinct Non-Detects	10
Minimum Detect	7.1000E-4	Minimum Non-Detect	7.0000E-4
Maximum Detect	3.9	Maximum Non-Detect	0.056
Variance Detects	1.125	Percent Non-Detects	21.67%
Mean Detects	0.638	SD Detects	1.06
Median Detects	0.16	CV Detects	1.662
Skewness Detects	2.111	Kurtosis Detects	3.353
Mean of Logged Detects	-1.996	SD of Logged Detects	2.185
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.62	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.946	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.302	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.128	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.501	KM Standard Error of Mean	0.126
KM SD	0.964	95% KM (BCA) UCL	0.701
95% KM (t) UCL	0.712	95% KM (Percentile Bootstrap) UCL	0.723
95% KM (z) UCL	0.708	95% KM Bootstrap t UCL	0.784
90% KM Chebyshev UCL	0.879	95% KM Chebyshev UCL	1.05
97.5% KM Chebyshev UCL	1.287	99% KM Chebyshev UCL	1.753
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.873	Anderson-Darling GOF Test	
5% A-D Critical Value	0.833	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.149	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.138	Detected Data Not Gamma Distributed at 5% Significance Level	
Detected Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.422	k star (bias corrected MLE)	0.409
Theta hat (MLE)	1.512	Theta star (bias corrected MLE)	1.56
nu hat (MLE)	39.66	nu star (bias corrected)	38.46
Mean (detects)	0.638		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.1000E-4	Mean	0.502
Maximum	3.9	Median	0.102
SD	0.972	CV	1.936
k hat (MLE)	0.358	k star (bias corrected MLE)	0.351
Theta hat (MLE)	1.403	Theta star (bias corrected MLE)	1.43
nu hat (MLE)	42.95	nu star (bias corrected)	42.14
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (42.14, α)	28.26	Adjusted Chi Square Value (42.14, β)	27.98
95% Gamma Approximate UCL (use when $n \geq 50$)	0.749	95% Gamma Adjusted UCL (use when $n < 50$)	0.756

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.501	SD (KM)	0.964
Variance (KM)	0.93	SE of Mean (KM)	0.126
k hat (KM)	0.27	k star (KM)	0.268
nu hat (KM)	32.45	nu star (KM)	32.16
theta hat (KM)	1.854	theta star (KM)	1.871
80% gamma percentile (KM)	0.745	90% gamma percentile (KM)	1.497
95% gamma percentile (KM)	2.377	99% gamma percentile (KM)	4.697

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (32.16, α)	20.2	Adjusted Chi Square Value (32.16, β)	19.97
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.798	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.808

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.946	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.13	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.128	Detected Data Not Lognormal at 5% Significance Level	

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.501	Mean in Log Scale	-2.783
SD in Original Scale	0.973	SD in Log Scale	2.503
95% t UCL (assumes normality of ROS data)	0.711	95% Percentile Bootstrap UCL	0.712
95% BCA Bootstrap UCL	0.744	95% Bootstrap t UCL	0.789
95% H-UCL (Log ROS)	7.075		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.859	KM Geo Mean	0.0573
KM SD (logged)	2.607	95% Critical H Value (KM-Log)	5.106
KM Standard Error of Mean (logged)	0.353	95% H-UCL (KM -Log)	9.689
KM SD (logged)	2.607	95% Critical H Value (KM-Log)	5.106
KM Standard Error of Mean (logged)	0.353		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.503	Mean in Log Scale	-2.62
SD in Original Scale	0.971	SD in Log Scale	2.41
95% t UCL (Assumes normality)	0.713	95% H-Stat UCL	5.809
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	1.05		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	60	Number of Distinct Observations	48
		Number of Missing Observations	10
Number of Detects	51	Number of Non-Detects	9
Number of Distinct Detects	42	Number of Distinct Non-Detects	8
Minimum Detect	9.5000E-4	Minimum Non-Detect	7.0000E-4
Maximum Detect	6.4	Maximum Non-Detect	0.35
Variance Detects	1.722	Percent Non-Detects	15%
Mean Detects	0.682	SD Detects	1.312
Median Detects	0.18	CV Detects	1.925
Skewness Detects	2.819	Kurtosis Detects	8.236
Mean of Logged Detects	-2.034	SD of Logged Detects	2.178

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.567	Normal GOF Test on Detected Observations Only
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.327	Lilliefors GOF Test
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.582	KM Standard Error of Mean	0.159
KM SD	1.221	95% KM (BCA) UCL	0.876
95% KM (t) UCL	0.848	95% KM (Percentile Bootstrap) UCL	0.855
95% KM (z) UCL	0.844	95% KM Bootstrap t UCL	0.965
90% KM Chebyshev UCL	1.06	95% KM Chebyshev UCL	1.276
97.5% KM Chebyshev UCL	1.577	99% KM Chebyshev UCL	2.167

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.347	Anderson-Darling GOF Test
5% A-D Critical Value	0.839	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.176	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.133	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.399	k star (bias corrected MLE)	0.388
Theta hat (MLE)	1.709	Theta star (bias corrected MLE)	1.755
nu hat (MLE)	40.68	nu star (bias corrected)	39.62
Mean (detects)	0.682		

Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	9.5000E-4	Mean	0.581
Maximum	6.4	Median	0.13
SD	1.232	CV	2.121
k hat (MLE)	0.357	k star (bias corrected MLE)	0.35
Theta hat (MLE)	1.627	Theta star (bias corrected MLE)	1.658
nu hat (MLE)	42.86	nu star (bias corrected)	42.05
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (42.05, α)	28.19	Adjusted Chi Square Value (42.05, β)	27.91
95% Gamma Approximate UCL (use when $n \geq 50$)	0.867	95% Gamma Adjusted UCL (use when $n < 50$)	0.875
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.582	SD (KM)	1.221
Variance (KM)	1.492	SE of Mean (KM)	0.159
k hat (KM)	0.227	k star (KM)	0.227
nu hat (KM)	27.26	nu star (KM)	27.23
theta hat (KM)	2.563	theta star (KM)	2.565
80% gamma percentile (KM)	0.814	90% gamma percentile (KM)	1.757
95% gamma percentile (KM)	2.898	99% gamma percentile (KM)	5.979
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (27.23, α)	16.33	Adjusted Chi Square Value (27.23, β)	16.12
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.971	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.983
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Approximate Test Statistic	0.948	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	0.044	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.116	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.123	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Approximate Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.581	Mean in Log Scale	-2.493
SD in Original Scale	1.232	SD in Log Scale	2.333
95% t UCL (assumes normality of ROS data)	0.847	95% Percentile Bootstrap UCL	0.853
95% BCA Bootstrap UCL	0.962	95% Bootstrap t UCL	0.982
95% H-UCL (Log ROS)	4.969		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.544	KM Geo Mean	0.0786
KM SD (logged)	2.408	95% Critical H Value (KM-Log)	4.699
KM Standard Error of Mean (logged)	0.323	95% H-UCL (KM -Log)	6.223
KM SD (logged)	2.408	95% Critical H Value (KM-Log)	4.699
KM Standard Error of Mean (logged)	0.323		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.585	Mean in Log Scale	-2.342
SD in Original Scale	1.23	SD in Log Scale	2.219
95% t UCL (Assumes normality)	0.85	95% H-Stat UCL	3.894
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	1.276		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Dibenzo(a,h)anthracene

General Statistics

Total Number of Observations	60	Number of Distinct Observations	45
		Number of Missing Observations	10
Number of Detects	33	Number of Non-Detects	27
Number of Distinct Detects	30	Number of Distinct Non-Detects	17
Minimum Detect	9.2000E-4	Minimum Non-Detect	3.4000E-4
Maximum Detect	1.1	Maximum Non-Detect	0.35
Variance Detects	0.0823	Percent Non-Detects	45%
Mean Detects	0.221	SD Detects	0.287
Median Detects	0.076	CV Detects	1.298
Skewness Detects	1.849	Kurtosis Detects	2.562
Mean of Logged Detects	-2.358	SD of Logged Detects	1.535

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.713	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.931	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.248	Lilliefors GOF Test
5% Lilliefors Critical Value	0.152	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.124	KM Standard Error of Mean	0.031
KM SD	0.236	95% KM (BCA) UCL	0.183
95% KM (t) UCL	0.176	95% KM (Percentile Bootstrap) UCL	0.178
95% KM (z) UCL	0.175	95% KM Bootstrap t UCL	0.191
90% KM Chebyshev UCL	0.217	95% KM Chebyshev UCL	0.259
97.5% KM Chebyshev UCL	0.317	99% KM Chebyshev UCL	0.432

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.696	Anderson-Darling GOF Test
5% A-D Critical Value	0.791	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.15	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.711	k star (bias corrected MLE)	0.666
Theta hat (MLE)	0.311	Theta star (bias corrected MLE)	0.332
nu hat (MLE)	46.9	nu star (bias corrected)	43.97
Mean (detects)	0.221		

Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	9.2000E-4	Mean	0.126
Maximum	1.1	Median	0.0135
SD	0.236	CV	1.874
k hat (MLE)	0.491	k star (bias corrected MLE)	0.477
Theta hat (MLE)	0.257	Theta star (bias corrected MLE)	0.264
nu hat (MLE)	58.88	nu star (bias corrected)	57.27
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (57.27, α)	40.87	Adjusted Chi Square Value (57.27, β)	40.53
95% Gamma Approximate UCL (use when $n \geq 50$)	0.177	95% Gamma Adjusted UCL (use when $n < 50$)	0.178
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.124	SD (KM)	0.236
Variance (KM)	0.0556	SE of Mean (KM)	0.031
k hat (KM)	0.276	k star (KM)	0.273
nu hat (KM)	33.06	nu star (KM)	32.74
theta hat (KM)	0.449	theta star (KM)	0.454
80% gamma percentile (KM)	0.185	90% gamma percentile (KM)	0.369
95% gamma percentile (KM)	0.583	99% gamma percentile (KM)	1.148
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (32.74, α)	20.66	Adjusted Chi Square Value (32.74, β)	20.42
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.196	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.198
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.943	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.931	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.149	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.152	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.124	Mean in Log Scale	-3.809
SD in Original Scale	0.238	SD in Log Scale	2.032
95% t UCL (assumes normality of ROS data)	0.175	95% Percentile Bootstrap UCL	0.175
95% BCA Bootstrap UCL	0.187	95% Bootstrap t UCL	0.189
95% H-UCL (Log ROS)	0.496		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-4.588	KM Geo Mean	0.0102
KM SD (logged)	2.886	95% Critical H Value (KM-Log)	5.532
KM Standard Error of Mean (logged)	0.405	95% H-UCL (KM -Log)	5.23
KM SD (logged)	2.886	95% Critical H Value (KM-Log)	5.532
KM Standard Error of Mean (logged)	0.405		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.13	Mean in Log Scale	-3.853
SD in Original Scale	0.236	SD in Log Scale	2.523
95% t UCL (Assumes normality)	0.18	95% H-Stat UCL	2.613
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Gamma Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM Approximate Gamma UCL	0.196		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Arsenic			
General Statistics			
Total Number of Observations	65	Number of Distinct Observations	52
		Number of Missing Observations	4
Minimum	2.09	Mean	7.716
Maximum	34	Median	6.4
SD	5.426	Std. Error of Mean	0.673
Coefficient of Variation	0.703	Skewness	2.148
Normal GOF Test			
Shapiro Wilk Test Statistic	0.824	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	2.195E-10	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.15	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.11	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	8.84	95% Adjusted-CLT UCL (Chen-1995)	9.015
		95% Modified-t UCL (Johnson-1978)	8.869
Gamma GOF Test			
A-D Test Statistic	0.783	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.109	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.112	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	2.621	k star (bias corrected MLE)	2.511
Theta hat (MLE)	2.944	Theta star (bias corrected MLE)	3.074
nu hat (MLE)	340.8	nu star (bias corrected)	326.4
MLE Mean (bias corrected)	7.716	MLE Sd (bias corrected)	4.87
		Approximate Chi Square Value (0.05)	285.5
Adjusted Level of Significance	0.0463	Adjusted Chi Square Value	284.7
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50)	8.82	95% Adjusted Gamma UCL (use when n<50)	8.847
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.959	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk P Value	0.0729	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.111	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.11	Data Not Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	0.737	Mean of logged Data	1.841
Maximum of Logged Data	3.526	SD of logged Data	0.636
Assuming Lognormal Distribution			
95% H-UCL	9.017	90% Chebyshev (MVUE) UCL	9.657
95% Chebyshev (MVUE) UCL	10.55	97.5% Chebyshev (MVUE) UCL	11.79
99% Chebyshev (MVUE) UCL	14.22		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	8.823	95% Jackknife UCL	8.84
95% Standard Bootstrap UCL	8.808	95% Bootstrap-t UCL	9.102
95% Hall's Bootstrap UCL	9.245	95% Percentile Bootstrap UCL	8.845
95% BCA Bootstrap UCL	8.948		
90% Chebyshev(Mean, Sd) UCL	9.735	95% Chebyshev(Mean, Sd) UCL	10.65
97.5% Chebyshev(Mean, Sd) UCL	11.92	99% Chebyshev(Mean, Sd) UCL	14.41
Suggested UCL to Use			
95% Approximate Gamma UCL	8.82		
When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test			
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			

		Benzo(a)anthracene	D_Benzo(a)anthracene	Benzo(a)pyrene	D_Benzo(a)pyrene	Benzo(b)fluoranthene	D_benzo(b)fluoranthene	Dibenzo(a,h)anthracene	D_Dibenzo(a,h)anthracene	Arsenic	D_Arsenic
SB1-1	1-3	0.14	1	0.25	1	0.26	1	0.044	1	8.84	1
SB1-4	8.5-10.5	0.002	1	0.0025	1	0.0049	1	0.00035	0	3.44	1
SB2-1	1-3	0.093	1	0.094	1	0.13	1	0.017	1	13	1
SB2-3	6-8	0.002	1	0.0019	1	0.0035	1	0.00034	0	3.36	1
SB3-1	1-3	0.47	1	0.48	1	0.13	1	0.071	1	12.2	1
SB3-3	6-8	0.026	1	0.029	1	0.08	1	0.0018	0	2.77	1
SB4-1	1-3	0.004	1	0.0051	1	0.0077	1	0.00092	1	3.38	1
SB4-4	8.5-10.5	0.00056	1	0.00071	1	0.0011	1	0.00035	0	3.47	1
SB5-1	1-3	0.14	1	0.14	1	0.22	1	0.023	1	4.51	1
SB5-4	8.5-10.5	0.0056	1	0.0052	1	0.014	1	0.00034	0	5.42	1
SB6-1	1-3	0.014	1	0.016	1	0.034	1	0.0017	0	3.53	1
SB6-4	8.5-10.5	0.0025	1	0.0018	1	0.0036	1	0.00035	0	2.38	1
SB7-4	8.5-10.5	0.0006	0	0.0007	0	0.0007	0	0.0007	0	2.65	1
SB7-5	11-13	0.0006	0	0.0007	0	0.001	1	0.0007	0	2.72	1
SB8-1	1-3	0.027	1	0.033	1	0.051	1	0.0054	1	2.09	1
SB8-3	8.5-10.5	0.03	1	0.031	1	0.072	1	0.0074	1	3.15	1
SB9-2	3.5-5.5	0.0042	1	0.0042	1	0.0089	1	0.0007	0	3.26	1
SB9-3	6-8	0.0006	0	0.0007	0	0.00095	1	0.0007	0	2.94	1
SB10-1	1-3	0.025	1	0.026	1	0.064	1	0.0007	0	5.45	1
SB10-4	8.5-10.5	0.19	1	0.014	0	0.021	1	0.014	0	13.8	1
GP-1A	0-2	0.78	1	0.9	1	1.9	1	0.31	1	7.9	1
GP-2B	2-4	0.59	1	0.55	1	1	1	0.13	1	8.5	1
GP-3A	0-2	7	1	6.3	1	8.7	1	1.7	1	4	1
GP-4B	2-4	1.2	1	1.1	1	1.5	1	0.18	1	5.2	1
GP-4E	8-10	0.2	1	0.16	1	0.28	1	0.055	0	6.2	1
GP-5A	0-2	0.092	1	0.072	1	0.16	1	0.057	0	6.8	1
GP-6A	0-2	0.099	1	0.086	1	0.18	1	0.056	0	7.7	1
GP-6C	4-6	6.1	1	3.8	1	6.4	1	0.82	1	5.2	1
GP-7D	6-8	12	1	13	1	12	1	1	1	11	1
GP-7F	10-12	3.1	1	2.3	1	4.8	1	0.46	1	7.6	1
GP-8A	0-2									5.8	1
GP-9B	2-4									5.5	1
GP-10B	2-4									3.4	1
GP-11B	2-4	0.067	1	0.056	0	0.07	1	0.056	0	9.2	1
GP-11D	6-8	2	1	3.1	1	2.1	1	0.19	1	4.6	1
GP-13A	0-2	0.2	1	0.16	1	0.29	1	0.075	1	8.1	1
GP-13D	6-8	0.05	0	0.05	0	0.05	0	0.05	0	2.5	1
GP-14B	2-4									3.9	1
GP-15A	0-2									12	1
GP-16B	2-4	0.052	0	0.052	0	0.052	0	0.052	0	2.6	1
GP-16E	8-10	0.054	0	0.054	0	0.054	0	0.054	0	3.1	1
GP-17A	0-2									18	1
GP-18B	2-4									2.4	1
GP-19A	0-2									5.4	1
ESB-1A	0-2	0.084	1	0.074	1	0.07	1	0.035	1	8.6	1
ESB-1C	13-14	0.034	0	0.034	0	0.034	0	0.034	0		
ESB-2A	1.5-2.5	0.045	1	0.038	0	0.038	0	0.038	0	8.6	1
ESB-3A	1-4	2.4	1	0.84	1	0.35	0	0.35	0	6.4	1
ESB-3B	5.5-6.5	2.6	1	3	1	2.9	1	0.87	1		
ESB-4A	0.5-1.5	3.1	1	3.2	1	3.3	1	0.81	1	13	1
ESB-5A	0-1	0.16	1	0.13	1	0.18	1	0.062	1	12	1
ESB-6A	2-4	0.25	1	0.26	1	0.35	1	0.094	1	18	1
B-1A	2-4	0.21	1	0.2	1	0.18	1	0.076	1	6.2	1
B-2A	0-2	0.16	1	0.16	1	0.15	1	0.064	1	12	1
B-3A	0-2	0.11	1	0.13	1	0.11	1	0.035	0	4.2	1
B-3B	6-8	0.036	0	0.036	0	0.036	0	0.036	0	2.7	1
B-4A	0-2	0.75	1	0.71	1	0.56	1	0.27	1	12	1
B-6A	1-3	4.9	1	3.9	1	3.5	1	1.1	1	6.8	1
B-6B	8-10	0.64	1	0.68	1	0.53	1	0.25	1	13	1
B-7A	0-2	0.17	1	0.039	0	0.042	1	0.14	1	12	1
B-9A	1-3	1.3	1	1.2	1	1	1	0.52	1	14	1
B-10A	0-1	0.25	1	0.31	1	0.41	1	0.11	1	7.5	1
B-11A	1-2	0.19	1	0.18	1	0.18	1	0.066	1	8.6	1
B-12A	0-2	0.73	1	0.91	1	0.63	1	0.25	1	7.2	1
B-14A	0-2	0.15	1	0.17	1	0.18	1	0.063	1	11	1
B-15A	1.5-3	0.24	1	0.22	1	0.23	1	0.05	1	11	1
B-16A	1-2	0.058	1	0.089	1	0.11	1	0.034	0	8.8	1
B-17A	1-2	0.18	1	0.17	1	0.23	1	0.066	1	34	1
B-18A	0-2	0.16	1	0.11	1	0.14	1	0.064	1	20	1
B-18B	4.5-5.5	0.034	0	0.034	0	0.034	0	0.034	0		

UCL Statistics for Data Sets with Non-Detects

User Selected Options	
Date/Time of Computation	ProUCL 5.111/13/2017 4:03:55 PM
From File	Average Input.xls
Full Precision	OFF
Confidence Coefficient	95%
Number of Bootstrap Operations	2000

Benzo(a)anthracene

General Statistics

Total Number of Observations	60	Number of Distinct Observations	49
		Number of Missing Observations	10
Number of Detects	51	Number of Non-Detects	9
Number of Distinct Detects	43	Number of Distinct Non-Detects	6
Minimum Detect	5.6000E-4	Minimum Non-Detect	6.0000E-4
Maximum Detect	6.1	Maximum Non-Detect	0.054
Variance Detects	1.603	Percent Non-Detects	15%
Mean Detects	0.675	SD Detects	1.266
Median Detects	0.16	CV Detects	1.875
Skewness Detects	2.784	Kurtosis Detects	8.077
Mean of Logged Detects	-2.006	SD of Logged Detects	2.159

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.578	Normal GOF Test on Detected Observations Only
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.337	Lilliefors GOF Test
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.575	KM Standard Error of Mean	0.154
KM SD	1.18	95% KM (BCA) UCL	0.864
95% KM (t) UCL	0.832	95% KM (Percentile Bootstrap) UCL	0.843
95% KM (z) UCL	0.828	95% KM Bootstrap t UCL	0.974
90% KM Chebyshev UCL	1.037	95% KM Chebyshev UCL	1.246
97.5% KM Chebyshev UCL	1.536	99% KM Chebyshev UCL	2.106

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.306	Anderson-Darling GOF Test
5% A-D Critical Value	0.837	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.206	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.133	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only			
k hat (MLE)	0.407	k star (bias corrected MLE)	0.396
Theta hat (MLE)	1.66	Theta star (bias corrected MLE)	1.705
nu hat (MLE)	41.5	nu star (bias corrected)	40.39
Mean (detects)	0.675		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	5.6000E-4	Mean	0.576
Maximum	6.1	Median	0.14
SD	1.19	CV	2.068
k hat (MLE)	0.363	k star (bias corrected MLE)	0.356
Theta hat (MLE)	1.587	Theta star (bias corrected MLE)	1.618
nu hat (MLE)	43.53	nu star (bias corrected)	42.68
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (42.68, α)	28.71	Adjusted Chi Square Value (42.68, β)	28.42
95% Gamma Approximate UCL (use when $n \geq 50$)	0.856	95% Gamma Adjusted UCL (use when $n < 50$)	0.864
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.575	SD (KM)	1.18
Variance (KM)	1.393	SE of Mean (KM)	0.154
k hat (KM)	0.237	k star (KM)	0.237
nu hat (KM)	28.5	nu star (KM)	28.4
theta hat (KM)	2.422	theta star (KM)	2.43
80% gamma percentile (KM)	0.818	90% gamma percentile (KM)	1.732
95% gamma percentile (KM)	2.829	99% gamma percentile (KM)	5.771
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (28.40, α)	17.24	Adjusted Chi Square Value (28.40, β)	17.03
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.947	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.959
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Approximate Test Statistic	0.953	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	0.0741	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.119	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.123	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			

Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.575	Mean in Log Scale	-2.539
SD in Original Scale	1.19	SD in Log Scale	2.397
95% t UCL (assumes normality of ROS data)	0.832	95% Percentile Bootstrap UCL	0.84
95% BCA Bootstrap UCL	0.919	95% Bootstrap t UCL	1.008
95% H-UCL (Log ROS)	6.01		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.628	KM Geo Mean	0.0722
KM SD (logged)	2.538	95% Critical H Value (KM-Log)	4.988
KM Standard Error of Mean (logged)	0.339	95% H-UCL (KM -Log)	9.39
KM SD (logged)	2.538	95% Critical H Value (KM-Log)	4.988
KM Standard Error of Mean (logged)	0.339		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.576	Mean in Log Scale	-2.496
SD in Original Scale	1.19	SD in Log Scale	2.44
95% t UCL (Assumes normality)	0.833	95% H-Stat UCL	7.364
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	1.246		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Benzo(a)pyrene			
General Statistics			
Total Number of Observations	60	Number of Distinct Observations	53
		Number of Missing Observations	10
Number of Detects	47	Number of Non-Detects	13
Number of Distinct Detects	43	Number of Distinct Non-Detects	10
Minimum Detect	7.1000E-4	Minimum Non-Detect	7.0000E-4
Maximum Detect	3.9	Maximum Non-Detect	0.056
Variance Detects	1.125	Percent Non-Detects	21.67%
Mean Detects	0.638	SD Detects	1.06
Median Detects	0.16	CV Detects	1.662
Skewness Detects	2.111	Kurtosis Detects	3.353
Mean of Logged Detects	-1.996	SD of Logged Detects	2.185
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.62	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.946	Detected Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.302	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.128	Detected Data Not Normal at 5% Significance Level	
Detected Data Not Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	0.501	KM Standard Error of Mean	0.126
KM SD	0.964	95% KM (BCA) UCL	0.701
95% KM (t) UCL	0.712	95% KM (Percentile Bootstrap) UCL	0.723
95% KM (z) UCL	0.708	95% KM Bootstrap t UCL	0.784
90% KM Chebyshev UCL	0.879	95% KM Chebyshev UCL	1.05
97.5% KM Chebyshev UCL	1.287	99% KM Chebyshev UCL	1.753
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.873	Anderson-Darling GOF Test	
5% A-D Critical Value	0.833	Detected Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.149	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.138	Detected Data Not Gamma Distributed at 5% Significance Level	
Detected Data Not Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	0.422	k star (bias corrected MLE)	0.409
Theta hat (MLE)	1.512	Theta star (bias corrected MLE)	1.56
nu hat (MLE)	39.66	nu star (bias corrected)	38.46
Mean (detects)	0.638		

Gamma ROS Statistics using Imputed Non-Detects

GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs

GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)

For such situations, GROS method may yield incorrect values of UCLs and BTVs

This is especially true when the sample size is small.

For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates

Minimum	7.1000E-4	Mean	0.502
Maximum	3.9	Median	0.102
SD	0.972	CV	1.936
k hat (MLE)	0.358	k star (bias corrected MLE)	0.351
Theta hat (MLE)	1.403	Theta star (bias corrected MLE)	1.43
nu hat (MLE)	42.95	nu star (bias corrected)	42.14
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (42.14, α)	28.26	Adjusted Chi Square Value (42.14, β)	27.98
95% Gamma Approximate UCL (use when $n \geq 50$)	0.749	95% Gamma Adjusted UCL (use when $n < 50$)	0.756

Estimates of Gamma Parameters using KM Estimates

Mean (KM)	0.501	SD (KM)	0.964
Variance (KM)	0.93	SE of Mean (KM)	0.126
k hat (KM)	0.27	k star (KM)	0.268
nu hat (KM)	32.45	nu star (KM)	32.16
theta hat (KM)	1.854	theta star (KM)	1.871
80% gamma percentile (KM)	0.745	90% gamma percentile (KM)	1.497
95% gamma percentile (KM)	2.377	99% gamma percentile (KM)	4.697

Gamma Kaplan-Meier (KM) Statistics

Approximate Chi Square Value (32.16, α)	20.2	Adjusted Chi Square Value (32.16, β)	19.97
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.798	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.808

Lognormal GOF Test on Detected Observations Only

Shapiro Wilk Test Statistic	0.941	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.946	Detected Data Not Lognormal at 5% Significance Level
Lilliefors Test Statistic	0.13	Lilliefors GOF Test
5% Lilliefors Critical Value	0.128	Detected Data Not Lognormal at 5% Significance Level

Detected Data Not Lognormal at 5% Significance Level

Lognormal ROS Statistics Using Imputed Non-Detects

Mean in Original Scale	0.501	Mean in Log Scale	-2.783
SD in Original Scale	0.973	SD in Log Scale	2.503
95% t UCL (assumes normality of ROS data)	0.711	95% Percentile Bootstrap UCL	0.712
95% BCA Bootstrap UCL	0.744	95% Bootstrap t UCL	0.789
95% H-UCL (Log ROS)	7.075		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.859	KM Geo Mean	0.0573
KM SD (logged)	2.607	95% Critical H Value (KM-Log)	5.106
KM Standard Error of Mean (logged)	0.353	95% H-UCL (KM -Log)	9.689
KM SD (logged)	2.607	95% Critical H Value (KM-Log)	5.106
KM Standard Error of Mean (logged)	0.353		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.503	Mean in Log Scale	-2.62
SD in Original Scale	0.971	SD in Log Scale	2.41
95% t UCL (Assumes normality)	0.713	95% H-Stat UCL	5.809
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Data do not follow a Discernible Distribution at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	1.05		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Benzo(b)fluoranthene

General Statistics

Total Number of Observations	60	Number of Distinct Observations	48
		Number of Missing Observations	10
Number of Detects	51	Number of Non-Detects	9
Number of Distinct Detects	42	Number of Distinct Non-Detects	8
Minimum Detect	9.5000E-4	Minimum Non-Detect	7.0000E-4
Maximum Detect	6.4	Maximum Non-Detect	0.35
Variance Detects	1.722	Percent Non-Detects	15%
Mean Detects	0.682	SD Detects	1.312
Median Detects	0.18	CV Detects	1.925
Skewness Detects	2.819	Kurtosis Detects	8.236
Mean of Logged Detects	-2.034	SD of Logged Detects	2.178

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.567	Normal GOF Test on Detected Observations Only
5% Shapiro Wilk P Value	0	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.327	Lilliefors GOF Test
5% Lilliefors Critical Value	0.123	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.582	KM Standard Error of Mean	0.159
KM SD	1.221	95% KM (BCA) UCL	0.876
95% KM (t) UCL	0.848	95% KM (Percentile Bootstrap) UCL	0.855
95% KM (z) UCL	0.844	95% KM Bootstrap t UCL	0.965
90% KM Chebyshev UCL	1.06	95% KM Chebyshev UCL	1.276
97.5% KM Chebyshev UCL	1.577	99% KM Chebyshev UCL	2.167

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	1.347	Anderson-Darling GOF Test
5% A-D Critical Value	0.839	Detected Data Not Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.176	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.133	Detected Data Not Gamma Distributed at 5% Significance Level

Detected Data Not Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.399	k star (bias corrected MLE)	0.388
Theta hat (MLE)	1.709	Theta star (bias corrected MLE)	1.755
nu hat (MLE)	40.68	nu star (bias corrected)	39.62
Mean (detects)	0.682		

Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	9.5000E-4	Mean	0.581
Maximum	6.4	Median	0.13
SD	1.232	CV	2.121
k hat (MLE)	0.357	k star (bias corrected MLE)	0.35
Theta hat (MLE)	1.627	Theta star (bias corrected MLE)	1.658
nu hat (MLE)	42.86	nu star (bias corrected)	42.05
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (42.05, α)	28.19	Adjusted Chi Square Value (42.05, β)	27.91
95% Gamma Approximate UCL (use when $n \geq 50$)	0.867	95% Gamma Adjusted UCL (use when $n < 50$)	0.875
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.582	SD (KM)	1.221
Variance (KM)	1.492	SE of Mean (KM)	0.159
k hat (KM)	0.227	k star (KM)	0.227
nu hat (KM)	27.26	nu star (KM)	27.23
theta hat (KM)	2.563	theta star (KM)	2.565
80% gamma percentile (KM)	0.814	90% gamma percentile (KM)	1.757
95% gamma percentile (KM)	2.898	99% gamma percentile (KM)	5.979
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (27.23, α)	16.33	Adjusted Chi Square Value (27.23, β)	16.12
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.971	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.983
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Approximate Test Statistic	0.948	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	0.044	Detected Data Not Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.116	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.123	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Approximate Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.581	Mean in Log Scale	-2.493
SD in Original Scale	1.232	SD in Log Scale	2.333
95% t UCL (assumes normality of ROS data)	0.847	95% Percentile Bootstrap UCL	0.853
95% BCA Bootstrap UCL	0.962	95% Bootstrap t UCL	0.982
95% H-UCL (Log ROS)	4.969		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-2.544	KM Geo Mean	0.0786
KM SD (logged)	2.408	95% Critical H Value (KM-Log)	4.699
KM Standard Error of Mean (logged)	0.323	95% H-UCL (KM -Log)	6.223
KM SD (logged)	2.408	95% Critical H Value (KM-Log)	4.699
KM Standard Error of Mean (logged)	0.323		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.585	Mean in Log Scale	-2.342
SD in Original Scale	1.23	SD in Log Scale	2.219
95% t UCL (Assumes normality)	0.85	95% H-Stat UCL	3.894
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Approximate Lognormal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (Chebyshev) UCL	1.276		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Dibenzo(a,h)anthracene

General Statistics

Total Number of Observations	60	Number of Distinct Observations	45
		Number of Missing Observations	10
Number of Detects	33	Number of Non-Detects	27
Number of Distinct Detects	30	Number of Distinct Non-Detects	17
Minimum Detect	9.2000E-4	Minimum Non-Detect	3.4000E-4
Maximum Detect	1.1	Maximum Non-Detect	0.35
Variance Detects	0.0823	Percent Non-Detects	45%
Mean Detects	0.221	SD Detects	0.287
Median Detects	0.076	CV Detects	1.298
Skewness Detects	1.849	Kurtosis Detects	2.562
Mean of Logged Detects	-2.358	SD of Logged Detects	1.535

Normal GOF Test on Detects Only

Shapiro Wilk Test Statistic	0.713	Shapiro Wilk GOF Test
5% Shapiro Wilk Critical Value	0.931	Detected Data Not Normal at 5% Significance Level
Lilliefors Test Statistic	0.248	Lilliefors GOF Test
5% Lilliefors Critical Value	0.152	Detected Data Not Normal at 5% Significance Level

Detected Data Not Normal at 5% Significance Level

Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs

KM Mean	0.124	KM Standard Error of Mean	0.031
KM SD	0.236	95% KM (BCA) UCL	0.183
95% KM (t) UCL	0.176	95% KM (Percentile Bootstrap) UCL	0.178
95% KM (z) UCL	0.175	95% KM Bootstrap t UCL	0.191
90% KM Chebyshev UCL	0.217	95% KM Chebyshev UCL	0.259
97.5% KM Chebyshev UCL	0.317	99% KM Chebyshev UCL	0.432

Gamma GOF Tests on Detected Observations Only

A-D Test Statistic	0.696	Anderson-Darling GOF Test
5% A-D Critical Value	0.791	Detected data appear Gamma Distributed at 5% Significance Level
K-S Test Statistic	0.15	Kolmogorov-Smirnov GOF
5% K-S Critical Value	0.16	Detected data appear Gamma Distributed at 5% Significance Level

Detected data appear Gamma Distributed at 5% Significance Level

Gamma Statistics on Detected Data Only

k hat (MLE)	0.711	k star (bias corrected MLE)	0.666
Theta hat (MLE)	0.311	Theta star (bias corrected MLE)	0.332
nu hat (MLE)	46.9	nu star (bias corrected)	43.97
Mean (detects)	0.221		

Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			
For gamma distributed detected data, BTVs and UCLs may be computed using gamma distribution on KM estimates			
Minimum	9.2000E-4	Mean	0.126
Maximum	1.1	Median	0.0135
SD	0.236	CV	1.874
k hat (MLE)	0.491	k star (bias corrected MLE)	0.477
Theta hat (MLE)	0.257	Theta star (bias corrected MLE)	0.264
nu hat (MLE)	58.88	nu star (bias corrected)	57.27
Adjusted Level of Significance (β)	0.046		
Approximate Chi Square Value (57.27, α)	40.87	Adjusted Chi Square Value (57.27, β)	40.53
95% Gamma Approximate UCL (use when $n \geq 50$)	0.177	95% Gamma Adjusted UCL (use when $n < 50$)	0.178
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	0.124	SD (KM)	0.236
Variance (KM)	0.0556	SE of Mean (KM)	0.031
k hat (KM)	0.276	k star (KM)	0.273
nu hat (KM)	33.06	nu star (KM)	32.74
theta hat (KM)	0.449	theta star (KM)	0.454
80% gamma percentile (KM)	0.185	90% gamma percentile (KM)	0.369
95% gamma percentile (KM)	0.583	99% gamma percentile (KM)	1.148
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (32.74, α)	20.66	Adjusted Chi Square Value (32.74, β)	20.42
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	0.196	95% Gamma Adjusted KM-UCL (use when $n < 50$)	0.198
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.943	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.931	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.149	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.152	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	0.124	Mean in Log Scale	-3.809
SD in Original Scale	0.238	SD in Log Scale	2.032
95% t UCL (assumes normality of ROS data)	0.175	95% Percentile Bootstrap UCL	0.175
95% BCA Bootstrap UCL	0.187	95% Bootstrap t UCL	0.189
95% H-UCL (Log ROS)	0.496		

Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	-4.588	KM Geo Mean	0.0102
KM SD (logged)	2.886	95% Critical H Value (KM-Log)	5.532
KM Standard Error of Mean (logged)	0.405	95% H-UCL (KM -Log)	5.23
KM SD (logged)	2.886	95% Critical H Value (KM-Log)	5.532
KM Standard Error of Mean (logged)	0.405		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	0.13	Mean in Log Scale	-3.853
SD in Original Scale	0.236	SD in Log Scale	2.523
95% t UCL (Assumes normality)	0.18	95% H-Stat UCL	2.613
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Gamma Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM Approximate Gamma UCL	0.196		
<p>Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.</p> <p>Recommendations are based upon data size, data distribution, and skewness.</p> <p>These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).</p> <p>However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.</p>			

Arsenic			
General Statistics			
Total Number of Observations	65	Number of Distinct Observations	52
		Number of Missing Observations	4
Minimum	2.09	Mean	7.716
Maximum	34	Median	6.4
SD	5.426	Std. Error of Mean	0.673
Coefficient of Variation	0.703	Skewness	2.148
Normal GOF Test			
Shapiro Wilk Test Statistic	0.824	Shapiro Wilk GOF Test	
5% Shapiro Wilk P Value	2.195E-10	Data Not Normal at 5% Significance Level	
Lilliefors Test Statistic	0.15	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.11	Data Not Normal at 5% Significance Level	
Data Not Normal at 5% Significance Level			
Assuming Normal Distribution			
95% Normal UCL		95% UCLs (Adjusted for Skewness)	
95% Student's-t UCL	8.84	95% Adjusted-CLT UCL (Chen-1995)	9.015
		95% Modified-t UCL (Johnson-1978)	8.869
Gamma GOF Test			
A-D Test Statistic	0.783	Anderson-Darling Gamma GOF Test	
5% A-D Critical Value	0.76	Data Not Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.109	Kolmogorov-Smirnov Gamma GOF Test	
5% K-S Critical Value	0.112	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data follow Appr. Gamma Distribution at 5% Significance Level			
Gamma Statistics			
k hat (MLE)	2.621	k star (bias corrected MLE)	2.511
Theta hat (MLE)	2.944	Theta star (bias corrected MLE)	3.074
nu hat (MLE)	340.8	nu star (bias corrected)	326.4
MLE Mean (bias corrected)	7.716	MLE Sd (bias corrected)	4.87
		Approximate Chi Square Value (0.05)	285.5
Adjusted Level of Significance	0.0463	Adjusted Chi Square Value	284.7
Assuming Gamma Distribution			
95% Approximate Gamma UCL (use when n>=50)	8.82	95% Adjusted Gamma UCL (use when n<50)	8.847
Lognormal GOF Test			
Shapiro Wilk Test Statistic	0.959	Shapiro Wilk Lognormal GOF Test	
5% Shapiro Wilk P Value	0.0729	Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.111	Lilliefors Lognormal GOF Test	
5% Lilliefors Critical Value	0.11	Data Not Lognormal at 5% Significance Level	
Data appear Approximate Lognormal at 5% Significance Level			

Lognormal Statistics			
Minimum of Logged Data	0.737	Mean of logged Data	1.841
Maximum of Logged Data	3.526	SD of logged Data	0.636
Assuming Lognormal Distribution			
95% H-UCL	9.017	90% Chebyshev (MVUE) UCL	9.657
95% Chebyshev (MVUE) UCL	10.55	97.5% Chebyshev (MVUE) UCL	11.79
99% Chebyshev (MVUE) UCL	14.22		
Nonparametric Distribution Free UCL Statistics			
Data appear to follow a Discernible Distribution at 5% Significance Level			
Nonparametric Distribution Free UCLs			
95% CLT UCL	8.823	95% Jackknife UCL	8.84
95% Standard Bootstrap UCL	8.808	95% Bootstrap-t UCL	9.102
95% Hall's Bootstrap UCL	9.245	95% Percentile Bootstrap UCL	8.845
95% BCA Bootstrap UCL	8.948		
90% Chebyshev(Mean, Sd) UCL	9.735	95% Chebyshev(Mean, Sd) UCL	10.65
97.5% Chebyshev(Mean, Sd) UCL	11.92	99% Chebyshev(Mean, Sd) UCL	14.41
Suggested UCL to Use			
95% Approximate Gamma UCL	8.82		
When a data set follows an approximate (e.g., normal) distribution passing one of the GOF test			
When applicable, it is suggested to use a UCL based upon a distribution (e.g., gamma) passing both GOF tests in ProUCL			
Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.			
Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			



APPENDIX F

R-26 Calculations

SSL PARAMETERS

4301 W Chicago Ave
Chicago, Illinois

Parameter	Symbol	Unit	Benzo(a)anthracene		Antimony		Chromium	
			Value ⁽¹⁾	Source ⁽¹⁾	Value ⁽¹⁾	Source ⁽¹⁾	Value ⁽¹⁾	Source ⁽¹⁾
Soil Remediation Objective (SSL Equation S17)								
Water-Filled Soil Porosity	Θ_w	L_{air}/L_{soil}	0.15	App. C, Table B, Surface Default ⁽²⁾	0.15	App. C, Table B, Surface Default ⁽²⁾	0.15	App. C, Table B, Surface Default ⁽²⁾
			0.3	App. C, Table B, Subsurface Default ⁽²⁾	0.3	App. C, Table B, Subsurface Default ⁽²⁾	0.3	App. C, Table B, Subsurface Default ⁽²⁾
Air-Filled Soil Porosity	Θ_a	L_{water}/L_{soil}	0.28	App. C, Table B, Surface Default ⁽²⁾	0.28	App. C, Table B, Surface Default ⁽²⁾	0.28	App. C, Table B, Surface Default ⁽²⁾
			0.13	App. C, Table B, Subsurface Default ⁽²⁾	0.13	App. C, Table B, Subsurface Default ⁽²⁾	0.13	App. C, Table B, Subsurface Default ⁽²⁾
Dry Soil Bulk Density	ρ_b	kg/L or g/cm ³	1.5	App. C, Table B, Default	1.5	App. C, Table B, Default	1.5	App. C, Table B, Default
Henry's Law Constant	H'	unitless	1.39E-04	App. C, Table E (chemical-specific)	0	Not applicable	0	Not applicable
Target Soil Leachate Concentration	C_w	mg/L	Calculated	App. C, Table A, SSL Eq. S18	Calculated	App. C, Table A, SSL Eq. S18	Calculated	App. C, Table A, SSL Eq. S18
Soil-Water Partition Coefficient	K_d	cm ³ /g	Calculated	App. C, Table A, SSL Eq. S19	Calculated	App. C, Table A, SSL Eq. S19	Calculated	App. C, Table A, SSL Eq. S19
Target Soil Leachate Concentration - C_w (SSL Equation S18)								
Groundwater Remediation Objective	GW_{obj}	mg/L	0.00013	App. B, Table E, Class I (chemical-specific)	0.006	App. B, Table E, Class I (chemical-specific)	0.1	App. B, Table E, Class I (chemical-specific)
Dilution Factor	DF	unitless	20	App. C, Table B, Default	20	App. C, Table B, Default	20	App. C, Table B, Default
Determination of Soil-Water Partition Coefficient - K_d (SSL Equation S19)								
Organic Carbon Partition Coefficient	K_{oc}	cm ³ /g or L/kg	4.00E+05	App. C, Table E (chemical-specific)	0	Not applicable	0	Not applicable
Organic Carbon Content of Soil	f_{oc}	g/g	0.002	Subsurface Default ⁽²⁾	0.002	Subsurface Default ⁽²⁾	0.002	Subsurface Default ⁽²⁾

Footnotes:

(1) Parameter definitions and values are presented in IAC 742 at the references given.

(2) Surface Soils are located in top meter, Subsurface Soils are located below 1 meter.

RBCA PARAMETERS

4301 W Chicago Ave
Chicago, Illinois

Parameter	Symbol	Unit	Benzo(a)anthracene		Antimony		Chromium	
			Value ⁽¹⁾	Source ⁽¹⁾	Value ⁽¹⁾	Source ⁽¹⁾	Value ⁽¹⁾	Source ⁽¹⁾
Determination of Groundwater Concentration at a Given Distance X From the Source - C_(x) (RBCA Equation R26)								
Groundwater Source Concentration (Soil Conc. x (GW _{obj} /RO))	C _{source}	mg/L	Calculated	See Footnote ⁽²⁾	Calculated	See Footnote ⁽²⁾	Calculated	See Footnote ⁽²⁾
Distance Along Centerline of Groundwater Plume	X	cm	304.8 cm = 10 feet	site-specific distance to concentration below Tier 1 Class II objective	30,480 cm = 1000 feet	site-specific distance to concentration below Tier 1 Class II objective	8230 cm = 270 ft	site-specific distance to concentration below Tier 1 Class II objective
Source Width Perpendicular to Groundwater Flow (horizontal)	S _w	cm	1524 cm = 50 ft	site-specific (estimated source, 50 feet)	1524 cm = 50 ft	site-specific (estimated source, 50 feet)	1524 cm = 50 ft	site-specific (estimated source, 50 feet)
Source Width Perpendicular to Groundwater Flow (vertical)	S _d	cm	200	App. C, Table D, Migration to GW Default	200	App. C, Table D, Migration to GW Default	200	App. C, Table D, Migration to GW Default
Specific Discharge	U	cm/d	Calculated	App. C, Table C RBCA, Eq. R19	Calculated	App. C, Table C RBCA, Eq. R19	Calculated	App. C, Table C RBCA, Eq. R19
First Order Degradation Constant	λ	d ⁻¹	5.10E-04	App. C, Table E	0.00E+00	Not applicable	0.00E+00	Not applicable
Longitudinal Dispersivity	α _x	cm	Calculated	App. C, Table C RBCA Eq. R16	Calculated	App. C, Table C RBCA Eq. R16	Calculated	App. C, Table C RBCA Eq. R16
Transverse Dispersivity	α _y	cm	Calculated	App. C, Table C RBCA Eq. R17	Calculated	App. C, Table C RBCA Eq. R17	Calculated	App. C, Table C RBCA Eq. R17
Vertical Dispersivity	α _z	cm	Calculated	App. C, Table C RBCA Eq. R18	Calculated	App. C, Table C RBCA Eq. R18	Calculated	App. C, Table C RBCA Eq. R18
Error Function Value	erf	unitless	Calculated	App. C, Table C RBCA Eq. R26	Calculated	App. C, Table C RBCA Eq. R26	Calculated	App. C, Table C RBCA Eq. R26
Concentration in Groundwater at Distance X from Source	C _(x)	mg/L	Calculated	App. C, Table C RBCA Eq. R26	Calculated	App. C, Table C RBCA Eq. R26	Calculated	App. C, Table C RBCA Eq. R26
Determination of Longitudinal Dispersivity - α_x (RBCA Equation R16)								
Longitudinal Dispersivity	α _x	cm	Calculated	App. C, Table C RBCA, Eq. R16	Calculated	App. C, Table C RBCA, Eq. R16	Calculated	App. C, Table C RBCA, Eq. R16
Determination of Transverse Dispersivity - α_y (RBCA Equation R17)								
Transverse Dispersivity	α _y	cm	Calculated	App. C, Table C RBCA, Eq. R17	Calculated	App. C, Table C RBCA, Eq. R17	Calculated	App. C, Table C RBCA, Eq. R17
Determination of Vertical Dispersivity - α_z (RBCA Equation R18)								
Vertical Dispersivity	α _z	cm	Calculated	App. C, Table C RBCA, Eq. R18	Calculated	App. C, Table C RBCA, Eq. R18	Calculated	App. C, Table C RBCA, Eq. R18
Determination of Specific Discharge - U (RBCA Equation R19)								
Aquifer Hydraulic Conductivity	K	cm/d	7.60E+01	site-specific	7.60E+01	site-specific	7.60E+01	site-specific
Hydraulic Gradient	i	cm/cm	0.0017	site-specific	0.0017	site-specific	0.0017	site-specific
Total Soil Porosity	Θ _T	cm ³ /cm ³	0.43	App. C, Table D, Default	0.43	App. C, Table D, Default	0.43	App. C, Table D, Default

Footnote:

- Parameter definitions and values are presented in 35 IAC 742 at the references given.
- C_{source} is calculated by multiplying the Soil Concentration (SOIL CONC) by the ratio of the groundwater remediation objective (GWobj) to the soil remediation objective (SOIL RO).

R-26 CALCULATIONS

4301 W Chicago Ave
Chicago, Illinois

TABLE 1 SOIL SCREENING LEVELS FOR MIGRATION TO GROUNDWATER (SSL Equation)

Constituent		Cw (mg/L)	Kd (cm ³ /g)	Koc	foc	Default Theta w	Default Theta a	H'	pb (g/cm ³)
Benzo(a)anthracene	2007 GP-7D	0.0026	8.0E+02	4.00E+05	0.002	0.3	0.13	0.000139	1.5
Antimony	2007 GP-4E	0.12	0.0E+00	0	0	0.3	0.13	0.00	1.5
Chromium	2007 GP-19A	2	0.0E+00	0	0	0.15	0.28	0.00	1.5

Constituent		GWobj (mg/L)	Soil		Soil Concentration mg/kg	Calculation of GW Concentrations from Soils (mg/L)	
			DF (Default)	Objective (mg/kg)		DF (calculated)	
Benzo(a)anthracene	2007 GP-7D	0.00013	2.0E+01	2.081	12	7.50E-04	2007 GP-3A
Antimony	2007 GP-4E	0.006	2.0E+01	0.024	23	5.75E+00	2007 GP-4E
Chromium	2007 GP-19A	0.1	2.0E+01	0.200	35	1.75E+01	2007 GP-19A

Prepared by: MEJ Date: 12/18/2017
Checked by: EJW Date: 12/21/2017

TABLE 2 DETERMINATION OF GROUNDWATER CONCENTRATION at a Distance X from the Source

Constituent		Csource (mg/L)	X (cm)	X (ft)	alpha x (cm)	lamda (day) ⁻¹	K (cm/day)	i (cm/cm)	Theta T (unitless)	Sw (cm)
Benzo(a)anthracene	2007 GP-3A	7.5E-04	304.8	10	30.48	5.10E-04	7.60E+01	0.0017	0.43	1524
Antimony	2007 GP-4E	5.75E+00	30480	1000	3048	0.00E+00	7.60E+01	0.0017	0.43	1524
Chromium	2007 GP-19A	1.75E+01	8229.6	270	822.96	0.00E+00	7.60E+01	0.0017	0.43	1524

Constituent	alpha y (cm)	Sd (cm)	alpha z (cm)	C(x) (mg/L)	Class II Objective (mg/L)	erf(Sw)	erf(Sd)	Cx/Csource	(Sw)	(Sd)
Benzo(a)anthracene	10.16	200.00	1.524	0.00046	0.00065	1.0000	1.0000	6.11E-01	6.846531969	4.639808276
Antimony	1016	200.00	152.4	0.0232	0.024	0.0771	0.0523	4.04E-03	0.06846532	0.046398083
Chromium	274.32	200.00	41.148	0.9412	1.00	0.2801	0.1920	5.38E-02	0.253575258	0.171844751

Prepared by: MEJ Date: 12/18/2017
Checked by: EJW Date: 12/21/2017



APPENDIX G

Soil Exploration and Analysis for Preliminary Site Development (Geotechnical Report)



www.msetinc.com

MIDLAND STANDARD ENGINEERING & TESTING, INC.

558 Plate Drive, Unit 6 East Dundee, Illinois
(847) 844-1895 f(847) 844-3875

November 6, 2017

Ms. Mary E. Jank
Amec Foster Wheeler Environment & Infrastructure, Inc.
8745 W. Higgins Road, Suite 300
Chicago, Illinois

Re: Soil Exploration and Analysis for Preliminary Site Development
Police & Fire Training Campus
Chicago, Illinois
MSET File No. 17439

Dear Ms. Jank:

Midland Standard Engineering & Testing, Inc. has completed a geotechnical exploration for the above referenced project.

Scope

The purpose of this exploration and analysis was to determine the various soil profile components, to determine the engineering characteristics of the subsurface materials and to provide criteria for use by the design engineers in preparing preliminary building foundation and site development plans. This report does not address environmental issues at the site. Environmental testing information is provided in a separate report by others.

The scope of this exploration included a geological reconnaissance of the site, subsurface exploration, soil testing and an engineering analysis and evaluation of the materials encountered.

General

The exploration and analysis of the foundation and subgrade conditions reported herein are considered sufficient in detail and scope to form a reasonable basis for preliminary design and project costing. This report has been prepared for the exclusive use and specific application to the proposed project.

The recommendations submitted are based on the available soil information and after discussion with the project engineer. Any revision in the plans for the proposed site development from those enumerated in this report should be brought to the attention of the Soils Engineer so that he may determine if changes in the recommendations are required. If deviations from the noted subsurface conditions are encountered during construction, they should also be brought to the attention of the Soils Engineer.

The Soils Engineer warrants that the findings, recommendations, specifications or professional advice contained herein have been promulgated after being prepared in accordance with generally accepted professional engineering practice in the fields of foundation engineering, soil mechanics and engineering geology. No other warranties are implied or expressed.

After the plans and specifications are more complete, it is recommended that the Soils Engineer be provided the opportunity to review the final design and specifications, in order that the earthwork and foundation recommendations may be properly interpreted and implemented. At that time, it may be necessary to submit supplementary recommendations.

Field Explorations

Our exploration program for the two proposed buildings consisted of drilling seventeen (17) structure borings, labeled B-1 through B-17, to depths of twenty-five (25) to forty (40) feet below the existing ground surface. Additionally, seven (7) borings, labeled ESB-1 through ESB-6 and B-18 were located to assess site conditions and for environmental testing by others.

The borings locations were staked at the site by MSET; reference the attached Boring Location Map. The ground surface elevation at each boring location was determined relative to the rim of a manhole in the eastbound lane of Kilbourn Avenue, with an assumed elevation of 100.0.

Drilling and Sampling Procedures

The soil borings were drilled using a track mounted drill rig equipped with a rotary head using hollow stem augers to advance the hole. Representative samples were obtained by the use of split-spoon sampling procedures in accordance with A.S.T.M. Procedure D-1586. Continuous sampling, back to back split spoons to a depth of sixteen feet, was conducted at all but two boring locations.

Field Tests and Measurements

Standard Penetration Tests - During the split-spoon sampling procedures, a standard penetration test was performed in accordance with current A.S.T.M. D-1586 Procedures. At sampling intervals, the sampler was lowered into the hole and seated in undisturbed soil by pushing or tapping, taking suitable precautions that the rods were reasonably tight. The sampling spoon was then advanced by driving using an automatic drop hammer. During the sampling procedure, the standard penetration value (N) of the soil was determined. The standard penetration value (N) is defined as the number of blows of a one hundred-forty pound (140 lb.) hammer required to advance the spoon sampler one foot (12") into the soil.

The results of the standard penetration tests indicate the relative density and comparative consistency of the soils, and thereby provide a basis for estimating the relative strength and compressibility of the soil profile components. The results of standard penetration tests can be found on the boring logs included in the attached documents.

Strength Tests - During the field boring operations, samples of the predominantly cohesive soil from the split-spoon sampling device were tested using a calibrated soil penetrometer to aid in determining the strength of the soil. Consideration must be given to the manner in which the values of the unconfined compressive strengths were obtained. Split-spoon sampling techniques provide a representative, but somewhat disturbed, soil sample.

Water Level Measurements - Water level observations were made during and after the boring operations and are noted on the boring logs presented herewith. In relatively pervious soils, such as sandy soils, the indicated elevations are considered reliable ground water levels. In relatively impervious soils, the accurate determination of the ground water elevation may not be possible, even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the ground water table, and volumes of water that may influence construction conditions will depend on the permeability of the soils.

Well Installation and Field Permeability Test

Temporary ground water monitoring well pipes were installed in borings ESB-4 and ESB-6. At ESB-4, a falling head permeability test was conducted to determine the soil permeability. At this location, 15.5 feet of well pipe was installed to a depth of 13 feet below the ground surface with 2.5 feet of stick up. The screened interval is the lower 10 feet minus the end cap, set at roughly a depth of 2.75 feet to 12.75 feet. Clay at this location starts at a depth of 9 feet. The permeability test consists of filling the well pipe and timing the drop of the water level for several time intervals. A total of 4 trials were conducted.

Laboratory Testing

A laboratory testing program was conducted to ascertain engineering characteristics of the foundation materials necessary in preparing recommendations for the proposed construction. The soil laboratory work was performed in accordance with applicable ASTM standards.

The laboratory testing program included visual classification and moisture content, on all split-spoon samples. Cohesive soil samples obtained from the split-spoon were also tested for unconfined compressive strength (Q_u). A laboratory permeability test was conducted per ASTM 5084-90 on a clay sample from boring B-10. The results of this laboratory testing are presented on the attached boring logs.

Subsurface Conditions

Subsurface Soil Profile

The subsurface soil profile present at the site consists of 5.5 to 17.5 feet of FILL overlying natural buried Topsoil and stiff Silty CLAY grading to very stiff Silty CLAY glacial till and hard Clayey SILT to Silty CLAY glacial till.

The thicker sections of FILL are present in the berm areas along the north and south property lines/street borders. The FILL is mostly granular and classifies as SAND to SAND and GRAVEL, with varying amounts of clay and silt. Silty SAND, SM and Clayey SAND, SC are also present. The FILL is slightly to medium dense with most Standard Penetration test values of 6 to 20 blows per foot. The FILL contained Slag that is mixed in with the granular soil sporadically in all locations, and more prevalent at the base of the fill. Occasional concrete and brick fragments were noted as well as wood pieces in the FILL.

The natural soil profile underlying the FILL described above consists of stiff to very stiff CLAY buried Topsoil, typically 12 to 18 inches thick, overlying stiff to very stiff light grey Silt CLAY. With greater depth, very stiff brown and grey Silty CLAY overlies hard, and in some cases very hard grey Silty CLAY to Clayey SILT.

Moisture contents (Mc) in the buried Topsoil layer range from 25 to 42 percent with most Mc readings from 30 to 39 percent. Site borings ESB-3 and ESB-5 had high moisture readings in the buried Topsoil at Mc = 82 and 46 percent, respectively. The underlying light grey Silty CLAY had moisture contents, Mc of 23 to 29 percent and unconfined compressive strengths of (Qu) of 0.93 to 3.26 tons per square foot. Except at B-2, where the light grey Silty CLAY was very moist and soft, Mc = 43 to 44 percent and Qu=0.19 tsf, and at ESB-5 where Mc = 24 and Qu = 0.31 tsf.

The brown and grey Silty CLAY had Mc=18 to 25 percent and Qu=2.25 to 5.08 tsf, in all boring locations except B-13 and B-14, where Mc of 30 to 34 percent and Qu of 1.13 and 1.40, respectively, were recorded.

The hard to very hard Clayey SILT to Silty Clay glacial till had moisture contents Mc of 9 to 19 percent with typical Qu of 4.5 to 10.86 tsf and a few sample intervals of Qu = 2 to 3 tsf. At boring B-6, a SAND layer was present from a depth of 27.5 feet to 30 feet plus.

Details of the soil types encountered in the soil borings are presented on the attached Boring Logs.

Ground Water Observations

Ground water measurements were performed during and immediately after the drilling operations. Table 1 below summarizes the ground water level readings at the borehole locations. Details of the ground water measurements are presented on the attached boring logs.

Table 1 – Ground Water Measurements

Boring Number	Ground Water Depth, ft		Ground Water Elevation	
	During Drilling	Delayed	During Drilling	Delayed
<i>BUILDING 1</i>				
B-1	NA	dry	NA	dry
B-2	13.5	16.2' @ 5 hrs	95.4	92.7
B-3	7.0	12.3' @ 1 day	101.0	95.7
B-4	9.8	Dry Cave @ 24'	91.6	NA
B-5	8.5	9.1' @ 6 hrs	95.8	95.2
B-6	25.0	Dry Cave @ 13.4'	78.2	NA
B-7	11.5	32' @ 0 hrs	94.8	NA
B-8	8.0	8.9' @ 1 day	95.5	94.6
B-9	7.5	8.1' @ 1 day	94.9	94.3
<i>BUILDING 2</i>				
B-10	5.5	5.5' @ 1 day	93.0	93.0
B-11	6.0	7.1' @ 1 day	94.0	92.9
B-12	4.8	4.8' @ 1 day	93.5	93.5
B-13	5.0	5.8' @ 1 day	93.5	92.7
B-14	6.0	7.0' @ 3 days	91.9	90.9
B-15	6.0	8.1' @ 1 day	95.8	93.7
B-16	6.0	7.3' @ 1 day	93.9	92.6
B-17	6.5	7.2' @ 1 hr	92.7	92.0

Table 1 – Ground Water Measurements (cont.)

<i>SITE</i>				
B-18	12.5	Dry Cave @ 7.7'	93.8	NA
ESB-1	19.0	DC @ 16.3' (4 hrs)	93.4	NA
ESB-2	NA	NA	NA	NA
ESB-3	14.0	DC @ 10'	94.6	NA
ESB-4	6.5	7.1' @ 1 day	95.5	94.9
ESB-5	7.0	5.4' @ 1 day	92.5	94.1
ESB-6	7.0	well	93.5	

Site Description and Location

The site is a triangular piece of property that lies south of W. Chicago Avenue, between Kilbourn Avenue and Tripp Avenue, in the Garfield Park/Humbolt Park neighborhood in Chicago. The site dimensions are roughly 2300 feet east to west and 740 feet north to south in the middle. The property is currently overgrown with fill berms located along a good portion of the north line and to about the west half of the south line. Previously, the site had railroad spur tracks that led into the site at W. Chicago Street and Kilbourn Avenue, and then dead ended on the east side of the site. The tracks have been removed with occasional wood ties and ballast exposed at the ground surface. The west end of the site is elevated above street level and contained by retaining wall structures.

Project Discussion

The project site is planned for a training campus for Chicago Police and Fire workers. The current site plans include a three-story building, 120,000 to 150,000 square feet in plan dimension, with a possible basement along W. Chicago Avenue, designated Building 1. A second building, labeled Building 2, is planned one story, 100,000 SF, high bay metal structure located in the northeast portion of the site. Either of these buildings may have a pool for rescue training.

Planned site improvements include parking lots to the west of Building 1 and surrounding Building 2 on three sides. Along the north property line, fire training aids will be constructed. These may consist of 3 story towers to practice fire rescues. In the south central portion of the site, a paved area is planned for truck driver training and other vehicle training.

Recommendations

Site Mass Grading and Subgrade Preparation

The site has been filled to raise the grade for the former rail yard, and fill was used to form berms along the north and a portion of the south property lines. This fill is mostly granular, sands to sand and gravel with varying amounts of silt and clay and cinders or slag. The site sits high, compared to surrounding streets and final grade has not yet been determined.

In non-green areas, all surface vegetation, railroad debris, or unsuitable support materials should be removed at the start of fill operations. Depending on site design grades, the large fill berms along portions of the north and south property lines will be removed or used as site fill. The site is a former rail yard and the existing Fill is expected to have some debris throughout, including slag and cinders. Larger items such as clay and concrete pipe, and/or concrete slabs should not be incorporated in the fill unless crushed to 3 inches or less. Wood railroad ties

should be removed from the site. Other debris, exposed in the site grading, may occur that should not be allowed in the structural fill.

After stripping the existing vegetation, tree removal, and removal of unsuitable underlying soils, subgrade preparation can begin. The grade should be cleaned of debris or other unsuitable accumulation. In areas to receive Structural FILL or at design grade, the exposed subgrade soils should be compacted, with a minimum of five passes of a heavy vibratory roller, then proof-rolled and examined for soft, loose or unstable areas. Proof-rolling should be done with a loaded semi-dump truck, rubber tired end loader or similar equipment with a wheel load sufficient to locate any soft or unstable areas. Any localized areas of unstable or otherwise unsuitable materials should be removed to the depth encountered or treated with a stabilizing layer on which base course layers can be constructed.

Structural Fill

Material used as Structural FILL for the yard area should be a cohesive (clay type) material, classified as 'CL' 'CL-ML' or a clean (low fines content) granular material such as 'SP', 'SW', 'GP' or 'GW', in accordance with ASTM D-2487, Classification of Soils for Engineering Purposes. The structural FILL should be placed in 9-inch maximum lifts loose measure, dried to within 2 percent of its optimum moisture content, and compacted to 95 percent of the maximum dry density as defined by ASTM D-1557.

Utility Trench Backfill

The trenches for utilities should be backfilled in accordance with the requirements of the project specifications. Pipes should be bedded in the specified bedding material. All trenches within any building, pavement areas, or supporting adjacent pavement or sidewalks should be backfilled and compacted to a minimum 95 % of the maximum dry density as defined by ASTM D-1557. Outside the limits of the building and pavement areas, compaction to 90% of ASTM D-1557 will be satisfactory.

For backfill supporting pavements or other utilities, granular trench backfill such as well-graded sand, crushed stone, or sand and gravel mixtures should be used. Controlled backfilling should be accomplished by placing the backfill materials in lifts not exceeding 9" loose measure and compacting the material with the appropriate equipment. Where imported granular soils are used for backfill, these should be adjusted to the correct moisture content for compaction, then placed in a controlled manner. Jetting, inundation, or flooding is not considered an appropriate or effective method of compaction for granular trench backfill on this site. The specifications should prohibit the use of these methods.

Foundation Recommendations - Building 1 – 4-Story Campus Building

The former rail yard was filled considerably to provide rail access using an overpass of Chicago Avenue. The fill is medium dense with some slightly dense granular material that is typically looser with depth. This existing granular fill will be suitable for support of pavements and floor slabs, but not suitable for building foundations. As such, it is recommended that foundations be located in underlying natural deposits. The existing FILL at the site was not constructed to support foundation loads for a building structure and a conventional shallow depth wall and column footings cannot be used without reconstructing or treating the existing fill at considerable cost to the project.

Design floor grades and whether a basement will be incorporated in the design will dictate the most economical foundation type. Design elevations for the structure have not been established as of this report. Table 2 below shows the foundation bearing elevations and recommended bearing pressures for conventional wall and column footings and for drilled piers for use in preliminary design and project costing. Depending on the first-floor elevation, a structure with a deeper basement may result in minor footing undercuts in areas to reach bearing soil, and therefore, footings to support the building may be more feasible. A structure without a basement will likely result in a drilled pier foundation being more feasible.

Table 2 – Building 1 Foundation Bearing Depths/Elevations

Boring No.	Ground Surface Elev.	Depth to 5000 psf for Footings	Elevation 5000 psf Footings	Depth to 14 ksf for Drilled Piers	Elevation 14 ksf for Drilled Piers
B-1	108.9	18.0	90.9	27.5	81.4
B-2	108.0	21.5	86.5	23.0	85.0
B-3	101.4	14.0	87.4	20.5	80.9
B-4	104.3	12.5	91.8	21.5	82.8
B-5	103.2	15.5	87.7	21.0	82.2
B-6	110.3	20.5	89.8	32.0	78.2
B-7	106.3	17.5	88.8	22.0	84.3
B-8	103.5	13.0	90.5	23.0	80.5
B-9	102.4	14.0	88.4	23.0	79.4

Foundation Recommendations - Building 2 – Single Story, High Bay, Metal Building

We expect this building to have a floor slab elevation near the existing grade at project elevation 98 to 100. Suitable bearing soil is 8 to 12 feet below this level, so recommended foundation types, are stepped down footings or short, drilled piers with grade beams.

Table 3 – Building 2 Foundation Bearing Depths/Elevations

Boring No.	Ground Surface Elev.	Depth to 3000 psf for Footings	Elevation 3000 psf Footings	Depth to 4000 psf for Footings	Elevation 4000 psf Footings
B-10	98.5	8.5	90.0	10.5	88.0
B-11	100.0	9.0	91.0	12.0	88.0
B-12	98.3	6.5	91.8	8.5	89.8
B-13	98.5	8.0	90.5	12.0	86.5
B-14	97.9	6.5	91.4	10.0	91.4
B-15	101.8	13.0	88.8	14.5	88.8
B-16	99.9	11.0	88.9	11.0	88.9
B-17	99.2	10.0	89.2	10.0	89.2

This structure can also be constructed with frost depth footings if Geopiers are used to create bearing strength in the upper existing FILL. Geopiers consists of properly spaced compacted aggregate columns, compacted with specialized equipment to densify the column and surrounding soil. A load transfer pad, typically aggregate reinforced with a geogrid, is used across the column matrix, to convey building loads.

Seismic Design Parameters

For the site seismic design calculations, the Spectral Response Accelerations from the 2003 NEHRP Seismic Design Provisions have been computed using the USGS website. The International Building Code (IBC) site classification definition is Class D. Please reference "2012/2015 International Building Code" Spectral Response Acceleration calculation sheet that is attached to this report for the computed design parameters. The resulting seismic design parameters are $S1=0.062\text{ g}$ (0.0 sec), $SM1=0.149\text{ g}$ (0.2 sec), and $SD1=0.099\text{ g}$ (1.0 sec).

Foundation Undercuts

Foundation undercut, where necessary and replaced with granular Structural Fill, should be extended horizontally one foot wider than the footing, on each side, plus one foot for each foot of undercut below the design footing elevation. Material used as granular Structural FILL under building foundations (undercuts) should be a crushed, select granular material such as Illinois Department of Transportation (IDOT) CA06, or approved equal. The material should be placed and compacted per the specification for 'Structural FILL'.

Design Parameters Slab-On-Grade - Interior

A six (6) inch minimum thickness granular FILL of well-graded aggregate such as IDOT CA-06 crushed stone should be used over the subgrade and under the slab. Based on the indicated thickness of granular sub base, a design subgrade modulus of 150 pounds per cubic inch for cohesive (clayey) subgrades and 200 pounds per cubic inch for granular subgrades (existing upper FILL) may be used for the slab design.

These values are representative of the design soil type and assume that the subgrade is properly dried and compacted prior to the slab construction. This means all areas disturbed by the superstructure erection are corrected in accordance with the plans and specifications.

Basement for Building 1

It is our understanding that a basement may be used for Building 1. Depending on final grades, a basement floor subgrade may be at or near the buried topsoil layer/ original ground elevation. If this is the case soft soil layers and or organic soil, as well as ground water may be present at this level. The basement floor subgrade should be inspected for strength and consistency and repaired with soil undercut/stone backfill replacement as necessary prior to floor construction. This would require a construction dewatering system in place during the work until the design basement dewatering, sumps and drains, and site storm sewer systems are in place and functioning.

Swimming Pool

A swimming pool for training is included in the plans for the campus. At this time, the pool may be located in either of the two buildings. The pool is expected to have similar soil subgrade problems as described in the basement section above. The pool will be below the prevailing ground water level in the borings and should be checked for buoyancy forces in the empty condition during pool service, and designed accordingly. Lateral earth pressures for design are shown below.

Lateral Earth Pressures for Structure Design

An undrained at rest earth pressure can develop for below grade concrete walls for pools and basements, rigidly restrained at the top by the floor slab. The following table outlines the earth pressure loading for design of these walls, based on these conditions. The effects of surcharge loads and live loads on the surface behind the wall must then also be added to these earth pressures.

Soil Description	Moist Unit Weight	Submerged Unit Weight	Angle of Internal Friction	At Rest Earth Pres. Coefficient	Equiv. Fluid Pressure
Granular FILL	125 pcf	63 pcf	30°	0.50	94 psf/ft*
Cohesive (Clayey)	130 pcf	68 pcf	28°	0.53	98 psf/ft*

Note * - Includes water pressure.

For sliding restraint, a soil to concrete friction coefficient of 0.30 for clays and 0.45 for the granular soil can be used.

Soil Permeability and Infiltration

Soil permeability testing was conducted on the existing granular FILL and underlying natural Silty CLAY. The granular FILL was tested for soil permeability in place at boring location ESB-4. The permeability of the Silty CLAY present at boring B-10 from a depth of 11 to 13 feet was determined by performing a laboratory hydraulic conductivity tests. The resulting soil permeability are:

Existing Granular FILL – Sand, little to some Gravel, trace Clay, SP-GP $k = 8.8 \times 10^{-4}$ cm/sec
Natural Silty CLAY–Brown & Grey Silty CLAY, trace Sand & Gravel, CL $k = 4.2 \times 10^{-7}$ cm/sec

Site surficial water infiltration will readily permeate or infiltrate through the upper granular fill and then essentially stop at the underlying natural clay soil profile.

Pavement Design Parameters

The pavement design should consider the strength of the subgrade soil, the number or frequency of vehicles and their axle load, the increase of traffic over the design life of the pavement, and the strengths and thickness of various pavement section materials. Both the AASHTO Design Method and the Mechanistic Design Method are commonly used to determine pavement section thicknesses. The results of these designs are subject to minimum standards provided by the local plan review agency. The materials used for the pavement section should be in accordance with the current Illinois Department of Transportation "Standard Specification for Road and Bridge Construction" and the "Supplemental Specifications and Recurring Special Provisions". A design bearing ratio of IBR=5 is appropriate for pavement section analysis for the subgrade soils prepared as recommended in this report.

Pavement Thickness

Recommended pavement sections have been selected using the AASHTO design method, and are adjusted for Illinois regional and material factors as recommended by the Illinois Department of Transportation "Pavement Design Manual". The design method takes into consideration traffic loading for a 20-year pavement design life, the subgrade support value and structural layer coefficients for each component of the pavement system.

It is our understanding that the facility will be used to train fire truck drivers. Considering an assumed truck traffic loading, the recommended pavement section thickness for these areas are listed below:

Flexible Pavement		Rigid Pavement	
Material	Layer Thickness	Material	Layer Thickness
Bituminous Surface	1.5"	PC Concrete	7.0"
Bituminous Binder	3.0"	Granular Base Course	4.0"
Granular Base Course	10.0"		

Notes

^{1,2} Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, Section 406, Hot Mix Asphalt Binder and Surface Course and Section 1030, Hot Mix Asphalt, High ESAL, N50 Design.

³ Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, Section 351, Aggregate Base Course and Section 1004, Coarse Aggregate, IDOT CA06 gradation.

⁴ Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, Section 420, Concrete Pavement and Section 1020, Portland Cement Concrete, Type PV and SI.

General Construction Recommendations

Excavations

Excavations into the granular soil profile, especially below the prevailing ground water levels will not stand vertical throughout the construction phase and will require sloping back or bracing of the sidewalls. Please note that OSHA and local codes require the use of shoring and bracing in the excavations during foundation installation and other excavation work, therefore the contractor should be well versed in these requirements.

Excavations below project elevation 93 to 95 will likely encounter ground water inflow and the contractor should be prepared to pump this water to maintain stable work conditions to avoid softening or loosening of soil.

Structural FILL and Earthwork Controls

Moisture-density relationships should be developed from materials obtained from the site excavations and from off-site borrow sources. These relationships should be used to monitor FILL and backfill placement and compaction.

Construction Materials Engineering

Foundation installation procedures should be reviewed prior to construction. Bearing materials should be sampled and tested for adequate strengths. Excavated soils and borrow materials should be evaluated for use in the project earthwork. A representative of the Geotechnical Engineer should be present during earthwork operations and foundation installation to ensure compliance with the Plans and Specifications.

Summary

The recommendations presented herein are based on the information available at the time of this writing. After the plans and specifications are more complete, we welcome the opportunity to review them with respect to prevailing soil and ground water conditions.

At that time, it may be necessary to conduct further analysis and submit supplementary recommendations. If the plans are changed with respect to the locations of structures or loading conditions, the soils information must be reviewed to determine whether it is pertinent to the new plans.

Closure

Thank you for the opportunity to provide our services. Please contact us with any questions you have regarding foundation design, earthwork, and construction for the project.

Sincerely,
MIDLAND STANDARD ENGINEERING & TESTING, INC.



William J. Wyzgala, P.E.
Principal Engineer

WJW

Attachments

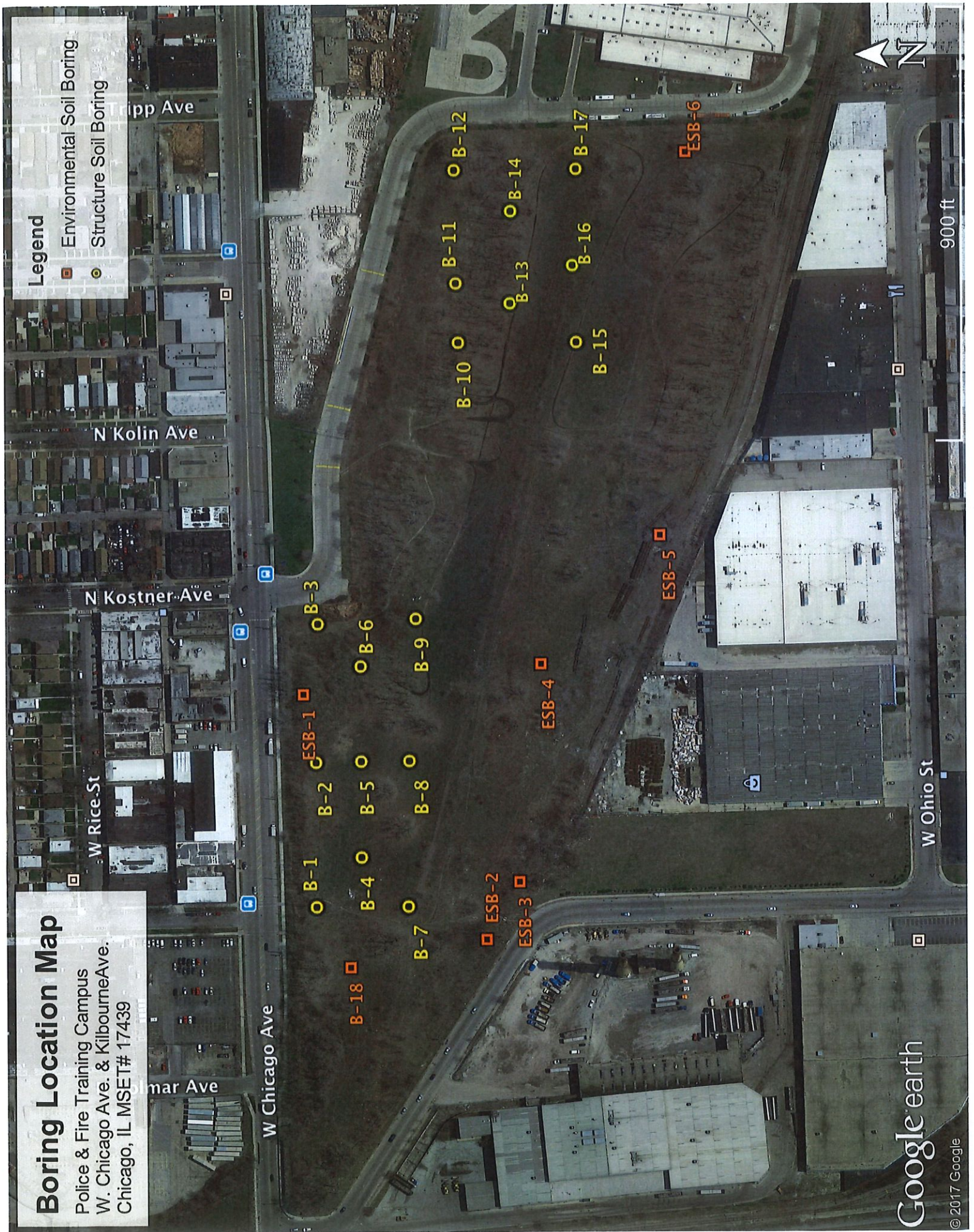
- Boring Location Diagram
- AMEC – Planned Land Development
- Records of Subsurface Exploration (B-1 to B-18 & ESB-1 to ESB-6)
- Soil Profile Drawings
- USGS Seismic Report
- Laboratory Data Sheets
- General Notes

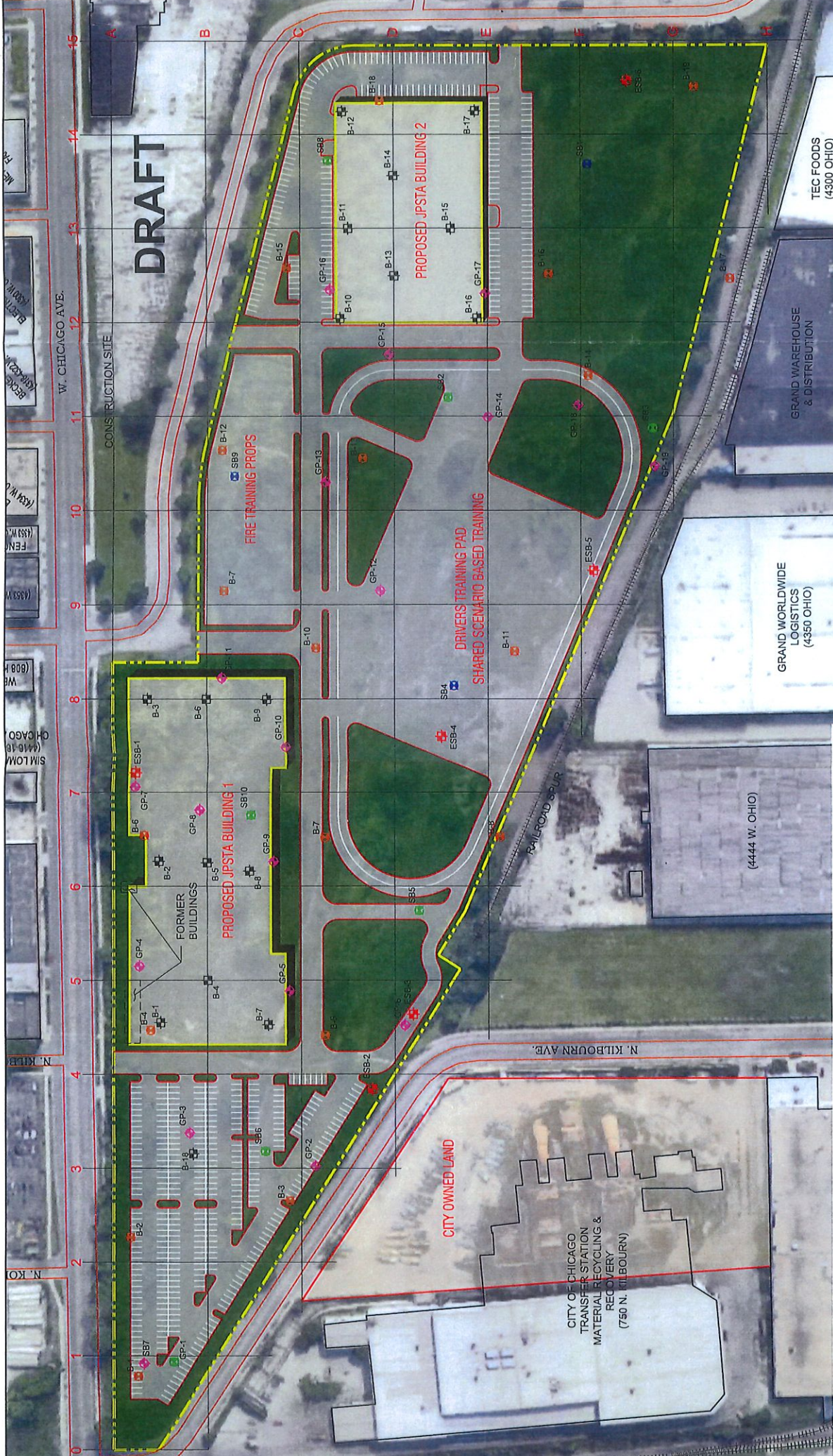
Boring Location Map

Police & Fire Training Campus
W. Chicago Ave. & Kilbourne Ave.
Chicago, IL MSET# 17439

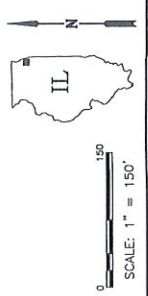
Legend

- Environmental Soil Boring
- Structure Soil Boring





- LEGEND:
- ◆ = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (CARLSON 2007)
 - = APPROXIMATE GEOTECHNICAL SOIL BORING LOCATION (WARZYN 1998)
 - = APPROXIMATE ENVIRONMENTAL SOIL BORING LOCATION (WARZYN 1991)
 - = LOCATION (CARLSON 1981)
 - ◆ = PROPOSED GEOTECHNICAL ENVIRONMENTAL SOIL BORING LOCATION (2017)
 - ◆ = PROPOSED ENVIRONMENTAL SOIL BORING LOCATION (2017)




 amec foster wheeler
 Environment & Infrastructure, Inc.

Map Showing Planned Land Development & Boring Locations
 Vacant Parcel
 4303 W. Chicago Avenue
 Chicago, IL

DRAWN: GAP
 PROJECT NUMBER: 3205171606
 APPROVED: 8/1/17
 DATE: REVISED DATE: REV. NO.:




PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown and Black Silty SAND, some Gravel, little Slag, trace Scrap Metal, SM, meium dense	108.9	SS	1	21	5			
		trace Concrete at 1.5'		SS	2	25	3			
4		trace RAP at 4.5'		SS	3	20	2			
		FILL: Black and Brown Clayey SAND to Sandy CLAY, some Gravel, trace Slag, SC, medium dense	102.9	SS	4	20	11			
		FILL: Black SAND, some Gravel, trace Brick, SP, medium dense	100.4	SS	5	28	7			
		Brown and Black Clay at 10.0'		SS	6	23	7			
12		FILL: Brown, Black and Grey Silty CLAY, some Sand, little Gravel, trace Slag, CL, moist, slightly dense	96.9	SS	7	4	18	103	1.98	
		Black to Dark Grey CLAY, CL-CH	93.4	SS	8A	6	14		1.0 Qp	
16		Brown and Grey Silty CLAY, trace Sand, trace Gravel, CL, stiff to very stiff	92.4	SS	8B	10	39		1.25 Qp	
				SS	9	9	22	100	3.96	
20				SS	10	9	24	97	3.18	
		Grey Silty CLAY, little Sand, trace Gravel, CL, hard	85.9	SS	11	12	17		4.5 + Qp	
24										
		Grey SILT, little Sand, ML, very dense	81.4	SS	12	39	16			
28										

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING:  None
 IMMEDIATELY AFTER DRILLING:  Dry
 DELAYED READING AFTER  None



BORING STARTED: 8/9/17
 BORING COMPLETED: 8/9/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
32		Grey SILT, little Sand, ML very dense	77.4							
		Grey Clayey SILT, some Sand, CL-ML	76.4							
				SS	13A	31	11			
				SS	13B	42	13	121	--	10.75
36		Grey Silty CLAY, little Sand, trace Gravel, CL	74.4							
				SS	14	48	10	113		5.01
40		End of Boring at 40 feet	68.9							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING:
 IMMEDIATELY AFTER DRILLING:
 DELAYED READING AFTER

 None
 Dry




BORING STARTED: 8/9/17
 BORING COMPLETED: 8/9/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0	[Pattern]	FILL: Black and Brown Sandy CLAY, some Gravel, SC, medium dense	108.0	SS	1	15	9			
		FILL: Black Sand, SP Concrete at 2.5'	106.5	SS	2	50/ 3"	7			
4	[Pattern]	FILL: Black Silty SAND, little Clay, some Gravel, trace Slag, SM, medium dense	104.0	SS	3	18	6			
		FILL: Brown SAND (f-c), little to some Gravel, SP, medium dense	101.5	SS	4A	14	9			
8	[Pattern]	FILL: Brown SAND (f-c), little to some Gravel, SP, medium dense	101.5	SS	4B	20	3			
		FILL: Brown and Black Clayey SAND, SC, slightly dense	99.5	ST	5					
12	[Pattern]	FILL: Brown SAND, with Clay seams, SP-CL	96.0	SS	6	7	14			
		wet at 13.5'		SS	7	6	17			
16	[Pattern]	Black to Dark Grey CLAY, CL-CH	92.5	SS	8A	6	10	80	1.16	
		Grey, trace Dark Grey CLAY, trace Sand, fe stains, CL-CH, moist, very soft	91.0	SS	8B	4	42	80	1.16	
20	[Pattern]	Grey Silty CLAY, little Sand, trace Gravel, CL, hard	86.5	SS	9	4	44	80	0.19	
		Grey Silty CLAY, little Sand, trace Gravel, CL, hard	86.5	SS	10A	WOH	43	78	0.04	
24	[Pattern]	Grey Silty CLAY, little Sand, trace Gravel, CL, hard	86.5	SS	10B	11	15	124	4.81	
		Grey Silty CLAY, little Sand, trace Gravel, CL, hard	86.5	SS	11	23	12	116	7.49	
28	[Pattern]	to very stiff								
		End of Boring at 30 feet		SS	12	54	11	107	2.83	

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 13.5'
 IMMEDIATELY AFTER DRILLING: 27.2'
 DELAYED READING AFTER 5.25 Hrs 16.2'



BORING STARTED: 8/9/17
 BORING COMPLETED: 8/9/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0	[Dotted pattern]	FILL: Brown and Black SAND to Sandy CLAY, little to some Gravel, SP-SC, medium dense	101.4	SS	1	11	8			very poor recovery
4			SS	2	11	12		1.5 Qp		
		FILL: Brown SAND (f-m), little Gravel, SP, medium to slightly dense	96.9	SS	3	13	6			
8		wet at 7.0'		SS	4	6	17			
		Black to Dark Grey CLAY, CL-CH	92.4	SS	5	4	30			
12		Dark Grey to Light Grey Silty CLAY, trace Sand, fe stains, CL, stiff	90.4	SS	6	9	29		2.0 Qp	
				SS	7	10	29	91	1.82	
16		Brown and Grey Silty CLAY, little to trace Sand, trace Gravel, CL, very stiff	87.4	SS	8	8	18	107	3.14	
		Grey Silty CLAY, little to trace Sand, trace Gravel, CL, stiff	85.4							
20				SS	9	7	24	97	1.90	
		Grey Silty CLAY to Clayey SILT, little Sand, trace Gravel, CL-ML, hard	80.9	SS	10	28	11	120	7.34	
24				SS	11	18	15	113	6.63	
28		Grey SILT, little Sand, ML, very dense	73.9	SS	12	37	9			

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 7.0'
 IMMEDIATELY AFTER DRILLING: Dry
 DELAYED READING AFTER 24 Hrs 12.3'



BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
32		Grey SILT, little Sand, ML, very dense	69.9							
		Grey Silty CLAY to Clayey SILT, little Sand, trace Gravel, CL-ML, very hard	68.9	SS	13	28	11	118	8.69	
36										
		Spoon Refusal at 39.5'	61.9	SS	14	50/ 5"	7			

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 7.0'
 IMMEDIATELY AFTER DRILLING: Dry
 DELAYED READING AFTER 24 Hrs 12.3'



BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.




PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black Silty SAND, little Gravel, SM, slightly dense	104.3	SS	1	9	13			
4		FILL: Brown SAND (f-m), little Gravel, trace Clay, trace Silt, SP slightly dense	102.3	SS	2	5	3			
				SS	3	8	15			
				SS	4	9	6			
8		Brown and Black, moist to wet at 9.8'		SS	5	6	16			poor recovery
		Dark Grey to Light Grey Silty CLAY, trace Sand, fe stains, CL, very stiff	94.3	SS	6	5	23	96	2.17	
12		Brown and Grey Silty CLAY, little Sand, trace Gravel, CL, hard to very stiff	91.8	SS	7	7	22	99	4.66	
				SS	8	6	24	95	2.75	
20		Grey Silty CLAY, little Sand, trace Gravel, CL, very stiff	86.8	SS	9	14	19	105	3.23	
				SS	10A	9	13	118	7.49	
				SS	10B	44	12			
24		Grey Silty CLAY to Clayey SILT, little Sand, trace Gravel, CL-ML	82.3	SS	11	42	10			
28				SS	12	44	9	113	7.09	
End of Boring at 30 feet										

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING:  9.8'
 IMMEDIATELY AFTER DRILLING:  Dry
 DELAYED READING AFTER 



MSET

BORING STARTED: 8/2/17
 BORING COMPLETED: 8/2/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black Silty SAND, SM	103.2							
		FILL: Brown SAND (f-m), little to some Gravel, SP, medium dense	102.2	SS	1	11	4			
4				SS	2	10	3			
				SS	3	18	9			
8		moist at 7.5'								
		FILL: Brown and Black SAND and GRAVEL, some Clay, GP-SP, wet	95.2	SS	4A	7	31		--	
		Black to Dark Grey CLAY, trace Sand, CL-CH, very stiff	93.7	SS	4B	4	31	85	2.10	
12		Grey and Dark Grey, trace Brown Silty CLAY, trace Sand, fe stains, CL, very stiff to stiff	92.2	ST	5	NA	25	105	2.75 Qp	
				SS	6	5	35	83	1.01	
16		moist Grey Silty CLAY, trace Sand, trace Gravel, CL, very stiff	87.7	SS	7	9	20	104	2.56	
		Grey Clayey SILT, little Sand, trace Gravel, CL-ML, medium dense to dense	85.7	SS	8	24	15	113		
20				SS	9	33	13			
24				SS	10	35	11			
28		Grey Silty CLAY, little to some Sand, trace to little Gravel, CL, hard	75.7	SS	11	28	19	109	7.64	

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 8.5'
 IMMEDIATELY AFTER DRILLING: 9.8'
 DELAYED READING AFTER 6 Hrs 9.1'



BORING STARTED: 8/4/17
 BORING COMPLETED: 8/4/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.




PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
32		Grey Silty CLAY, little to some Sand, trace to little Gravel, CL hard to very stiff	71.7							no recovery
				SS	12	50/5"				
36										
40		End of Boring at 40 feet	63.2							
				SS	13	92/9"	12	123	3.62	

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING:  8.5'
 IMMEDIATELY AFTER DRILLING:  9.8'
 DELAYED READING AFTER 6 Hrs  9.1'



BORING STARTED: 8/4/17
 BORING COMPLETED: 8/4/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown and Black Silty CLAY, some Sand, some Gravel, some Concrete, CL-SC, dense	110.3	SS	1	46	10			poor recovery
				SS	2	29	2			poor recovery
4		to slightly dense		SS	3	8				no recovery
				SS	4	4	21		1.0 Qp	
8		FILL: Black Silty SAND, little Gravel, SM, medium dense	101.8	SS	5A	4	27	91	0.5 Qp	
				SS	5B	29	14			
12		FILL: Brown SAND (f-m) little to some Gravel, trace Silt, SP, slightly to medium dense	100.3	SS	6	27	4			
				SS	7	7	6			
16		moist		SS	8	8	12			
20		Black to Dark Grey CLAY, CL-CH, very stiff	92.8	SS	9A	6	25	95	2.83	
				SS	9B	6	24	96	3.26	
		Light Grey Silty CLAY, trace Sand, stains, CL, very stiff	91.3							
		Brown and Grey Silty CLAY, trace Sand, trace Gravel, CL, very stiff	89.8	SS	10	8	23		3.69	
24		Grey Silty CLAY, little Sand, trace Gravel, CL, very stiff	87.3	SS	11	11	19		2.37	
28		Grey SAND (f-c), little Gravel, SP, wet medium dense	82.8	SS	12	10	18			
			End of Boring at 30 feet							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 25.0'
 IMMEDIATELY AFTER DRILLING: dry
 DELAYED READING AFTER 24 Hrs dry



BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black Silty SAND, trace Clay, some Gravel, SM, medium dense	106.3	SS	1	10	6			
4		FILL: Brown SAND (f-m), little Gravel, trace to little Clay, little Silt, SP-SM slightly dense	103.8	SS	2	9	7			
				SS	3	6	11			
				SS	4	5	7			
				SS	5	9	4			
				SS	6	8	7			
12		FILL: Black SAND, some Gravel, SP, medium dense, moist to wet	94.3	SS	7A	11	10			--
		Black to Dark Grey CLAY, CL-CH,	93.3	SS	7B	5	26	95		2.0 Qp
		Light Grey Silty CLAY, trace Sand, fe stains, CL, very stiff	92.3	SS	8	11	24	101		2.87
16										
20		Brown and Grey to Grey Silty CLAY with intermittent Sandy Silt seams, little Sand, trace to little Gravel, CL hard	88.8	SS	9	10	18	105		5.08
				SS	10	17	12	114		5.07
		wet at 22.0'								
24				SS	11	31	9	110		7.99
28		to very hard	78.3	SS	12	23	13	120		13.58

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 11.5'
 IMMEDIATELY AFTER DRILLING: 32.0'
 DELAYED READING AFTER





BORING STARTED: 8/2/17
 BORING COMPLETED: 8/2/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.




PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
32		Brown and Grey Silty CLAY, little Sand, trace to little Gravel, CL hard	74.8							
			SS	13	38	12	114	4.5+ Qp		
36										
40		Grey SILT, trace Sand, ML	67.8	SS	14	73	10			
		End of Boring at 40 feet	66.3							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING:  11.5'
 IMMEDIATELY AFTER DRILLING:  32.0'
 DELAYED READING AFTER 



BORING STARTED: 8/2/17
 BORING COMPLETED: 8/2/17
 LOGGED BY: GPF
 BORING METHOD: H.S.A.

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, Topsoil, 12"	103.5							
		FILL: Brown, trace Black SAND, little to some Gravel, trace Silt, SP-GP medium to slightly dense	102.5	SS	1	14	3			
4		little Silt	99.5	SS	2	7	10			
		trace slag, moist to wet	96.5	SS	3	17	11			
8		clayey seam at 9 feet	94.5	SS	4A	8	13			
		Black CLAY, CL-CH stiff	94.0	SS	4B	10	31	85	1.82	
12		Light Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	93.0	ST	5				2.25 Qp	
		Brown and Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	90.5	SS	6	8	24	97	3.38	
16		Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	87.5	SS	7	12	18	106	3.84	
		Grey Clayey SILT, CL-ML medium dense	85.5	SS	8A	10	15			
20		Grey SAND & GRAVEL, trace Silt, GP-SP medium dense	84.5	SS	8B	12	9			
		to SAND, trace Silt, SP		SS	9A	11	29			
		Grey SILT, ML medium dense	81.5	SS	9B	12	21			
24		Grey Silty CLAY, little Sand, trace Gravel, CL hard	80.5	SS	10	40	13	121	4.5+ Qp	
28		End of Boring at 30 Feet		SS	11	44	11	122	6.60	

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 8.0'
 IMMEDIATELY AFTER DRILLING: 11.5'
 DELAYED READING AFTER 1 day: 8.9'



BORING STARTED: 8/3/17
 BORING COMPLETED: 8/3/17
 LOGGED BY: GPF
 BORING METHOD: HJSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown & Black Silty CLAY, some Sand, some Gravel, SC	102.4	SS	1A	13	12		4.5+ Qp	
		FILL: Black SAND, some Gravel, trace Slag, SP-GP medium dense	101.4	SS	1B	21	10			
				SS	2A	21	13			
				SS	2B	20	7			
4		FILL: Brown SAND, little Gravel, some Silt & Clay, SM medium dense	99.4	SS	3	15	7			
		Black & Brown SAND & GRAVEL to Clayey SAND seam at 7 to 8 feet	96.4	SS	4	13	8			
		some slag	93.9	SS	5	22	9			
		FILL: Brown and Grey SAND & GRAVEL, little Clay, GM-SP medium dense	93.4	SS	6A	13	12			
		Black and Dark Grey CLAY, CL-CH stiff	91.4		6B	4	38	89	2.17	
12		Light Grey Silty CLAY, trace Sand, trace Gravel, CL stiff	90.4	SS	7	6	25	97	1.98	
		Brown & Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	88.4	SS	8	5	23	100	2.79	
16										
		Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	84.9	SS	9	9	21		2.25 Qp	
20		Grey Clayey SILT, little Sand, trace Gravel, CL-ML, very stiff moist seam at 21.5'	81.9	SS	10	24	12	117	2.37	
24				SS	11	49	12			
28		Grey Silty CLAY, little Sand, trace Gravel, CL very hard	73.9	SS	12	43	10	119	9.31	

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 7.5'
 IMMEDIATELY AFTER DRILLING: 9.2'
 DELAYED READING AFTER 1 Day: 8.1'



BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: **Police and Fire Training Campus** SITE LOCATION: **Chicago, Illinois**
 BORING LOCATION: **See Location Map** CLIENT: **AMEC Foster Wheeler**

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
32		Grey Silty CLAY, little Sand, trace Gravel, CL, very hard	70.9							
				SS	13	70/9"	12	121	10.86	
36		Possible Boulder at 36.0'	67.4							
		End of Boring, Refusal at 36 Feet	66.4		14	50/2"	8			

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 7.5'
 IMMEDIATELY AFTER DRILLING: 9.2'
 DELAYED READING AFTER 1 Day: 8.1'



BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS			
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf				
0	[Pattern: Dotted]	FILL: Black Sandy CLAY Topsoil 6"	98.5	SS	1	15	2						
		FILL: Brown SAND, little to some Gravel, SP, medium dense	98.0								2	22	3
4											3	16	9
	[Pattern: Dotted]	FILL: Black & Brown SAND & GRAVEL, little Clay, Gm-SM trace Slag	93.5	SS	4	4	27	89	1.20				
		Black & Dark Grey CLAY, CL-CH	92.5								4	4	27
8	[Pattern: Diagonal Lines]	Grey & Dark Grey Silty CLAY, trace Sand, stiff, CL to light grey with fe stains	91.5	SS	5	4	25	95	1.51				
			91.0								5	4	25
12	[Pattern: Diagonal Lines]	Brown and Grey to Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	88.0	ST	6	NA	25	99	4.0 Qp				
											6	NA	25
16	[Pattern: Diagonal Lines]	Grey Silty CLAY to Clayey SILT, little Sand, trace Gravel, CL-ML	81.0	SS	8	19	19	106	2.33				
											8	19	19
20	[Pattern: Diagonal Lines]	sand seam at 19'		SS	9	23	16	115	2.10				
											9	23	16
24	[Pattern: Diagonal Lines]	Grey Silty CLAY, little Sand, trace Gravel, CL very stiff to hard	78.0	SS	10	20	11	117	7.72				
											10	20	11
		End of Boring at 25 Feet	73.5										

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 5.5'
 IMMEDIATELY AFTER DRILLING: 18.2'
 DELAYED READING AFTER 1 Day: 5.5'

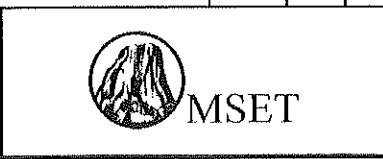


BORING STARTED: 8/7/17
 BORING COMPLETED: 8/7/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown & Black Silty CLAY, some Sand, Little to some Gravel, SC-GC hard	100.0	SS	1	14	16		4.5 + Qp	
		FILL: Black SAND, little Clay, SC medium dense	98.0	SS	2A	18	11			
			97.0		2B	19	2			
4		FILL: Brown SAND, little to some Gravel, SP-GP medium dense Dark Brown Clay FILL layer at 4 Feet	96.0	SS	3	19	5			
			93.5	SS	4A	9	11			
		FILL: Brown SAND & GRAVEL, GP-SP, wet, slightly dense	92.5		4B	4	18			
8		Black & Dark Grey CLAY, CL-CH		SS	5	4	-			
		Grey to Dark Grey Silty CLAY, trace Sand, trace fibers, fe stains, CL, very stiff	91.0	SS	6	7	24	97	2.06	
12		Brown & Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff moist seams at 14 & 14.5 feet	88.0	SS	7	7	21	103	3.76	
				SS	8	7	27	92	2.44	
16										
		Grey Clayey SILT, little Sand, CL-ML, medium dense	82.5	SS	9	16	18			
20		Grey Silty CLAY, little Sand, trace Gravel, CL hard to very hard	79.5	SS	10	20	15	114	8.94	
24				SS	11	21	16	113	7.95	
		End of Boring at 25 Feet	75.0							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 6.0'
 IMMEDIATELY AFTER DRILLING: Dry
 DELAYED READING AFTER 1 Day: 0.45'



BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, little Clay, some Gravel, SC-GC Topsoil	98.3	SS	1	16	6			
		FILL: Brown SAND, little to some Gravel, SP-GP medium dense	96.8	SS	2	15	6			
4				SS	3A	16	11			
		moist	93.3							
		Black Sandy CLAY, SC stiff	92.8		3B	8	34		1.0 Qp	
		Black CLAY, CL-CH stiff	92.3	SS	4A	4	37		1.0 Qp	
		Grey & Dark Grey Silty CLAY, trace Sand, CL, very stiff	91.8		4B	6	25	94	2.29	
8				SS	5	5	21	102	2.99	
		Brown & Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	89.8							
				SS	6	6	23	100	2.29	
12				SS	7	8	25	95	2.68	
		Grey SILT to Clayey SILT, trace Sand, CL-ML medium dense	84.3	SS	8	21	18			
16										
		to little sand, trace Gravel	79.3	SS	9	28	10	118	6.28	
20				SS	10	18	15	111	7.33	
		Grey Silty CLAY, little Sand, trace Gravel, CL hard	77.8							
24				SS	11	23	12	116	7.64	
		End of Boring at 25 Feet	73.3							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 5.0'
 IMMEDIATELY AFTER DRILLING: 19.4'
 DELAYED READING AFTER 1 Day: 4.8'



BORING STARTED: 8/7/17
 BORING COMPLETED: 8/7/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, little Gravel, trace Clay, Topsoil 12"	98.5							
		FILL: Brown SAND, little to some Gravel, trace Silt, GP-GP medium dense	97.5	SS	1	19	5			
4				SS	2	15	12			
		FILL: Black SAND & GRAVEL, trace Slag, trace Clay, wet, slightly dense to brown at 6 Feet	94.0	SS	3A	10	11			
		Dark Grey CLAY, CL-CH stiff	92.0		3B	4	38		1.0 Qp	
8		Light Grey, trace Dark Grey Silty CLAY, trace Sand, fe stains, CL stiff	90.5	SS	4	5	25	103	1.94	
		Brown & Grey Silty CLAY, trace Sand, trace Gravel, CL stiff	88.0	SS	5	6	23	100	1.40	
12		Grey Clayey SILT, little Sand, CL-ML, hard	85.5	SS	6	7	25	100	2.10	
		sand seam at 17' clay seam at 17.2'								
16		trace Gravel		SS	7	22	20	106	5.03	
				SS	8	28	12			
20		Grey Silty CLAY, little Sand, trace Gravel, CL hard	78.0	SS	9	18	16	111	7.22	
		Grey Clayey SILT, little Sand, trace Gravel, CL-ML hard	75.5	SS	10	26	11	117	4.66	
24										
28		End of Boring at 30 Feet		SS	11	21	12	119	7.53	

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 5.0'
 IMMEDIATELY AFTER DRILLING: 24.2'
 DELAYED READING AFTER 1 Day: 5.8'



BORING STARTED: 8/7/17
 BORING COMPLETED: 8/7/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, little Gravel, SP	97.9	SS	1	8	11			
		Topsoil 12"	96.9							
		FILL: Brown SAND, little to some Gravel, SP-GP slightly dense	95.4	SS	2	7	21		2.5 Qp	
4		FILL: Dark Brown Sandy CLAY, little Gravel, SC, slightly dense	93.9	SS	3	16	8			
		FILL: Brown SAND, little to some Gravel, moist, SP, medium dense	91.9	SS	4	5	26	92	1.86	
		Dark Grey CLAY, CL-CH stiff	91.4	SS	4	5	26	92	1.86	
8		Grey & Dark Grey Silty CLAY, trace Sand, fe stains, CL	89.4	SS	5	6	26	83	1.40	
		trace wood/organics	87.9	SS	6	8	30	89	2.06	
12		Brown, Grey & Dark Grey Silty CLAY, trace Sand, CL very stiff to stiff	87.9	SS	6	8	30	89	2.06	
		very moist at 13'		SS	7	6	34	100	1.13	
				SS	8A	6	19	104	2.83	
16		Grey Clayey SILT, little Sand, trace Gravel, CL-ML, medium dense	83.4		8B	18	15	111		
			80.4	SS	9	23	12	115	9.47	
20		Grey Silty CLAY, little Sand, trace Gravel, CL hard to very hard	80.4	SS	9	23	12	115	9.47	
24				SS	10	28	16	114	8.26	
				SS	11	21	12	121	6.79	
28				SS	12	20	12	120	4.58	
		End of Boring at 30 Feet	68.4							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 6.0'
 IMMEDIATELY AFTER DRILLING: dry
 DELAYED READING AFTER 3 Days: 7.0'



BORING STARTED: 8/4/17
 BORING COMPLETED: 8/4/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black Clayey SAND, little Gravel, SC Topsoil 18"	101.8	SS	1A	8	11			
		FILL: Black SAND & SLAG, SP, slightly to medium dense	100.3	SS	1B	8	65			
					2A	11	10			
		FILL: Brown SAND, little Gravel, trace to little Silt, SP medium to slightly dense	98.8		2B	10	6			
4				SS	3	12	8			
		moist	96.3							
		FILL: Brown to Black Sandy CLAY, little Gravel, wet, SC, slightly to medium dense	95.8	SS	4	6	23			
8				SS	5	11	19			
				SS	6A	7	13			
		Black & Dark Grey CLAY, CL-CH stiff	90.3		6B	4	34		1.25 Qp	
12		Grey to Dark Grey Silty CLAY, trace Sand, fe stains, CL, trace fibers, stiff	89.3	SS	7	6	27			
		Brown & Grey Silty CLAY, little Sand, trace Gravel, CL, very stiff	87.3	SS	8	6	25	101	3.49	
16										
		Grey Clayey SILT, little Sand, trace Gravel, CL medium dense to dense	84.3	SS	9	27	15	117	3.65	
20										
		Grey Silty CLAY, little Sand, trace Gravel, CL, hard	81.3	SS	10	30	11	117	5.05	
24				SS	11	12	17	110	5.41	
		End of Boring at 25 Feet	76.8							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 6.0'
 IMMEDIATELY AFTER DRILLING: 12.6'
 DELAYED READING AFTER 1 Day: 8.1'

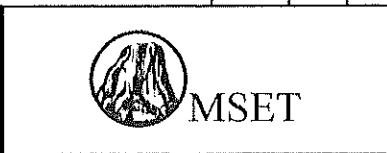


BORING STARTED: 8/8/17
 BORING COMPLETED: 8/8/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, little Clay, SP-SC Topsoil 18"	99.9	SS	1	18	6			
		FILL: Brown SAND, little to some Gravel, SP-GP medium dense	98.4	SS	2	17				
4				SS	3	16	4			
		Silty SAND layer	93.4	SS	4	7	34			
8		FILL: Black SAND & GRAVEL, little Silt, trace Slag, wood, SM-GM	92.9	SS	5	4	32			1.0
	Black CLAY, CL-CH stiff	91.4								
		Grey and Dark Grey Silty CLAY, trace Sand, CL firm		SS	6A	4	26	104	0.93	
		Brown & Grey Silty CLAY, little Sand, trace Gravel, CL very stiff	88.9		6B	5	22	100	3.45	
12		moist	86.4	SS	7	4	24	97	1.55	
				SS	8	4	23	97	2.10	
16										
		Grey Silty CLAY, little Sand, trace Gravel, CL hard	82.4	SS	9	26	12	120	5.90	
20				SS	10	19	16	111	5.86	
24				SS	11	17	16	113	5.63	
		End of Boring at 25 Feet	74.9							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 6.0'
 IMMEDIATELY AFTER DRILLING: 7.7'
 DELAYED READING AFTER 1 Day 7.3'



BORING STARTED: 8/7/17
 BORING COMPLETED: 8/7/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, trace Silt, SP	99.2	SS	1A	10	8			Poor Recovery
		Topsoil 12"	98.2		1B	24	4			
		FILL: Brown SAND & GRAVEL, little clay, GP-SP medium dense		SS	2	19	-			
4		FILL: Brown SAND, little to some Gravel, little Silt, SP-GP, medium dense	95.2	SS	3	13	14			
		Black, trace Slag, wet	92.2	SS	4A	6	44		1.25 Qp	
		Dark Grey & Black CLAY, CL-CH stiff	91.7		4B	4	36			
8		Light Grey and Dark Grey Silty CLAY, trace Sand, fe stains, CL very stiff	90.7	SS	5	4	28	90	1.20	
				SS	6	8	27	90	2.25	
12		Brown & Grey Silty CLAY, little Sand, trace Gravel, CL very stiff	86.7	ST	7		20	108		
16		Grey Clayey SILT, trace to little Sand, trace Gravel, CL-ML very stiff	83.7	SS	8	19	17	107	2.91	
20		to Silty CLAY, hard	78.7	SS	9	24	13	116	3.75	
				SS	10	24	11	114	9.00	
24				SS	11	22	12	112	9.47	
		End of Boring at 25 Feet	74.2							

WATER LEVEL OBSERVATIONS, ft.

DURING DRILLING:

▽ 6.5'

IMMEDIATELY AFTER DRILLING:

▽ 16.5'

DELAYED READING AFTER 1 Day

▽ 7.2'



MSET

BORING STARTED: 8/4/17

BORING COMPLETED: 8/4/17

LOGGED BY: GPF

BORING METHOD: HSA

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown to Black Silty SAND, some Gravel, little Slag, SM-GM medium to slightly dense	106.3	SS	1	13	7			
				SS	2	7	15			
4		FILL: Brown SAND, little to some Gravel, trace Silt & Clay, SP slightly to medium dense	101.8	SS	3	14	3			
				SS	4	6	7			
8				SS	5	8	4			
				SS	6	7	5			
12		FILL: Brown & Dark Grey SAND & GRAVEL, trace Slag, wet, GP-SP slightly dense	94.3	SS	7A	6	22			
				93.3		7B	4	32	90	1.71
16		Black to Dark Grey CLAY, CL-CH stiff	92.1							
		Light Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	90.3	SS	8	6	23	97	3.30	
		End of Boring at 16 Feet								

WATER LEVEL OBSERVATIONS, ft.

DURING DRILLING:

IMMEDIATELY AFTER DRILLING:

DELAYED READING AFTER 2 hrs

12.5'
 Dry
 0'0" 7'



MSET

BORING STARTED: 8/9/17

BORING COMPLETED: 8/9/17

LOGGED BY: GPF

BORING METHOD: HSA

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown & Black Sandy CLAY, some Gravel, SC-GC medium dense Concrete	106.3 104.8	SS	1	19	6			
4		FILL: Black SAND, some Gravel, little clay, trace Slag, SP-GP slightly dense	103.8	SS	2	7	6			
		Wood, Organics	99.8	SS	3	7	8			
8			97.8	SS	4	10	6			
		FILL: Black Sandy CLAY, some Gravel, trace slag, SC-GC, slightly to medium dense	97.8 96.3	SS	5	6	22			
12		brick fragments	94.5							
		FILL: Brown SAND, little to some Gravel, SP-GP, dense	93.8	SS	6	17	12			
		FILL: Dark Brown & Black Silty CLAY, some Sand, some Gravel, SC-GC, very stiff	92.3 90.8	SS	7	31	4			
16		FILL: Brown SAND, little to some Gravel, SP medium dense			8A	11	16			2.5 Qp
		FILL: Brown Silty SAND, SM, wet, slightly dense	88.8		8B	18	4			
20			86.8 86.3	SS	9A	9	20			
		Black to Dark Grey CLAY, CL-CH very stiff			9B	4	34	84		2.29
		End of Boring at 20 Feet								

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 19.0'
 IMMEDIATELY AFTER DRILLING: Dry
 DELAYED READING AFTER 4 hrs: Dayc



BORING STARTED: 8/9/17
 BORING COMPLETED: 8/9/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus

SITE LOCATION: Chicago, Illinois

BORING LOCATION: See Location Map

CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Brown, Grey, & Black Silty CLAY, some Sand, little Gravel, CL very stiff	112.4	SS	1	6	11		3.5 Qp	
		heavy roots at 5"	110.9							
		FILL: Black Clayey SAND, SC Topsoil	110.4	SS	2	18	3			
4		FILL: Brown SAND, little to some Gravel, SP-GP, medium to slightly dense		SS	3	6	-			
				SS	4	11	5			
8				SS	5	9	3			
				SS	6	25	5			
12		Black, moist	100.9	SS	7	4	27	88	2.60	
		Black to Dark Grey Silty CLAY, trace Sand, CL-CH very stiff	99.4							
		Light Grey, trace Dark Grey Silty CLAY, trace Sand, fe stains, CL, very stiff	98.4	SS	8	7	21	99	2.83	
16		End of Boring at 16 Feet	96.4							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: None
 IMMEDIATELY AFTER DRILLING: Dry
 DELAYED READING AFTER Completion: Dry



BORING STARTED: 8/2/17
 BORING COMPLETED: 8/2/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, some Gravel, little clay, little RAP, SP-GP, medium dense to dense	106.2	SS	1	11	7			
				SS	2	11	8			
4		sand, cinders, trace slag	101.2	SS	3	10	7			
					SS	4	30	7		
8		FILL: Brown SAND, little to some Gravel, SP-GP medium dense	98.2	SS	6	16	7			
				SS	7	12	5			
12		FILL: Brown Silty SAND, little to some Gravel, SM, slightly dense	94.7	SS	8	7	10			
		moist	92.7							
		fine slag or glass	91.2							
16		Black to Dark Grey CLAY, CL-CH, stiff	90.7	9A	7	32				
			90.2	9B	2	82	57		1.09	
		End of Boring at 16 Feet								

WATER LEVEL OBSERVATIONS, ft. DURING DRILLING: 14.0' IMMEDIATELY AFTER DRILLING: dry DELAYED READING AFTER		BORING STARTED: <u>8/2/17</u> BORING COMPLETED: <u>8/2/17</u> LOGGED BY: <u>GPF</u> BORING METHOD: <u>HSA</u>
---	--	--

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS	
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf		
0		FILL: Black Clayey SAND, some Gravel, little Concrete, SC-GC Topsoil	108.6	SS	1	50/3"					
		FILL: Brown SAND, little to some Gravel, trace Clay, SP-GP medium to slightly dense	107.1	SS	2	10	4				
4				SS	3	10	6				
			Silty sand layer, wet	101.6	SS	4	7				
8			Black Slag	100.6	SS	5A	8	12			
			Brown & Grey SAND & GRAVEL	100.1		5B	4	20		1.0 Qp	
			Dark Grey & Black CLAY, CL-CH stiff	99.6	SS	6	7	25	93	1.90	
12			Grey & Dark Grey Silty clay, trace Sand, trace Gravel, CL stiff	98.6		7	8	25	93	2.25	
		Brown, Grey, & Dark Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff moist seam	96.1 95.1	8		6	-				
16		End of Boring at 16 Feet	92.6								

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 6.5'
 IMMEDIATELY AFTER DRILLING: 7.2'
 DELAYED READING AFTER 1 Day 7.1'



BORING STARTED: 8/7/17
 BORING COMPLETED: 8/7/17
 LOGGED BY: GPF
 BORING METHOD: HSA

PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, some Gravel, SP-GP medium dense	102.0	SS	1A	19	5			
		FILL: Brown SAND, little to some Gravel, SP-GP, medium dense	101.0		1B	16	3			
				SS	2	19	6			
4		moist	96.5	SS	3	16	11			
		Brown & Black, wet	95.0	SS	4A	3	12			
		Dark Grey CLAY, CL-CH firm	94.5		4B	2	46		0.75 Qp	
8		Light Grey Silty CLAY, trace Sand, fe stains, CL soft	94.0	SS	5	3	24	107	0.31	
		Brown & Grey Silty CLAY, little Sand, trace Gravel, CL very stiff to hard	91.5	SS	6	7	21	105	3.18	
12			SS	7	12	18	112	4.62		
	sand seam at 13.5'	88.5								
	Grey Silty CLAY, trace Sand, trace Gravel, CL very stiff	88.0	SS	8	8	20	107	2.95		
16		End of Boring at 16 Feet	86.0							

WATER LEVEL OBSERVATIONS, ft.
 DURING DRILLING: 7.0'
 IMMEDIATELY AFTER DRILLING: --
 DELAYED READING AFTER 1 Day 5.4'

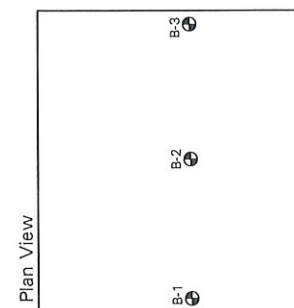
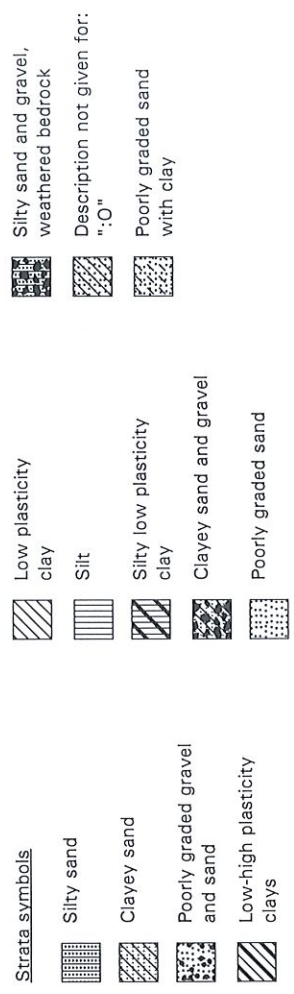
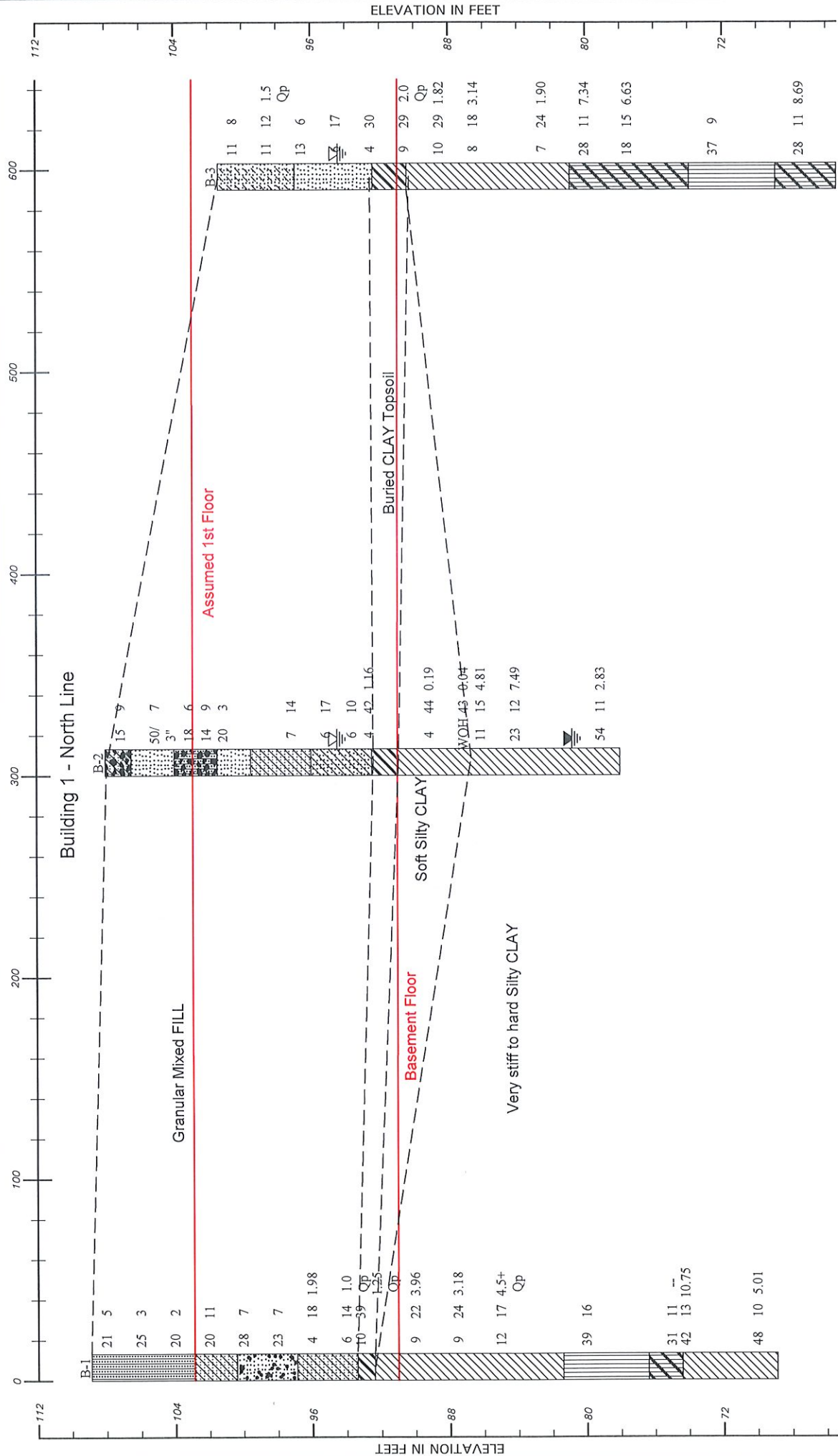


BORING STARTED: 8/3/17
 BORING COMPLETED: 8/3/17
 LOGGED BY: GPF
 BORING METHOD: HSA

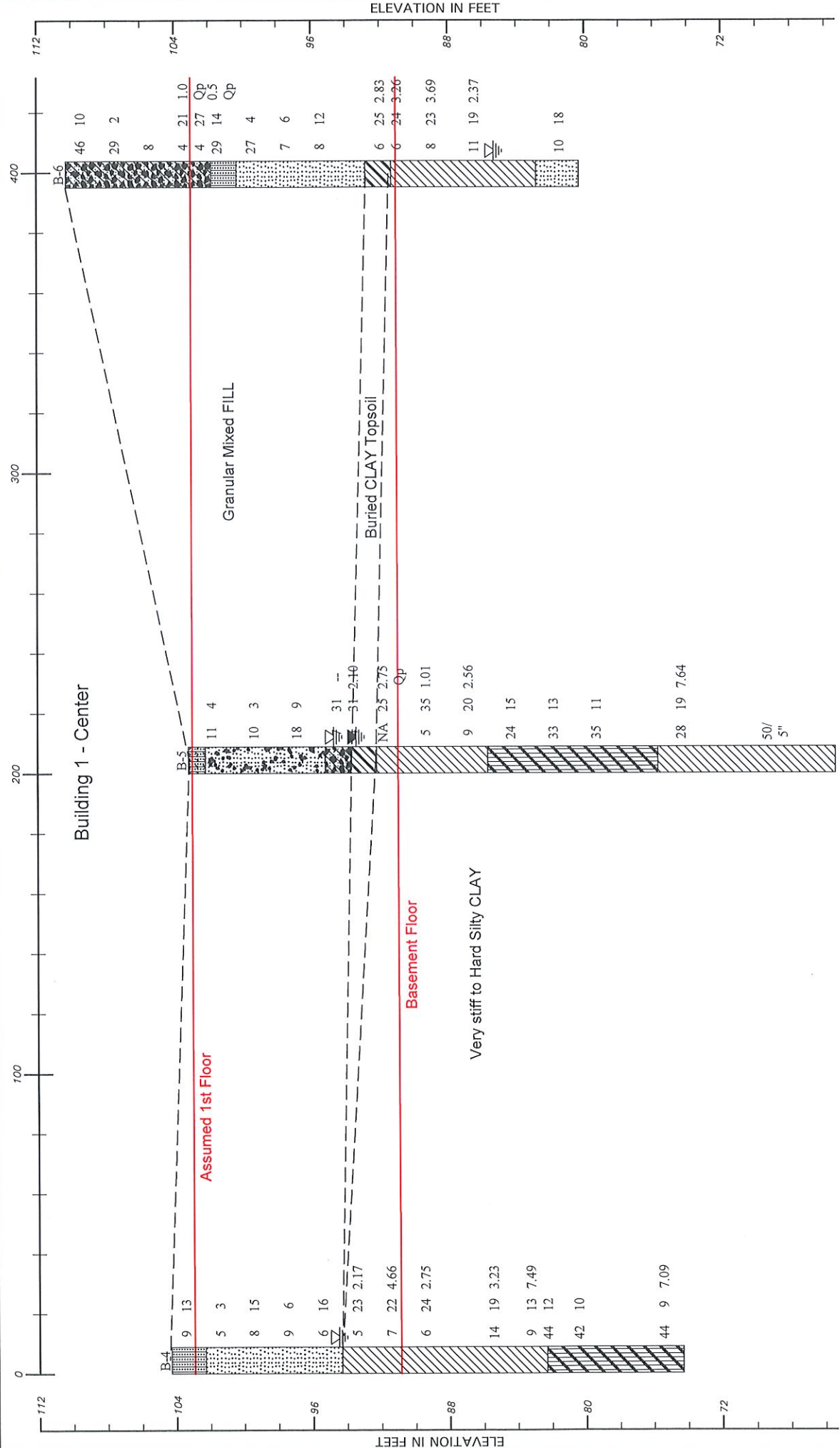
PROJECT: Police and Fire Training Campus SITE LOCATION: Chicago, Illinois
 BORING LOCATION: See Location Map CLIENT: AMEC Foster Wheeler

DEPTH (feet)	SOIL TYPE	Material Description	Elevation	SAMPLE			TESTS			REMARKS
				TYPE/ INTERVAL	NO.	N-VALUE Blows per ft.	Wc%	Dry Unit Weight, pcf	Unconfined Compressive Strength, tsf	
0		FILL: Black SAND, little Gravel, SP, Topsoil	100.5	SS	1	14	10			
				SS	2	38	9			
4		to Brown & Black, some Gravel	97.0							
		FILL: Brown SAND, little Gravel, trace clay, SP dense to medium dense	96.5	SS	3	13	5			
		wet	94.0	SS	4	8	18			
8		Black, trace Slag	93.0							
				SS	5A	10	13			
				SS	5B	4	29	83	1.28	
		Dark Grey & Black CLAY, trace Sand, CL-CH stiff	91.0							
		Light Grey & Dark Grey Silty CLAY, trace Sand, fe stains, CL very stiff	90.0	SS	6	7	24	104	2.33	
12		Brown, Grey & Dark Grey Silty CLAY, little Sand, trace Gravel, CL very stiff	88.5	SS	7	5	26	98	2.33	
				SS	8	9	23		3.0 Qp	
16		End of Boring at 16 Feet	84.5							

WATER LEVEL OBSERVATIONS, ft. DURING DRILLING: 7.0' IMMEDIATELY AFTER DRILLING: 11.5' DELAYED READING AFTER: Well		BORING STARTED: <u>8/4/17</u> BORING COMPLETED: <u>8/4/17</u> LOGGED BY: <u>GPF</u> BORING METHOD: <u>HSA</u>
---	--	--



Midland Standard Engineering & Testing
GENERALIZED SOIL PROFILE
 DRAWN BY/APPROVED BY: [Name]
 DATE DRAWN: 8/28/2017
 Police and Fire Training Campus
 PROJECT NO. 17439
 FIGURE NUMBER



Midland Standard Engineering & Testing
GENERALIZED SOIL PROFILE

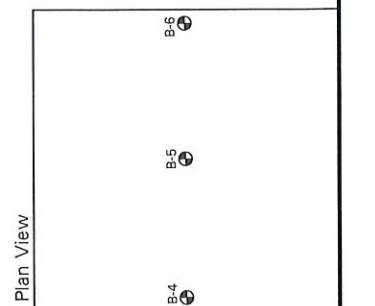
HORIZONTAL SCALE: 1"=8'
 VERTICAL SCALE: 1"=8'

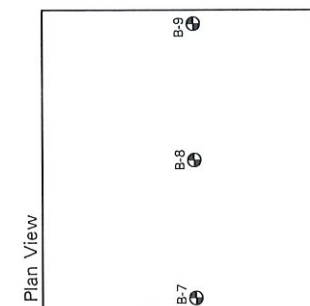
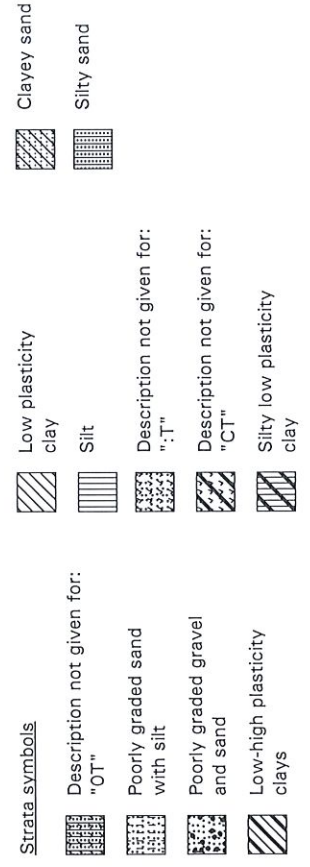
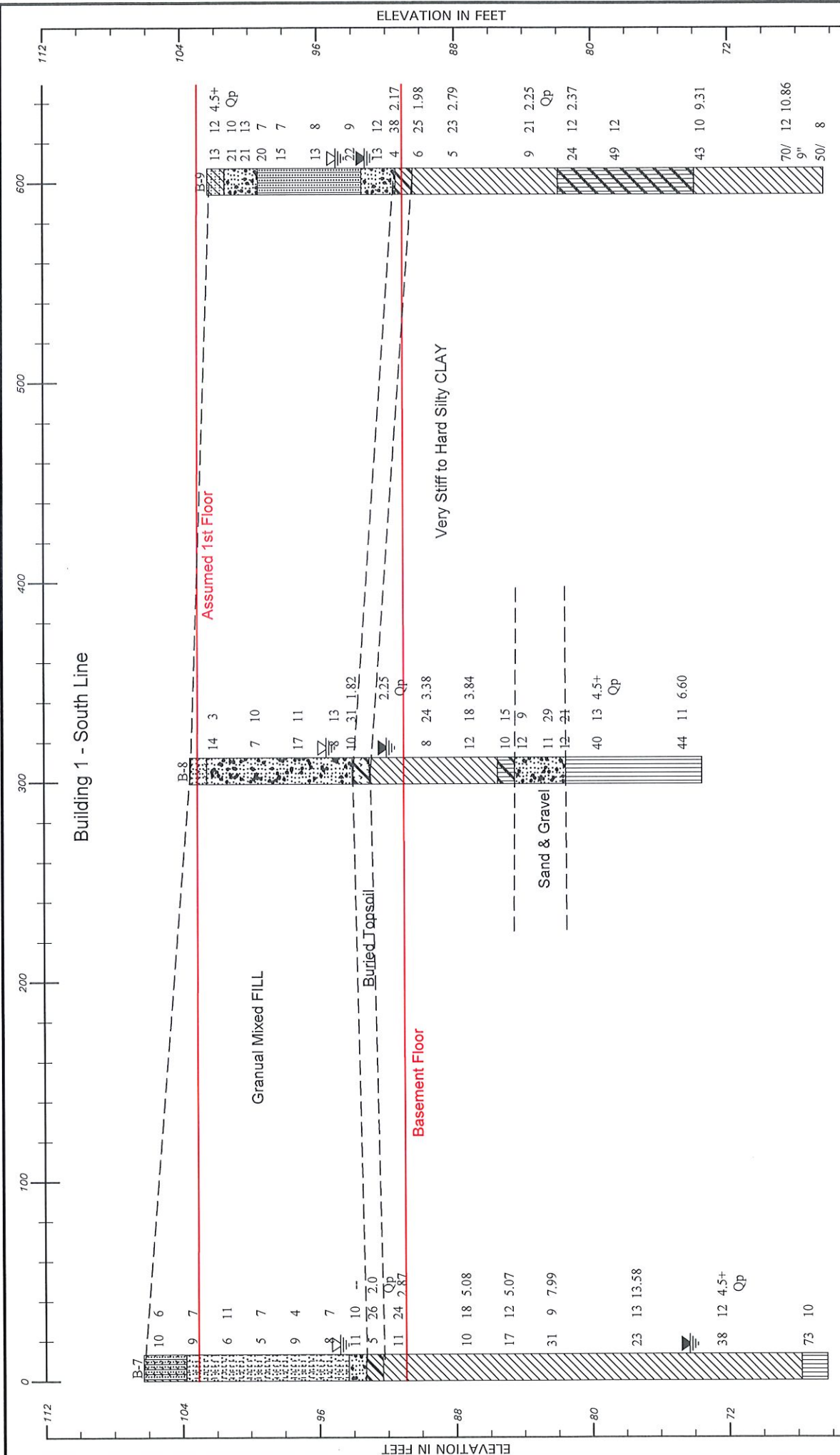
DRAWN BY/APPROVED BY: [Signature]
 DATE DRAWN: 8/28/2017

Police and Fire Training Campus

PROJECT NO. 17439

FIGURE NUMBER





Midland Standard Engineering & Testing

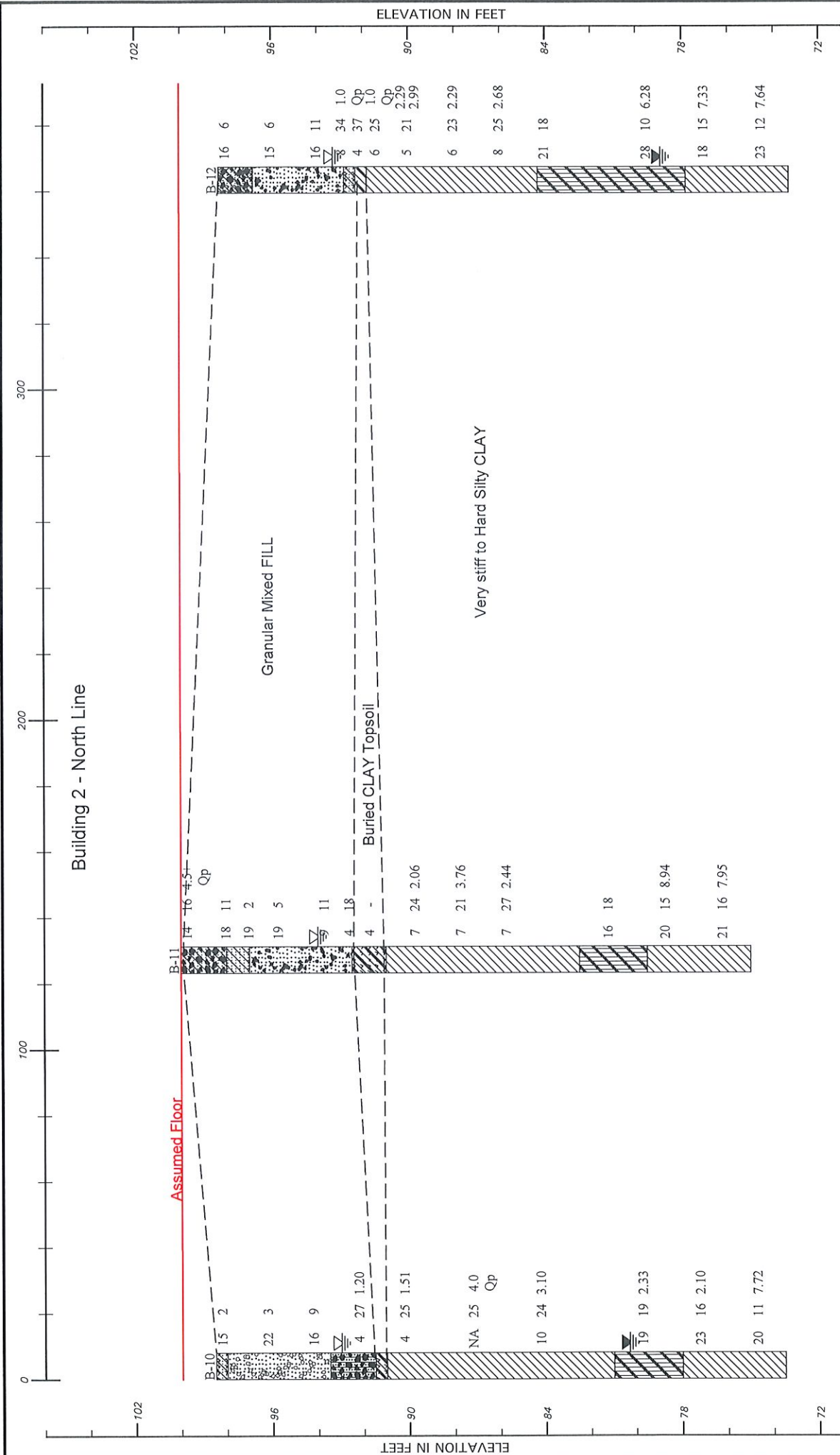
GENERALIZED SOIL PROFILE

HORIZONTAL SCALE: 1"=(proportional)
 DRAWN BY/APPROVED BY: [Signature]
 DATE DRAWN: 8/28/2017

Police and Fire Training Campus

PROJECT NO. 17439

FIGURE NUMBER



Plan View

Strata symbols

- Clayey SAND w/roots, organics
- Description not given for: "Y"
- Silty sand and gravel, weathered bedrock
- Description not given for: "COT"
- Low plasticity clay
- Silty low plasticity clay
- Clayey sand and gravel
- Clayey sand
- Poorly graded gravel and sand
- Description not given for: "DO8T"
- Low-high plasticity clays

Midland Standard Engineering & Testing

GENERALIZED SOIL PROFILE

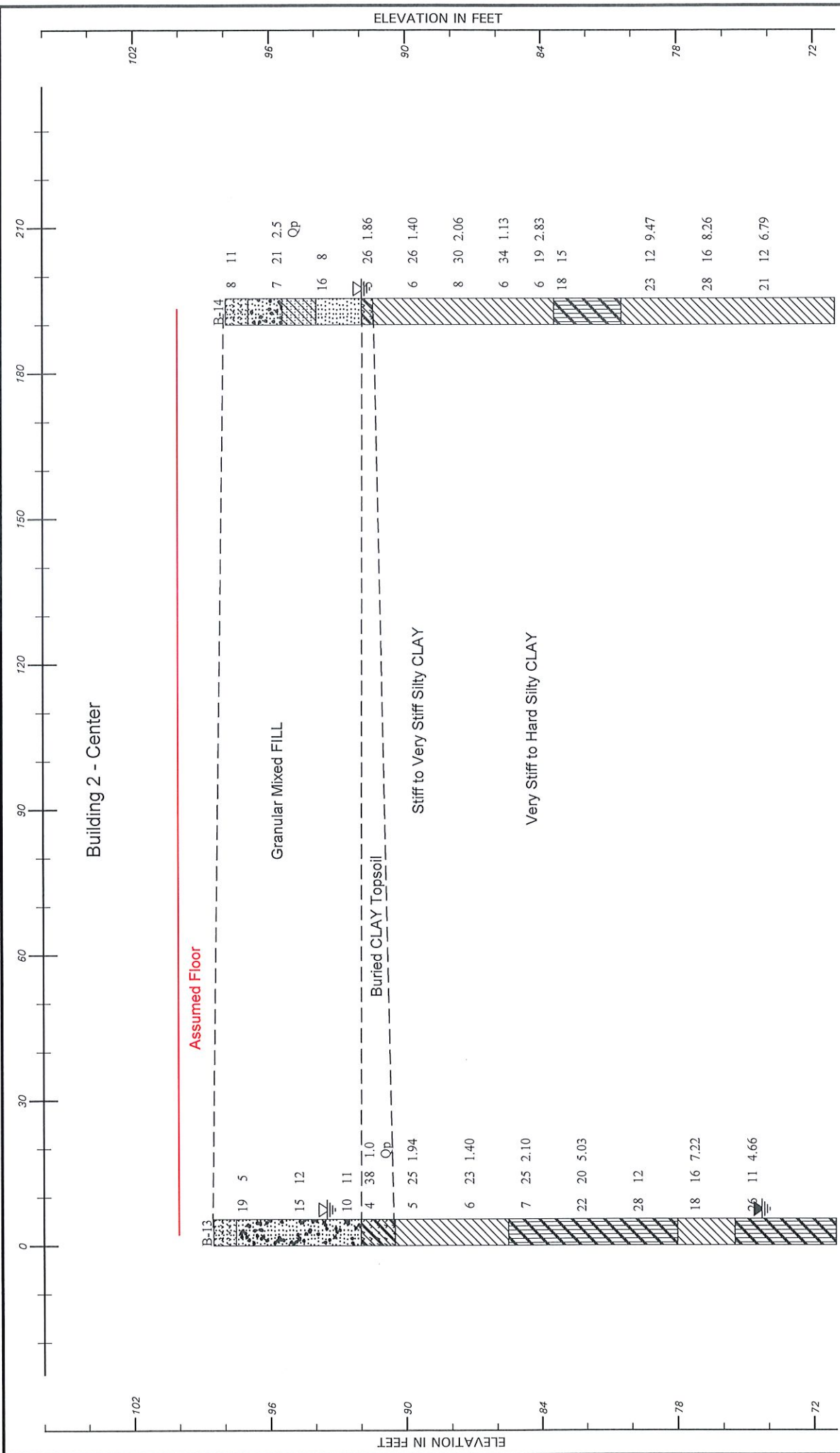
HORIZONTAL SCALE: 1"=60' (proportional)
 VERTICAL SCALE: 1"=6'

DRAWN BY/APPROVED BY: [Signature]
 DATE DRAWN: 8/28/2017

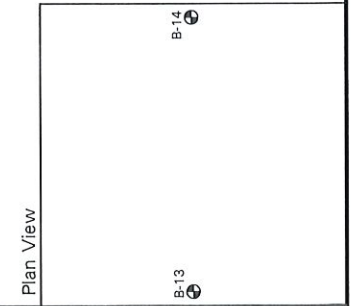
Police and Fire Training Campus

PROJECT NO. 17439

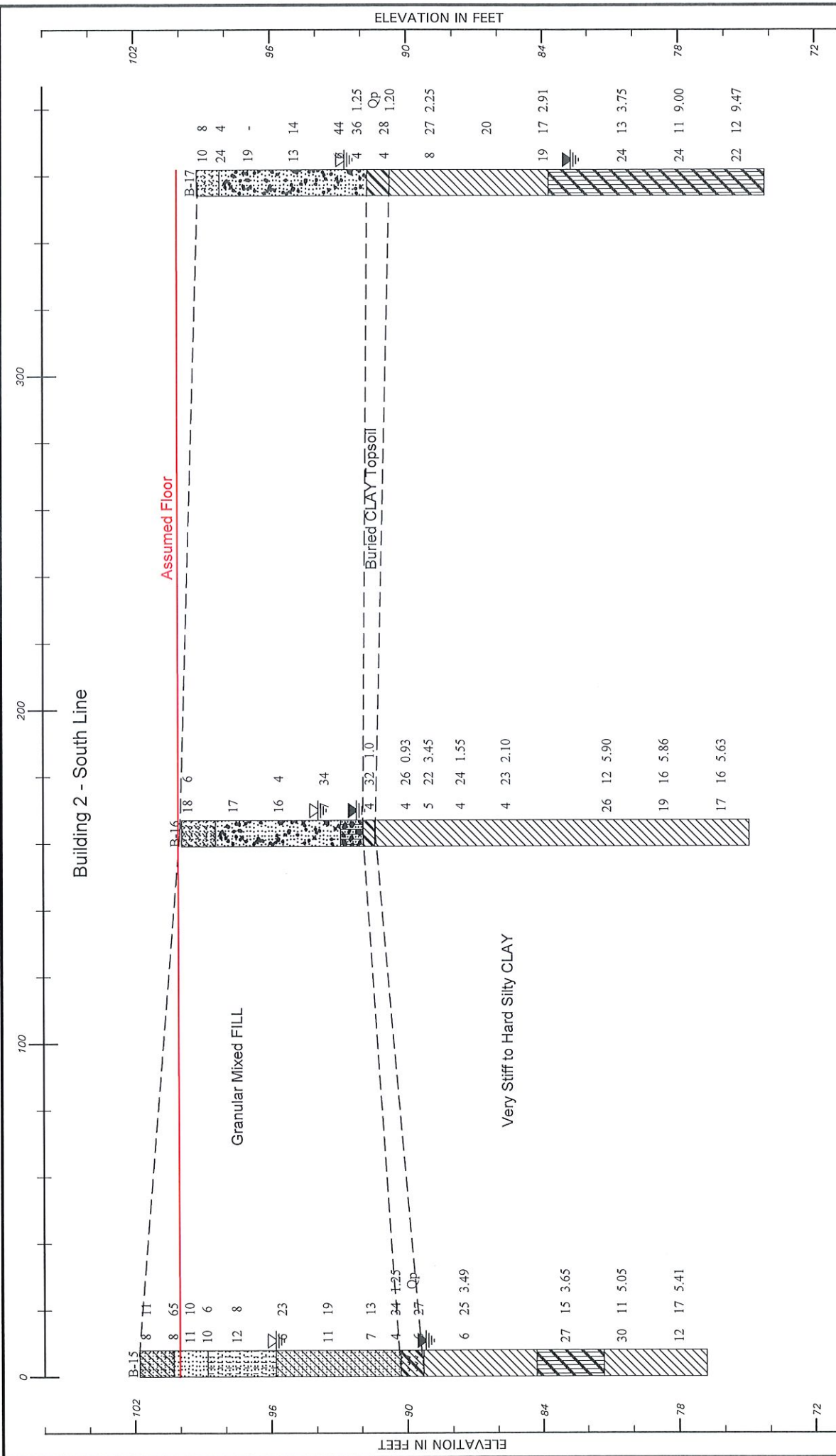
FIGURE NUMBER



- Strata symbols**
- Silty low plasticity clay
 - Clayey sand
 - Poorly graded sand
 - Description not given for: "T"
 - Poorly graded gravel and sand
 - Description not given for: "COT"
 - Low plasticity clay



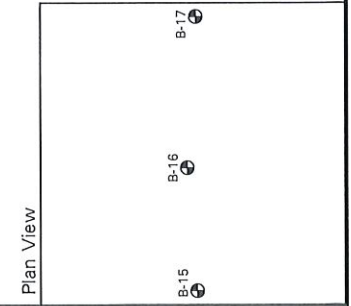
Midland Standard Engineering & Testing
GENERALIZED SOIL PROFILE
 DRAWN BY/APPROVED BY: [Name]
 DATE DRAWN: 8/28/2017
 POLICE and Fire Training Campus
 PROJECT NO. 17439
 FIGURE NUMBER



Midland Standard Engineering & Testing
GENERALIZED SOIL PROFILE

DRAWN BY/APPROVED BY	DATE DRAWN
HORIZONTAL SCALE: 1"=6'	8/28/2017
VERTICAL SCALE: 1"=6'	
Police and Fire Training Campus	

- Strata symbols**
- Clayey SAND w/roots, organics
 - Poorly graded sand
 - Poorly graded sand with silt
 - Clayey sand
- Description not given for:**
- Silty sand and gravel, weathered bedrock
 - Low-high plasticity clays
 - Description not given for: "T"
- Description not given for:**
- Description not given for: "COT"
 - Low plasticity clay
 - Silty low plasticity clay
 - Description not given for: "RT"
 - Poorly graded gravel and sand



PROJECT NO. 17439

FIGURE NUMBER

USGS Design Maps Summary Report

User-Specified Input

Report Title Chicago Police & Fire Training Campus
 Fri August 25, 2017 14:09:23 UTC

Building Code Reference Document 2012/2015 International Building Code
 (which utilizes USGS hazard data available in 2008)

Site Coordinates 41.89368°N, 87.73813°W

Site Soil Classification Site Class D - "Stiff Soil"

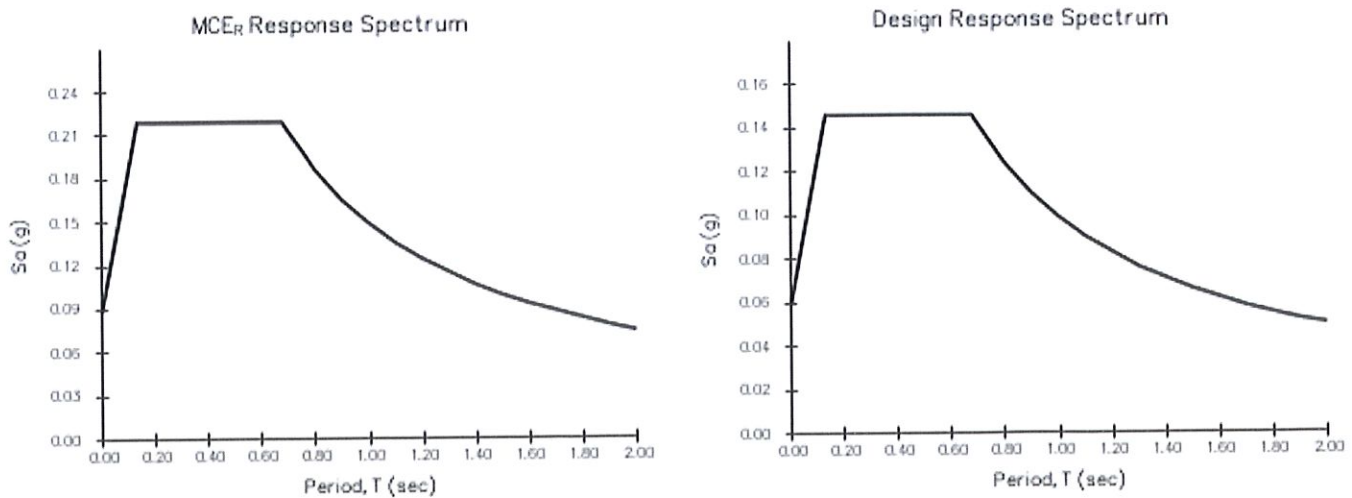
Risk Category I/II/III



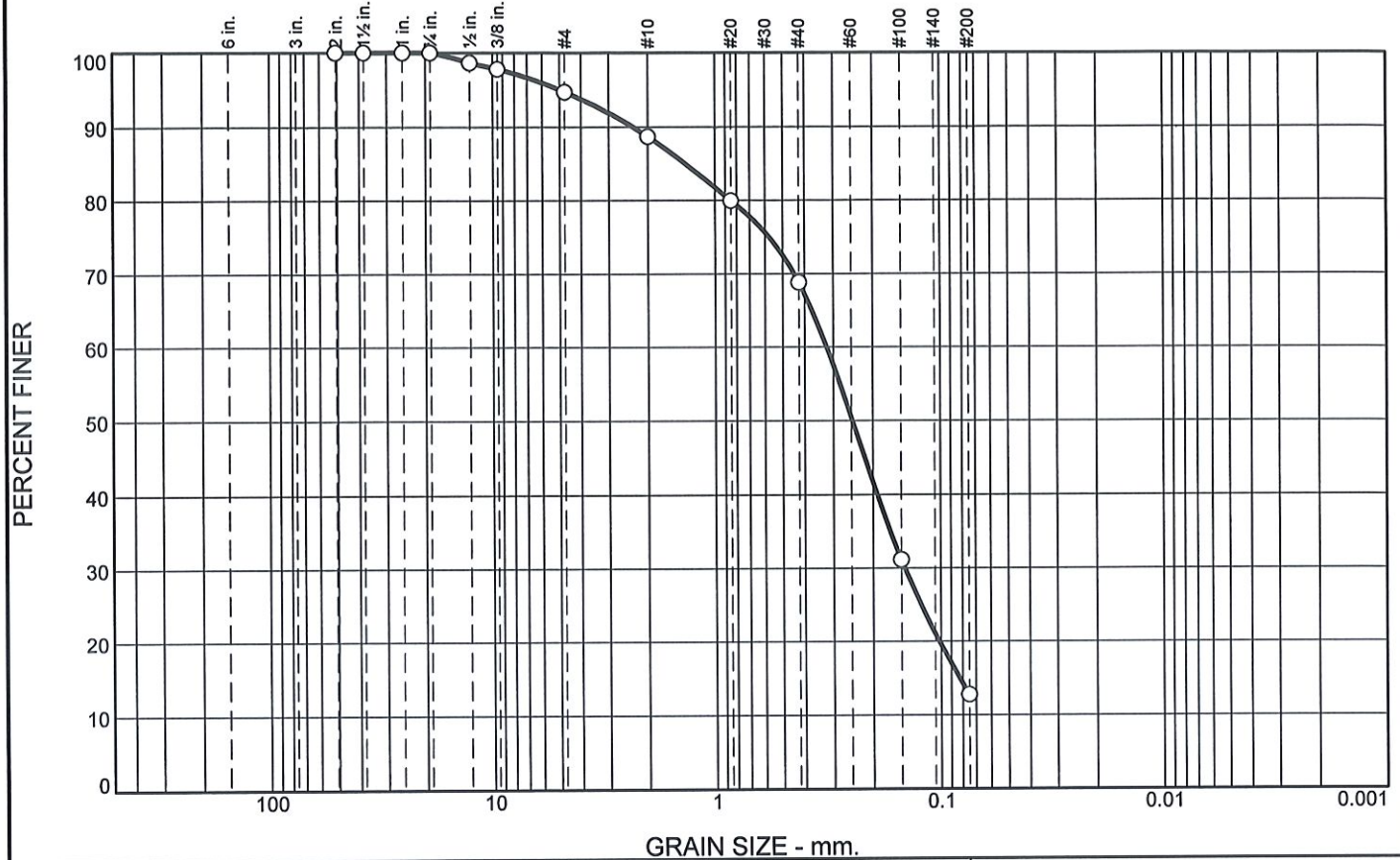
USGS-Provided Output

$S_S = 0.137 \text{ g}$	$S_{MS} = 0.219 \text{ g}$	$S_{DS} = 0.146 \text{ g}$
$S_1 = 0.062 \text{ g}$	$S_{M1} = 0.149 \text{ g}$	$S_{D1} = 0.099 \text{ g}$

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.



Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	5	6	20	56	13	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100		
1 1/2"	100		
1"	100		
3/4"	100		
1/2"	99		
3/8"	98		
#4	95		
#10	89		
#20	80		
#40	69		
#100	31		
#200	13		

Soil Description

Brown some Dark Grey SAND, trace Gravel, little Silt

Atterberg Limits
 PL= NP LL= NV PI= NP

Coefficients
 D₉₀= 2.3341 D₈₅= 1.3592 D₆₀= 0.3209
 D₅₀= 0.2466 D₃₀= 0.1449 D₁₅= 0.0826
 D₁₀= C_u= C_c=

Classification
 USCS= SM AASHTO= A-2-4(0)

Remarks

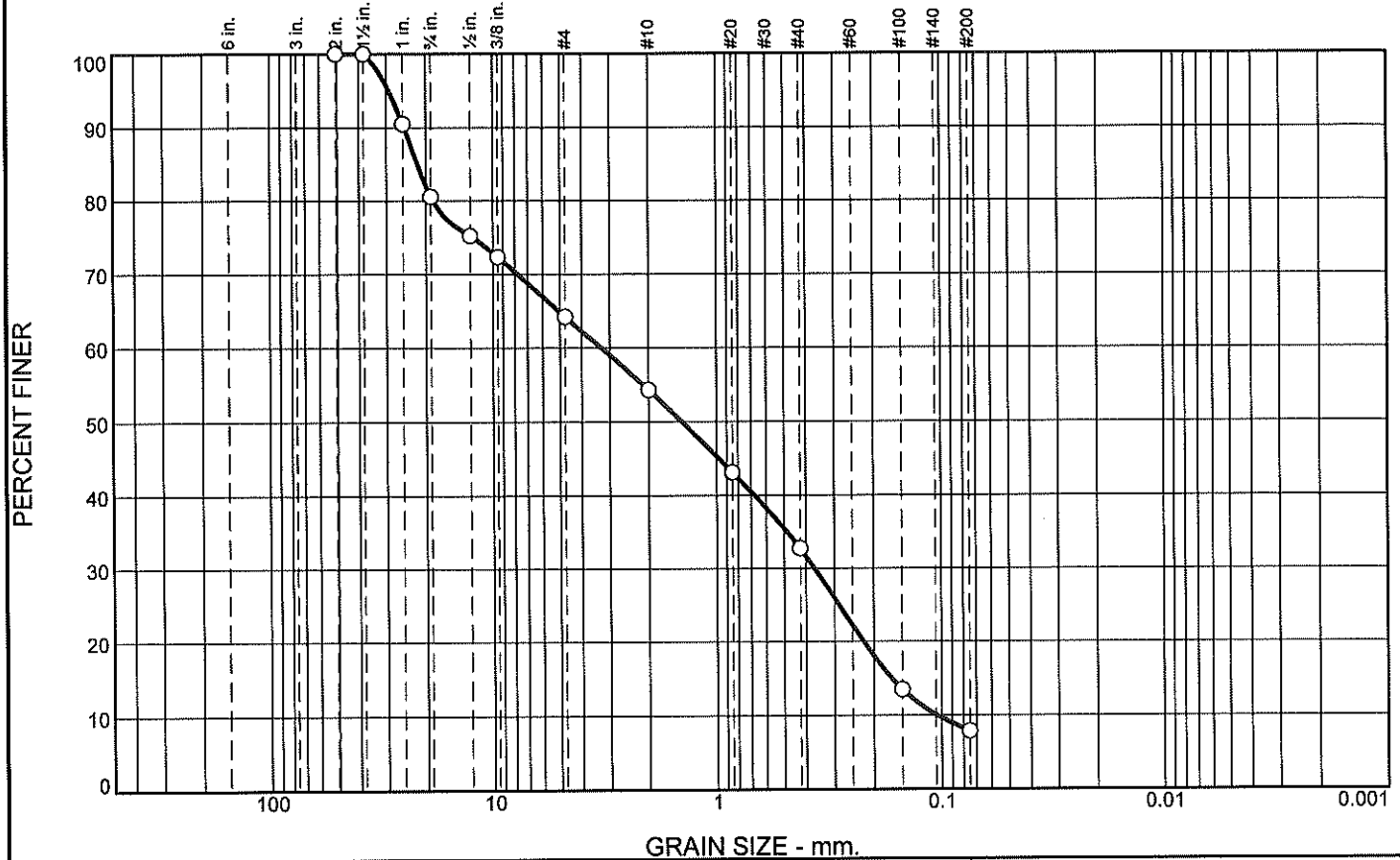
* (no specification provided)

Location: B-7 **Sample Number:** SS-4 **Depth:** 6.0'-8.0' **Date:**

Midland Standard Engineering & Testing East Dundee, IL	Client: AMEC Foster Wheeler Project: Police and Fire Training Campus Project No: 17439
Figure	

Tested By: JDS **Checked By:** KP

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	19	17	10	21	25	8	

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
2"	100		
1 1/2"	100		
1"	90		
3/4"	81		
1/2"	75		
3/8"	72		
#4	64		
#10	54		
#20	43		
#40	33		
#100	14		
#200	7.9		

Soil Description

Brown Poorly graded SAND, and Gravel, trace Silt

Atterberg Limits

PL= NP LL= NV PI= NP

Coefficients

D₉₀= 25.0518 D₈₅= 21.8775 D₆₀= 3.2763
D₅₀= 1.4209 D₃₀= 0.3669 D₁₅= 0.1665
D₁₀= 0.1053 C_u= 31.12 C_c= 0.39

Classification

USCS= SP-SM AASHTO= A-1-b

Remarks

* (no specification provided)

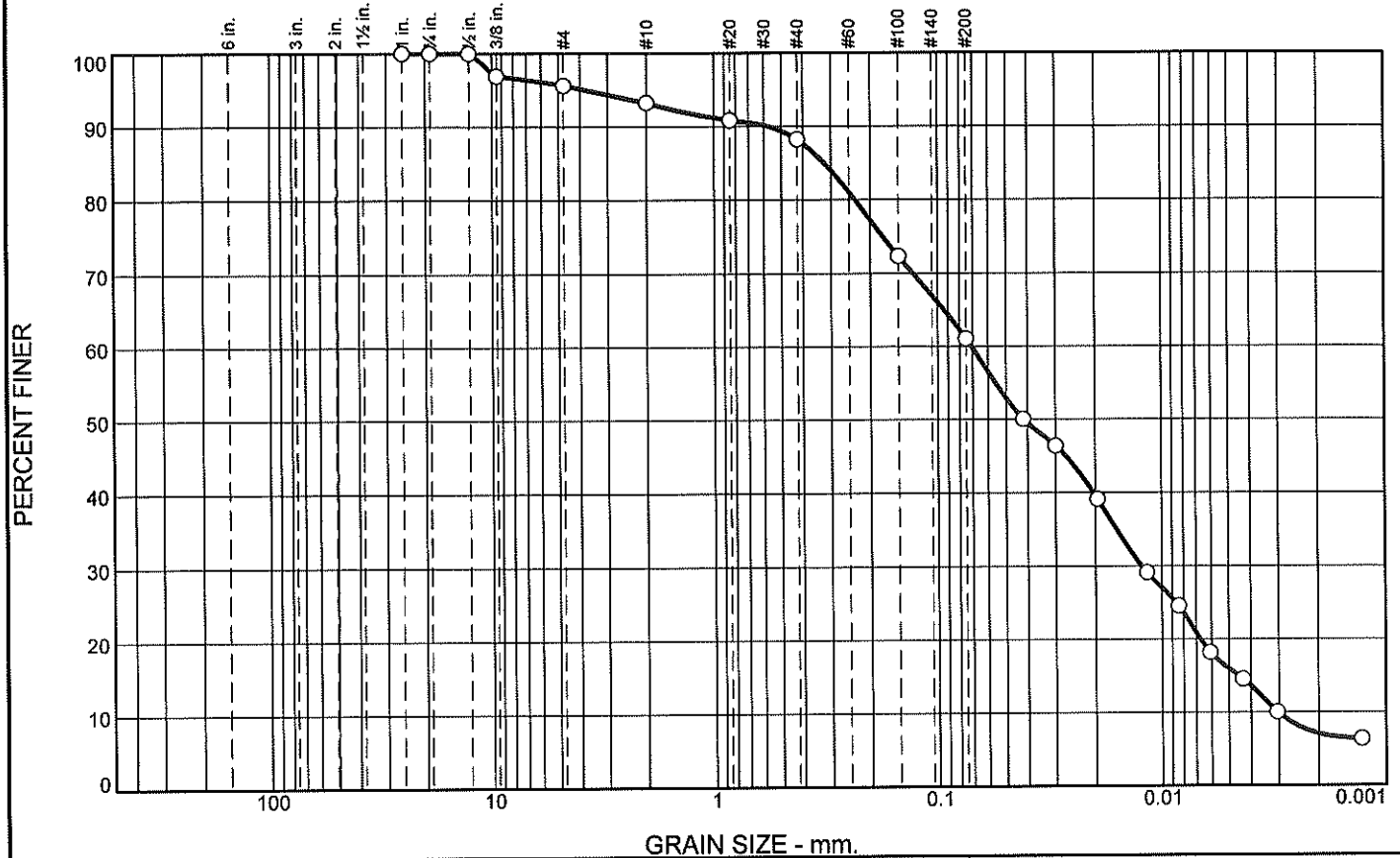
Location: B-11 Depth: 4.0'-6.0'
Sample Number: SS-3

Date:

Midland Standard Engineering & Testing East Dundee, IL	Client: AMEC Foster Wheeler Project: Police and Fire Training Campus Project No: 17439
Figure	

Tested By: JDS Checked By: KP

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	4	3	5	27	54	7

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100		
3/4"	100		
1/2"	100		
3/8"	97		
#4	96		
#10	93		
#20	91		
#40	88		
#100	72		
#200	61		
0.0418 mm.	50		
0.0300 mm.	46		
0.0195 mm.	39		
0.0117 mm.	29		
0.0084 mm.	25		
0.0061 mm.	18		
0.0043 mm.	15		
0.0030 mm.	10		
0.0013 mm.	6.4		

* (no specification provided)

Soil Description

Grey Sandy Lean CLAY

Atterberg Limits

PL= 16 LL= 26 PI= 10

Coefficients

D₉₀= 0.5760 D₈₅= 0.3222 D₆₀= 0.0710
D₅₀= 0.0417 D₃₀= 0.0124 D₁₅= 0.0045
D₁₀= 0.0030 C_u= 23.33 C_c= 0.71

Classification

USCS= CL AASHTO= A-4(3)

Remarks

Location: B-9
Sample Number: SS-10

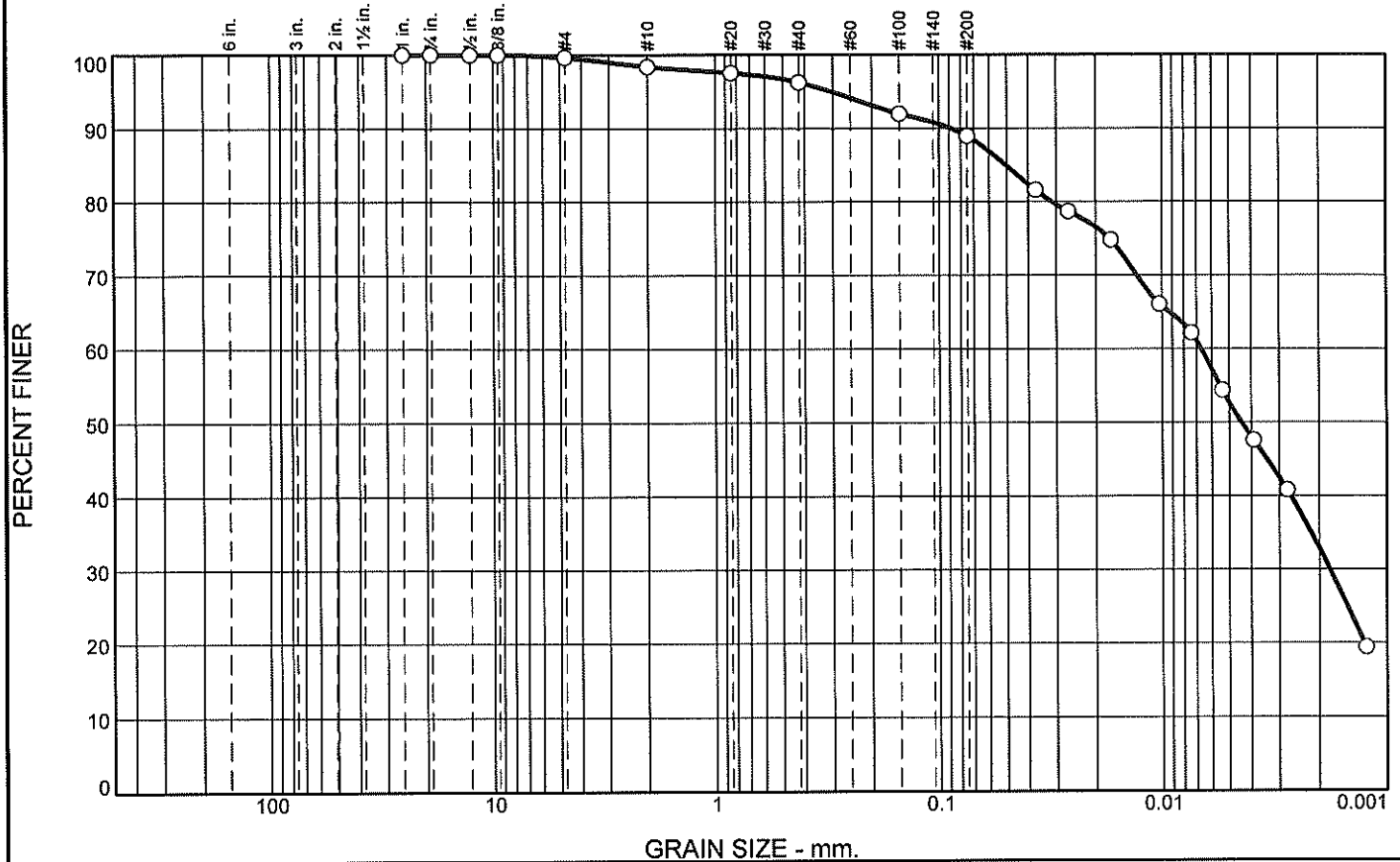
Date:

Midland Standard Engineering & Testing East Dundee, IL	Client: AMEC Foster Wheeler Project: Police and Fire Training Campus Project No: 17439
Figure	

Tested By: JDS

Checked By: KP

Particle Size Distribution Report



% +3"	% Gravel		% Sand			% Fines	
	Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
0	0	0	2	2	7	56	33

SIEVE SIZE	PERCENT FINER	SPEC.* PERCENT	PASS? (X=NO)
1"	100		
3/4"	100		
1/2"	100		
3/8"	100		
#4	100		
#10	98		
#20	98		
#40	96		
#100	92		
#200	89		
0.0371 mm.	82		
0.0266 mm.	79		
0.0171 mm.	75		
0.0103 mm.	66		
0.0074 mm.	62		
0.0054 mm.	54		
0.0039 mm.	48		
0.0028 mm.	41		
0.0012 mm.	19		

* (no specification provided)

Soil Description

Brown and Grey Lean CLAY

Atterberg Limits

PL= 17 LL= 35 PI= 18

Coefficients

D₉₀= 0.0884 D₈₅= 0.0505 D₆₀= 0.0067
D₅₀= 0.0044 D₃₀= 0.0018 D₁₅=
D₁₀= C_u= C_c=

Classification

USCS= CL AASHTO= A-6(15)

Remarks

Location: B-15
Sample Number: SS-8

Date:

Midland Standard Engineering & Testing East Dundee, IL	Client: AMEC Foster Wheeler Project: Police and Fire Training Campus Project No: 17439
Figure	

Tested By: JDS

Checked By: KP

MIDLAND STANDARD ENGINEERING & TESTING, INC.

558 PLATE DRIVE UNIT 6 EAST DUNDEE, ILLINOIS 60118 (847) 844-1895 F (847) 844-3875

REPORT OF PERMEABILITY TESTING

PROJECT NAME	<u>Police and Fire Training Campus</u>	REPORT NO:	<u>1 perm</u>
SAMPLE NO.	<u>B-10 ST-6 11.0'-13.0'</u>	DATE:	<u>8/11/17</u>
CLASSIFICATION	<u>Dark Grey CLAY</u>	PROJECT NO:	<u>17439</u>
SAMPLE TYPE	<u>Shelby Tube</u>		
METHOD OF TEST	<u>ASTM D-5084-90</u> Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter		

PERMEANT LIQUID <u>Tap Water</u>	TOTAL BACK PRESSURE <u>30 psi</u>
TEMPERATURE, °C <u>20</u>	EFF. CONSOLIDATION STRESS, max <u>0.72 tsf</u>
	EFF. CONSOLIDATION STRESS, min <u>0.5 tsf</u>
CELL PRESSURE, psi <u>40</u>	HYDRAULIC GRADIENT, i <u>14.5</u>

		PERMEABILITY, k (cm/sec)
TEST INTERVAL	1	4.79E-07
TEST INTERVAL	2	4.18E-07
TEST INTERVAL	3	4.06E-07
TEST INTERVAL	4	3.82E-07
AVERAGE k		4.21E-07
k ₂₀		4.21E-07

SAMPLE DATA:	INITIAL	FINAL
DIAMETER, in	2.85	2.84
LENGTH, in	5.75	5.71
VOLUME, cu in	36.73	36.10
WEIGHT, gm	1281.2	1276.8
UNIT WEIGHT, pcf	132.8	134.6
MOIST. CONTENT, %	16.3	15.9
DRY DENSITY, pcf	114.1	116.2
DEGREE OF SATUR, %	92	95

Respectfully Submitted:
William D. Prigge, P.E.

WEIGHT VOLUME RELATIONSHIPS OF SOIL

PROJECT NAME Police and Fire Training Campus

DATE: 8/11/17

SAMPLE ID: B-10 ST-6 11.0'-13.0'
SOIL CLASS: Dark Grey CLAY

PROJ NO. 17439

$V = 1.0 \text{ cf}$	$V_v = 0.32 \text{ cf}$	$V_a = 0.02 \text{ cf}$ $V_w = 0.30 \text{ cf}$ $V_s = 0.68 \text{ cf}$	AIR WATER SOLIDS	$W_a = 0 \text{ lb}$ $W_w = 18.6$ $W_s = 114.2$	$W_t = 132.8 \text{ lb}$
----------------------	-------------------------	---	---	---	--------------------------

ENTER LABORATORY MOISTURE CONTENT, % - -

	START	FINISH
Mc=	16.3	15.9

ENTER SAMPLE WEIGHT, grams - - - - -

W=	1281	1277
----	------	------

ENTER SAMPLE DIAMETER, inches - - - - -

Ds=	2.85	2.84
-----	------	------

ENTER SAMPLE LENGTH, inches - - - - -

Ls=	5.75	5.71
-----	------	------

ENTER ESTIMATED/KNOWN SPECIFIC GRAVITY, Gs

Gs=	2.700	2.700
-----	-------	-------

SAMPLE VOLUME, cubic inches - - - - -

V=	36.73	36.10
----	-------	-------

WET DENSITY, #/cu ft - - - - -

Wt=	132.8	134.6
-----	-------	-------

WEIGHT OF SOLIDS, pounds - - - - -

Ws=	114.2	116.1
-----	-------	-------

WEIGHT OF WATER, pounds - - - - -

Ww=	18.6	18.5
-----	------	------

VOLUME OF SOLIDS, cubic feet - - - - -

Vs=	0.68	0.69
-----	------	------

VOLUME OF WATER, cubic feet - - - - -

Vw=	0.30	0.30
-----	------	------

VOLUME OF AIR, cubic feet - - - - -

Va=	0.02	0.01
-----	------	------

VOLUME OF VOIDS, cubic feet - - - - -

Vv=	0.32	0.31
-----	------	------

POROSITY, n - - - - -

n=	0.32	0.31
----	------	------

VOID RATIO, e - - - - -

e=	0.48	0.45
----	------	------

DEGREE OF SATURATION, Sr - - - - -

Sr=	92%	95%
-----	-----	-----

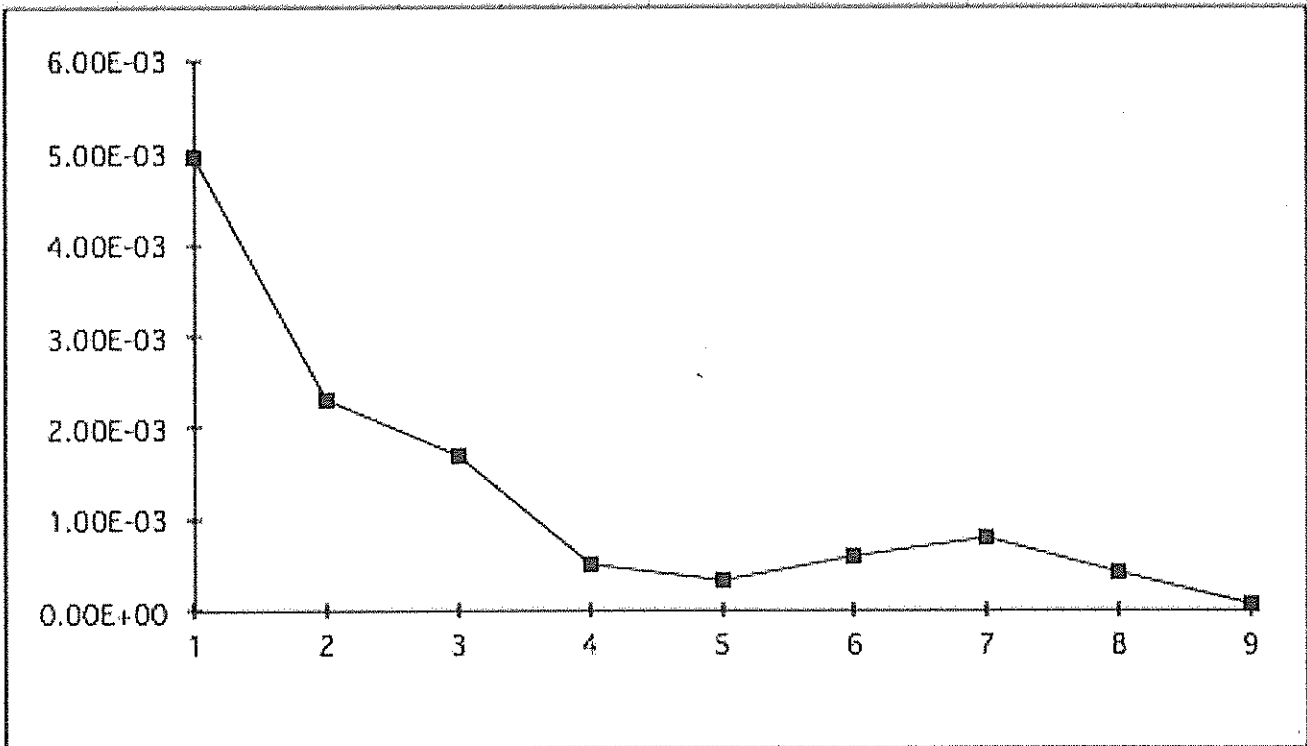
Respectfully Submitted:
William D. Prigge, P.E.

FIELD PERMEABILITY TEST

TEST WELL NO. ES8-4 BORING DIA. (in) D= 8.5 TRIAL 1
 WELL PIPE LENGTH, (in) WPL= 186 STAND PIPE DIA. (in) d= 2
 SCREEN LENGTH, IN. L= 120
 WELL DEPTH, FT. 13

TEST NO.	T	H2O DEPTH	Δ T	H1(ft)	H2(ft)	k(IN./MIN.)	k(FT/SEC)	k(CM/SEC)
	min.	feet	min.					
	0	7.21						
1	0.25	8.12	0.25	8.29	7.38	1.17E-01	1.62E-04	4.95E-03
2	0.50	8.51	0.25	7.38	6.99	5.46E-02	7.59E-05	2.31E-03
3	0.75	8.78	0.25	6.99	6.72	3.96E-02	5.50E-05	1.68E-03
4	1.00	8.86	0.25	6.72	6.64	1.20E-02	1.67E-05	5.10E-04
5	1.25	8.91	0.25	6.64	6.59	7.60E-03	1.06E-05	3.22E-04
6	1.50	9.00	0.25	6.59	6.50	1.38E-02	1.92E-05	5.86E-04
7	1.75	9.12	0.25	6.50	6.38	1.87E-02	2.60E-05	7.94E-04
8	2.00	9.18	0.25	6.38	6.32	9.51E-03	1.32E-05	4.02E-04
9	2.50	9.20	0.50	6.32	6.30	1.59E-03	2.21E-06	6.75E-05

Readings 2 to 9 AVE. 1.97E-02 AVE. 2.74E-05 AVE. 8.34E-04

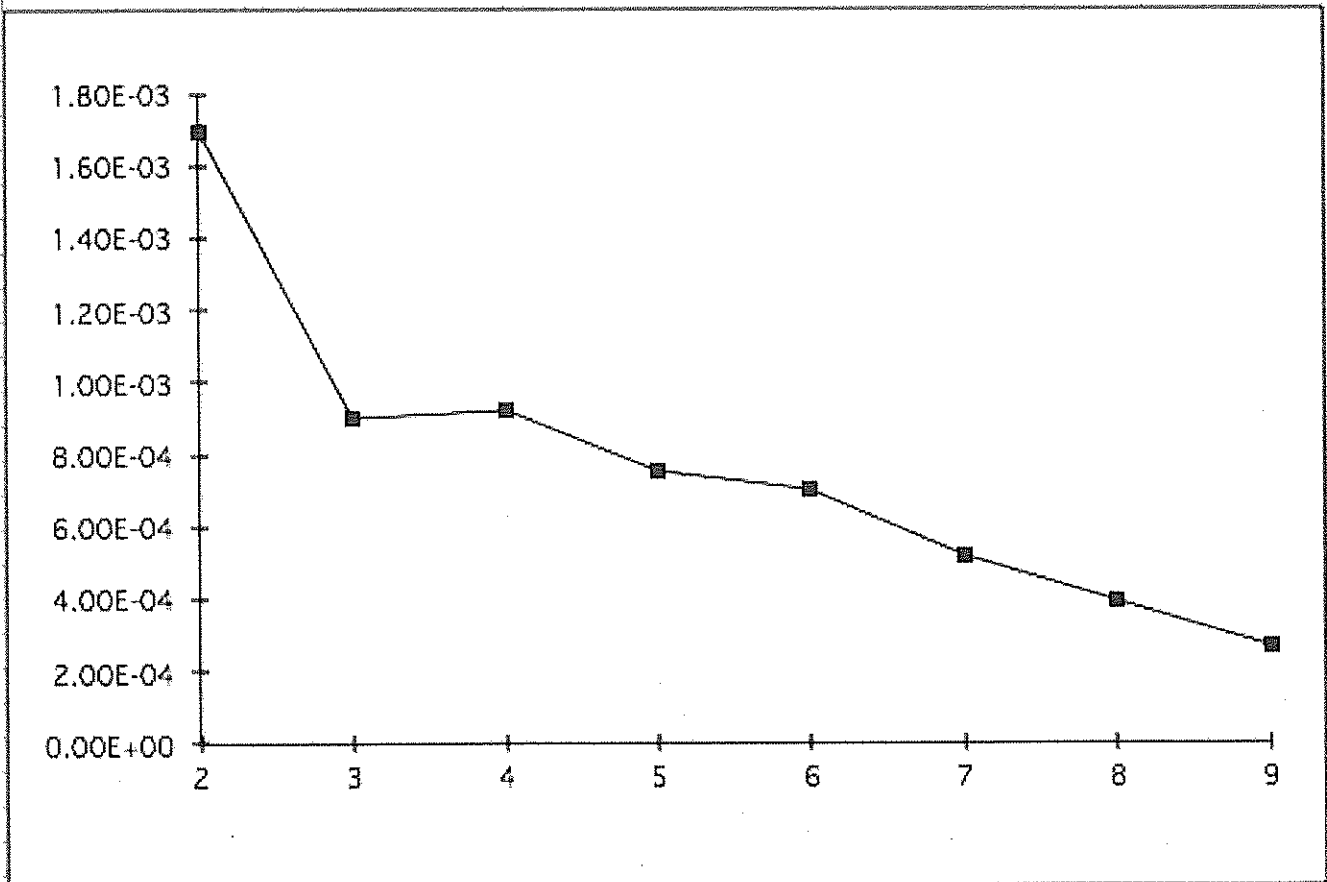


FIELD PERMEABILITY TEST

TEST WELL NO. ESB-4 BORING DIA. (in) D= 8.5 TRIAL 2
WELL PIPE LENGTH, (in) WPL= 186 STAND PIPE DIA. (in) d= 2
SCREEN LENGTH, IN. L= 120
WELL DEPTH, FT 13

TEST NO.	T	H2O DEPTH	Δ T	H1(ft)	H2(ft)	k(IN./MIN.)	k(FT/SEC)	k(CM/SEC)
	min.	feet	min.					
	0	4.45						
1	0.25	8.06	0.25	11.05	7.44	3.98E-01	5.53E-04	1.68E-02
2	0.50	8.35	0.25	7.44	7.15	4.00E-02	5.56E-05	1.69E-03
3	0.75	8.50	0.25	7.15	7.00	2.13E-02	2.96E-05	9.03E-04
4	1.00	8.65	0.25	7.00	6.85	2.18E-02	3.03E-05	9.23E-04
5	1.25	8.77	0.25	6.85	6.73	1.78E-02	2.47E-05	7.53E-04
6	1.50	8.88	0.25	6.73	6.62	1.66E-02	2.30E-05	7.02E-04
7	1.75	8.96	0.25	6.62	6.54	1.22E-02	1.70E-05	5.18E-04
8	2.00	9.02	0.25	6.54	6.48	9.27E-03	1.29E-05	3.93E-04
9	2.50	9.10	0.50	6.48	6.40	6.25E-03	8.68E-06	2.65E-04

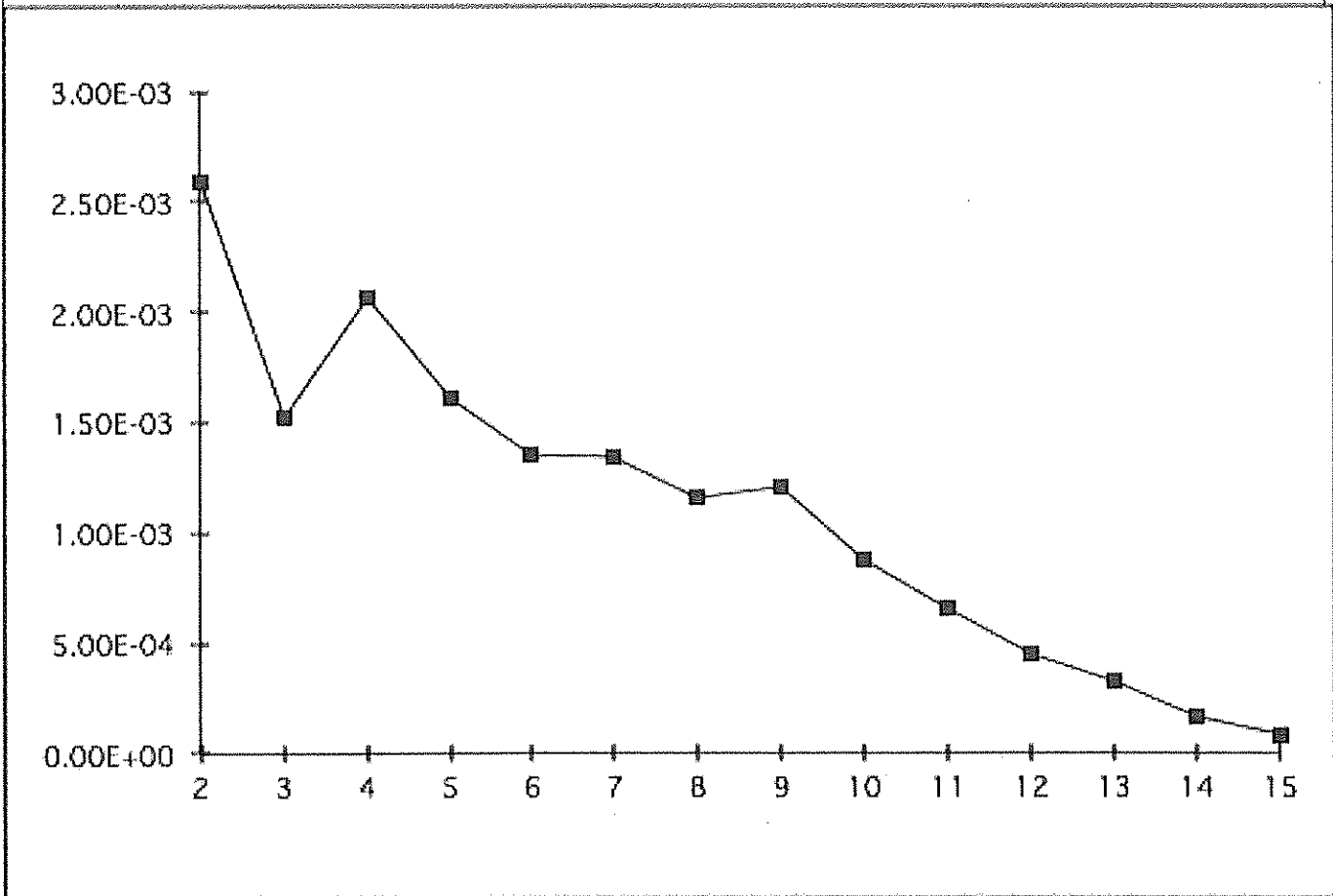
Readings 2 to 9 AVE. 1.82E-02 AVE. 2.52E-05 AVE. 7.69E-04



FIELD PERMEABILITY TEST

TEST WELL NO. ES8-4 BORING DIA. (in) D= 8.5 TRIAL 3
 WELL PIPE LENGTH, (in) WPL= 186 STAND PIPE DIA. (in) d= 2
 SCREEN LENGTH, IN. L= 120
 WELL DEPTH, FT 13

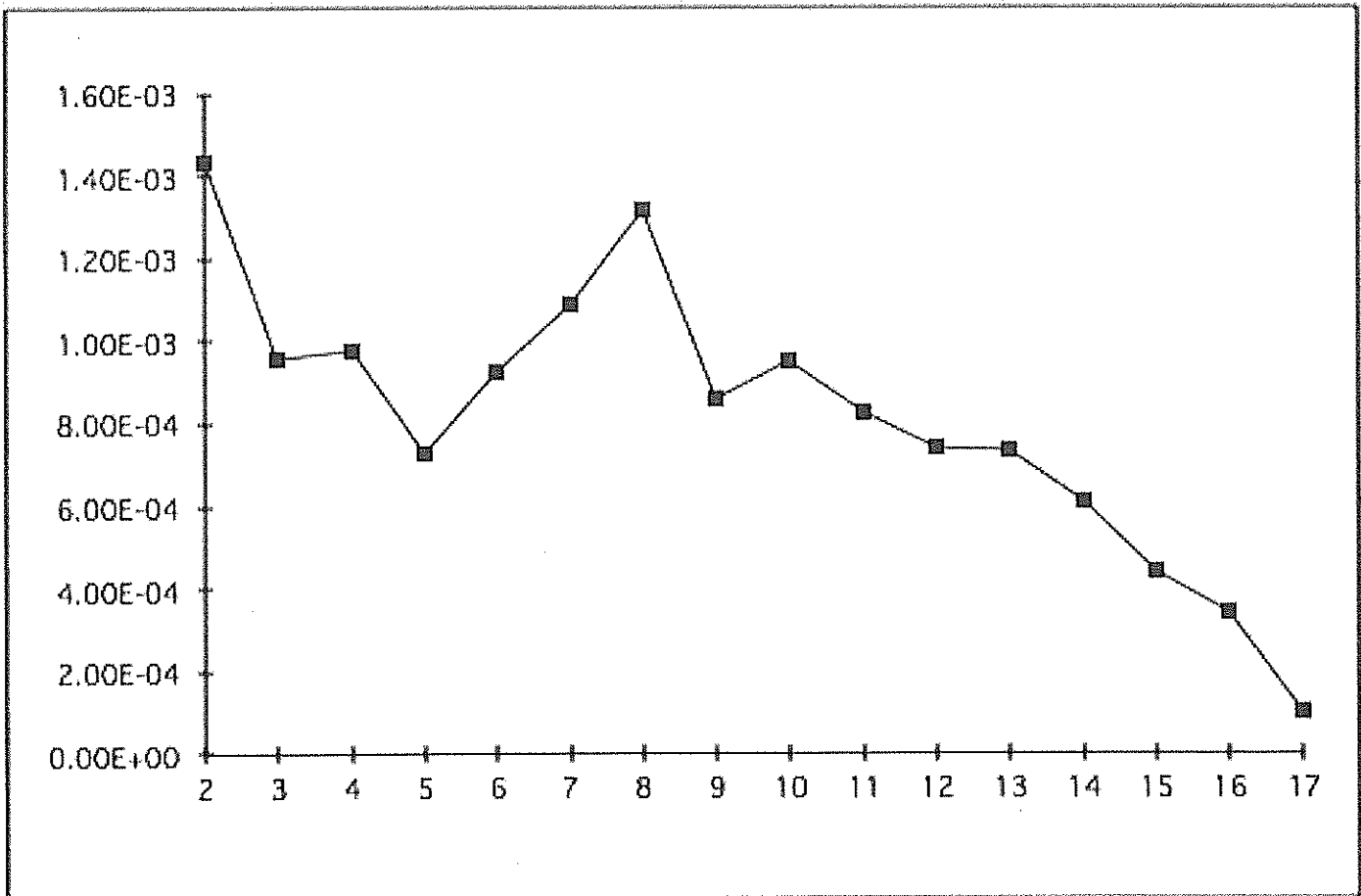
TEST NO.	T	H2O DEPTH	Δ T	H1(ft)	H2(ft)	k(IN./MIN.)	k(FT/SEC)	k(CM/SEC)
	min.	feet	min.					
	0	4.00						
1	0.25	5.50	0.25	11.50	10.00	1.41E-01	1.95E-04	5.95E-03
2	0.50	6.09	0.25	10.00	9.41	6.12E-02	8.50E-05	2.59E-03
3	0.75	6.42	0.25	9.41	9.08	3.59E-02	4.99E-05	1.52E-03
4	1.00	6.85	0.25	9.08	8.65	4.88E-02	6.78E-05	2.07E-03
5	1.25	7.17	0.25	8.65	8.33	3.79E-02	5.27E-05	1.61E-03
6	1.50	7.43	0.25	8.33	8.07	3.19E-02	4.43E-05	1.35E-03
7	1.75	7.68	0.25	8.07	7.82	3.17E-02	4.40E-05	1.34E-03
8	2.00	7.89	0.25	7.82	7.61	2.74E-02	3.80E-05	1.16E-03
9	2.50	8.31	0.50	7.61	7.19	2.86E-02	3.97E-05	1.21E-03
10	3.00	8.60	0.50	7.19	6.90	2.07E-02	2.88E-05	8.77E-04
11	3.50	8.81	0.50	6.90	6.69	1.55E-02	2.16E-05	6.58E-04
12	4.00	8.95	0.50	6.69	6.55	1.06E-02	1.48E-05	4.50E-04
13	4.50	9.05	0.50	6.55	6.45	7.74E-03	1.07E-05	3.28E-04
14	5.00	9.10	0.50	6.45	6.40	3.91E-03	5.44E-06	1.66E-04
15	6.00	9.15	1.00	6.40	6.35	1.97E-03	2.74E-06	8.35E-05
				6.35				
				Readings	2 to 15	AVE.	AVE.	AVE.
						2.60E-02	3.61E-05	1.10E-03



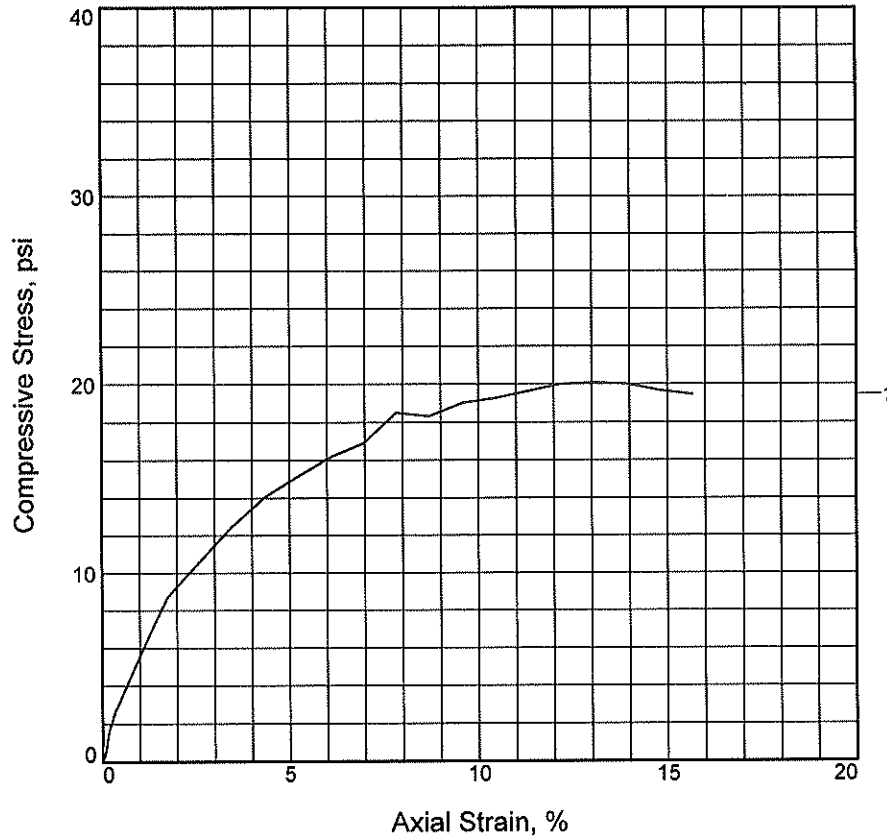
FIELD PERMEABILITY TEST

TEST WELL NO. ES8-4 BORING DIA. (in) D= 8.5 TRIAL 4
 WELL PIPE LENGTH, (in) WPL= 186 STAND PIPE DIA. (in) d= 2
 SCREEN LENGTH, IN. L= 120
 WELL DEPTH, FT 13

TEST NO.	T	H2O DEPTH	Δ T	H1(ft)	H2(ft)	k(IN./MIN.)	k(FT/SEC)	k(CM/SEC)
	min.	feet	min.					
	0	4.4						
1	0.25	5.25	0.25	11.10	10.25	8.01E-02	1.11E-04	3.39E-03
2	0.50	5.59	0.25	10.25	9.91	3.39E-02	4.71E-05	1.44E-03
3	0.75	5.81	0.25	9.91	9.69	2.26E-02	3.14E-05	9.56E-04
4	1.00	6.03	0.25	9.69	9.47	2.31E-02	3.21E-05	9.78E-04
5	1.25	6.19	0.25	9.47	9.31	1.71E-02	2.38E-05	7.26E-04
6	1.50	6.39	0.25	9.31	9.11	2.18E-02	3.03E-05	9.25E-04
7	1.75	6.62	0.25	9.11	8.88	2.57E-02	3.57E-05	1.09E-03
8	2.00	6.89	0.25	8.88	8.61	3.11E-02	4.31E-05	1.32E-03
9	2.50	7.23	0.50	8.61	8.27	2.03E-02	2.81E-05	8.58E-04
10	3.00	7.59	0.50	8.27	7.91	2.24E-02	3.11E-05	9.48E-04
11	3.50	7.89	0.50	7.91	7.61	1.94E-02	2.70E-05	8.23E-04
12	4.00	8.15	0.50	7.61	7.35	1.75E-02	2.43E-05	7.40E-04
13	4.50	8.40	0.50	7.35	7.10	1.74E-02	2.42E-05	7.37E-04
14	5.00	8.60	0.50	7.10	6.90	1.44E-02	2.00E-05	6.08E-04
15	6.00	8.88	1.00	6.90	6.62	1.04E-02	1.45E-05	4.41E-04
16	7.00	9.09	1.00	6.62	6.41	8.11E-03	1.13E-05	3.43E-04
17	8.00	9.15	1.00	6.41	6.35	2.37E-03	3.29E-06	1.00E-04
				6.35				
				Readings	2 to 17	AVE. 1.92E-02	AVE. 2.67E-05	AVE. 8.14E-04



UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	20.07			
Undrained shear strength, psi	10.03			
Failure strain, %	13.1			
Strain rate, in./min.	0.870			
Water content, %	25.3			
Wet density, pcf	128.1			
Dry density, pcf	102.3			
Saturation, %	102.3			
Void ratio	0.6789			
Specimen diameter, in.	2.84			
Specimen height, in.	5.75			
Height/diameter ratio	2.02			

Description: Dark Grey CLAY

LL = PL = PI = **GS= 2.75** **Type: Shelby Tube**

Project No.: 17439

Date Sampled: 8/11/17

Remarks:

Figure _____

Client: AMEC Foster Wheeler

Project: Police and Fire Training Campus

Location: B-5

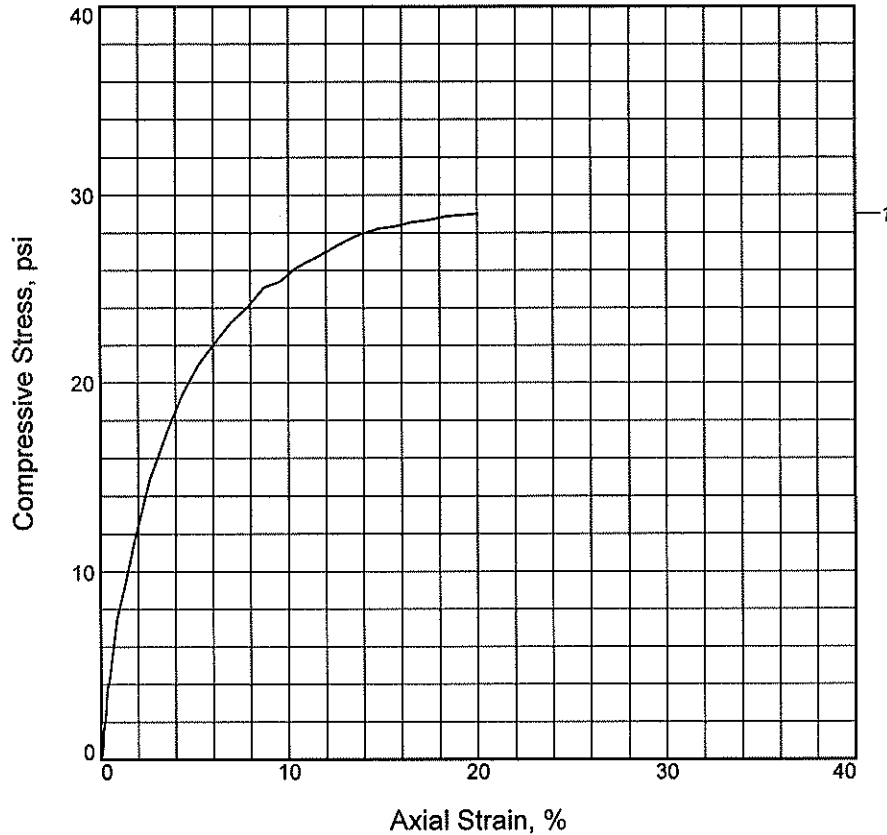
Sample Number: ST-5 **Depth:** 11.0'-13.0'

UNCONFINED COMPRESSION TEST
Midland Standard Engineering & Testing
East Dundee, IL

Tested By: JDS

Checked By: KP

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	29.00			
Undrained shear strength, psi	14.50			
Failure strain, %	20.0			
Strain rate, in./min.	0.870			
Water content, %	24.8			
Wet density, pcf	126.5			
Dry density, pcf	101.3			
Saturation, %	98.4			
Void ratio	0.6943			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.02			

Description: Dark Grey to Brown and Grey CLAY

LL = **PL =** **PI =** **GS= 2.75** **Type: Shelby Tube**

Project No.: 17439
Date Sampled: 8/11/17
Remarks:

Client: AMEC Foster Wheeler
Project: Police and Fire Training Campus
Location: B-8
Sample Number: ST-5 **Depth:** 11.0'-13.0'

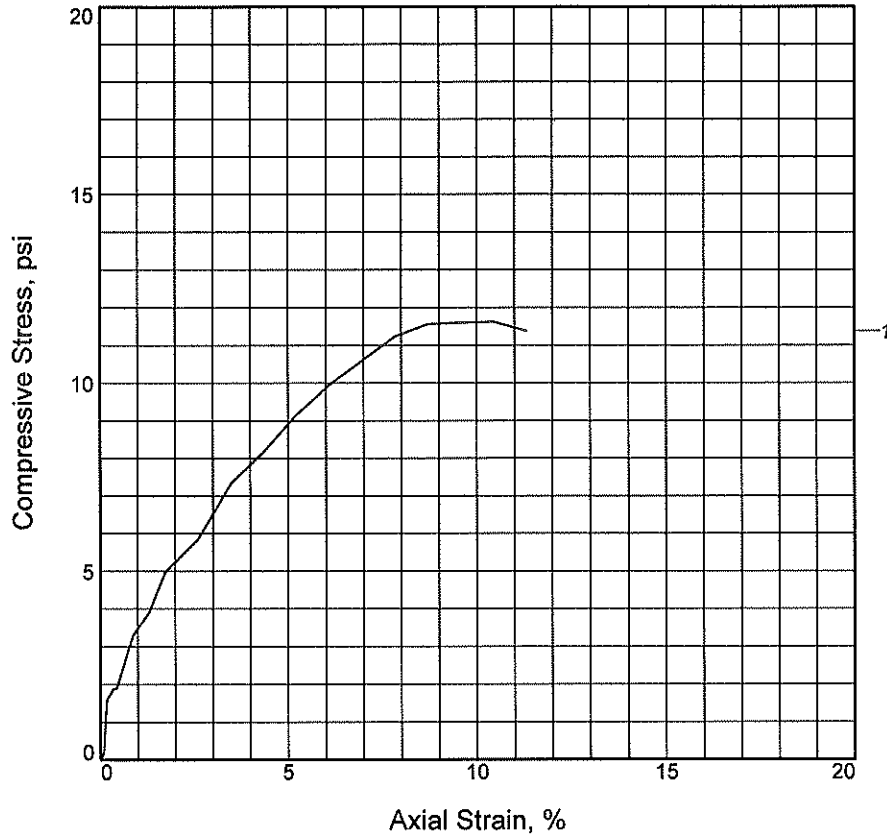
UNCONFINED COMPRESSION TEST
 Midland Standard Engineering & Testing
 East Dundee, IL

Figure _____

Tested By: JDS

Checked By: KP

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	11.62			
Undrained shear strength, psi	5.81			
Failure strain, %	10.5			
Strain rate, in./min.	0.870			
Water content, %	25.3			
Wet density, pcf	124.5			
Dry density, pcf	99.3			
Saturation, %	95.6			
Void ratio	0.7290			
Specimen diameter, in.	2.84			
Specimen height, in.	5.74			
Height/diameter ratio	2.02			

Description: Brown and Grey CLAY

LL = **PL =** **PI =** **GS= 2.75** **Type: Shelby Tube**

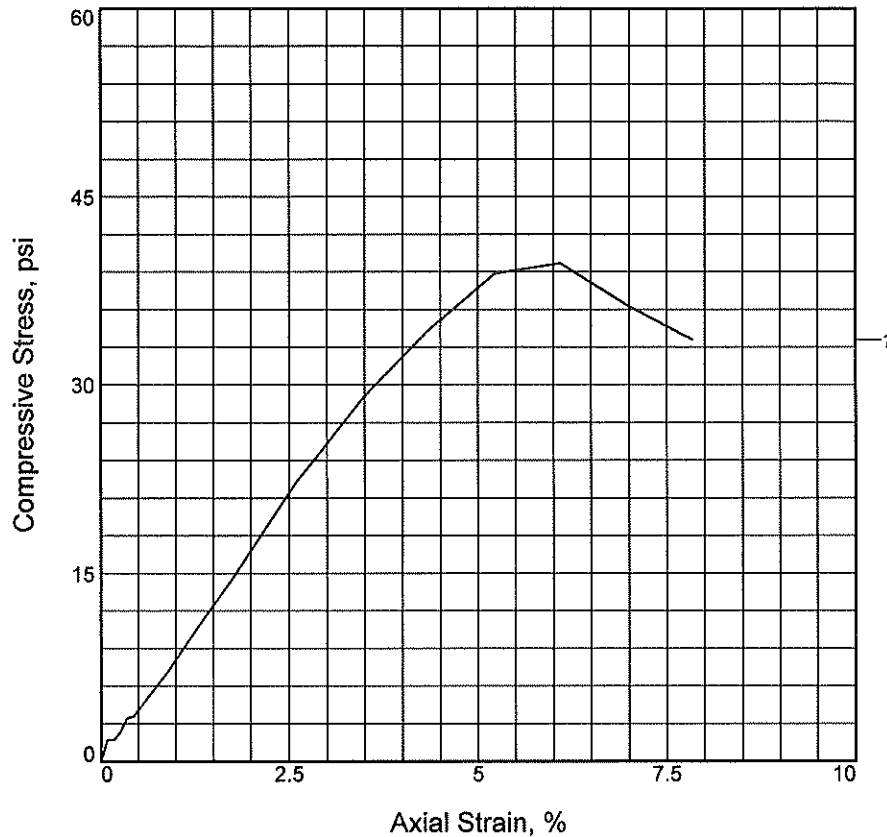
Project No.: 17439
Date Sampled: 8/11/17
Remarks:

Client: AMEC Foster Wheeler
Project: Police and Fire Training Campus
Location: B-10
Sample Number: ST-6 **Depth:** 11.0'-13.0'
UNCONFINED COMPRESSION TEST
 Midland Standard Engineering & Testing
 East Dundee, IL

Figure _____

Tested By: JDS **Checked By:** KP

UNCONFINED COMPRESSION TEST



Sample No.	1			
Unconfined strength, psi	39.66			
Undrained shear strength, psi	19.83			
Failure strain, %	6.1			
Strain rate, in./min.	0.870			
Water content, %	20.1			
Wet density, pcf	129.4			
Dry density, pcf	107.7			
Saturation, %	93.2			
Void ratio	0.5933			
Specimen diameter, in.	2.85			
Specimen height, in.	5.74			
Height/diameter ratio	2.01			

Description: Brown, little Grey CLAY

LL = **PL =** **PI =** **GS= 2.75** **Type: Shelby Tube**

Project No.: 17439
Date Sampled: 8/11/17
Remarks:

Client: AMEC Foster Wheeler
Project: Police and Fire Training Campus

Location: B-17
Sample Number: ST-7 **Depth:** 12.5'-14.5'

UNCONFINED COMPRESSION TEST
 Midland Standard Engineering & Testing
 East Dundee, IL

Figure _____

Tested By: JDS

Checked By: KP

GENERAL NOTES

PARTICLE SIZE DESCRIPTION & TERMINOLOGY

Coarse Grained or Granular Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays or clayey silts if they are cohesive and silts if they are non-cohesive. In addition to gradation, granular soils are defined on the basis of their relative in-place density and the fine grained soils on the basis of their strength or consistency and their plasticity.

Major Component of Sample	Size Range	Descriptive Term of Components Also Present in Sample	Approximate Quantity (Percent)
Boulders	Over 8 in. (200 mm)	Trace	1 - 9
Cobbles	8 inches to 3 inches (200 mm to 75mm)		
Gravel	3 inches to #4 sieve (75mm to 4.75mm)	Little	10 - 19
Sand	#4 to #200 sieve (4.75mm to 0.075mm)	Some	20 - 34
Silt	Passing #200 sieve (0.075mm to 0.002mm)	And	35 - 50
Clay	Smaller than 0.002mm		

RELATIVE DENSITY AND CONSISTENCY CLASSIFICATION

GRANULAR SOILS

DENSITY CLASSIFICATION	APPROXIMATE RANGE OF N *
Very Loose	0 - 3
Slightly Dense	4 - 9
Medium Dense	10 - 29
Dense	30 - 49
Very Dense	50 - 80
Extremely Dense	80 +

COHESIVE SOILS

CONSISTENCY	UNCONFINED COMPRESSIVE STRENGTH, Qu - TSF	APPROXIMATE RANGE OF N *
Very Soft	0.25	0 - 2
Soft	0.25 - 0.49	3 - 4
Firm	0.50 - 0.99	5 - 8
Stiff	1.00 - 1.99	9 - 15
Very Stiff	2.00 - 3.99	16 - 30
Hard	4.00 - 8.00	31 - 50
Very Hard	8.00 +	Over 50

* STANDARD PENETRATION TEST (ASTM D1586) - A 2.0" outside-diameter, split barrel sampler is driven into undisturbed soil by means of a 140 pound weight falling freely through a vertical distance of 30 inches. The sampler is normally driven 3 successive 6 inch increments. The total number of blows required for the final 12 inches of penetration is the Standard Penetration Resistance (N).



Joint Public Safety Training Campus (JPSTC) Traffic Impact Study

City of Chicago
121 N LaSalle St
Chicago, IL 60602

For Chicago Department of Transportation Review

June 11, 2020

Prepared for:

Chicago Department of Transportation
30 N LaSalle St., Suite 1100
Chicago, IL 60602

Prepared by:

AECOM
303 E. Wacker Drive, Suite 1400
Chicago, IL 60601
aecom.com

Executive Summary

The City of Chicago has contracted the Public Safety and Community Builders Joint Venture to design and build the new Joint Public Safety Training Campus (JPSTC) for the City's first responders. The 30-acre project site is located at 4301 W. Chicago Avenue and will provide Chicago Fire and Police departments (CPD and CFD) with a modern facility where scenario-based training can occur. The main training facility will have 380 off-street parking spaces. Access to this surface lot will be off of Kilbourne Avenue. In addition to this facility, the proposed campus will contain two restaurants. One of these is a 9,000 square foot sit-down breakfast restaurant with no drive-through service (Peaches) and the other is a 7,000 square foot fast casual restaurant (Culver's) with drive-through service. As part of this development, the Chicago Transit Authority (CTA) access route currently at Kostner Avenue will be realigned to Kolin Avenue. This campus will be constructed in multiple phases with estimated groundbreaking in December 2020 and completion in December 2022.

This study evaluates traffic operations on the nearby road network in existing year (2020) and future year (2022) scenarios for the AM and PM peak hour. Future (2022) traffic volumes within the study area include the background traffic growth due to regional population or employment changes, and site generated traffic volumes from the proposed site development. This report has not considered other potential developments which may be occurring with the study area.

The Chicago Metropolitan Agency for Planning (CMAP) provided projections for the surrounding roadway network. Their travel demand model indicated a 1% total growth rate from existing (2020) to future (2022) background traffic volumes. This growth rate was applied to existing (2020) traffic volumes at all study intersections to project future (2022) background traffic volumes.

The JPSTC site generated traffic includes traffic that would be added to the system as a result of the JPSTC, Peaches and Culvers end users. The CPD and CFD users will arrive at the site significantly earlier than the AM peak hour of the surrounding roadway network while the Peaches and Culvers traffic will coincide with the AM peak hour of the surrounding street network. Therefore, only the Peaches and Culvers traffic is captured in the AM peak analysis. All traffic contributing to the JPSTC training facility will depart in concurrence with the surrounding networks PM peak hour. Site generated traffic due to the JPSTC campus will add 103 vehicles¹ during the AM peak and 638 vehicles during the PM peak.

Synchro traffic analysis software was used to determine the intersection level of service (LOS) and 95th percentile queue lengths in the existing (2020) and future (2022) conditions. Key findings of the analysis are listed below:

W Chicago Avenue and N Kilbourn Avenue (West)

This intersection is operating at a LOS D in existing condition (2020) during the AM peak hour and a LOS C in the PM peak hour with the lowest LOS experienced by the eastbound through (EBT) movement at LOS E during the AM peak hour. The 95th percentile queues along W Chicago Avenue are greatest in the EB direction during the AM peak (approximately 800 feet) and in the WB direction during the PM peak (approximately 700 feet). The long queues are created by reducing the four-lane cross section to a two-lane cross section at this intersection due to the viaduct constraint.

In the 2022 Build condition, this intersection is expected to operate at a LOS C and LOS D in the AM and PM, respectively, with signal timing adjustment. All individual movements operate at a

¹ Representing only restaurant trips during AM peak hour of surrounding street. For more details refer Section 4 of this report.

LOS D or better indicating no significant impact from proposed development. However, restriping the westbound approach at N Kilbourne and Chicago Avenue to provide a left turn lane to improve safety for this movement is recommended as part of this study.

W Chicago Avenue and N Kolin Avenue

Due to the realignment of the CTA Access Road, the northbound approach at this intersection is expected to operate a LOS F during the 2022 Build condition. The northbound left turn will experience an average delay of 95 seconds in the AM peak and 105 seconds in the PM peak compared to an existing 25 seconds of delay. Although northbound approach experiences such a high delay, the 95th percentile queues will not be longer than 4 vehicles at this approach. A signal warrant analysis was performed for this intersection to determine if the intersection warrants a traffic signal in 2022. Based on the analysis, the W Chicago Avenue and N Kolin Avenue intersection does not warrant a traffic signal in 2022. That said the implementation of a signal would improve the LOS for this intersection and likely improve on the queue length for the CTA. A decision to place a signal at this intersection should be discussed between CDOT and the CTA.

N Kilbourne Avenue and Ohio Street

All-Way Stop Controlled (AWSC) Intersection on N Kilbourne Avenue at Ohio St and Lake St is operating with LOS C or better in the existing and 2022 no-build conditions, and LOS F for southbound movement during PM peak hour during 2022 build condition with approx. 250 feet queue lengths. Once, development is in place, it is expected to add northbound/southbound traffic on N Kilbourne Avenue and hence, conversion of 'Two-Way Stop Controlled (TWSC)' with stop sign at Ohio St will improve this intersection to LOS C or better for 2022 build condition.

All other intersections within the study area are operating with LOS D or better in the existing and 2022 conditions with reasonable queue lengths.

Table of Contents

Contents

- Executive Summary iii
- 1. Introduction 1
 - 1.1 Project Background..... 1
 - 1.2 Purpose and Objectives 1
- 2. Existing (2020) Conditions 2
 - 2.1 Site Location and Study Area 2
 - 2.2 Transportation System 3
 - 2.2.1 Roadway Characteristics..... 3
 - 2.2.2 Public Transportation 5
 - 2.2.3 Pedestrian Network..... 5
 - 2.2.4 Bicycle Network..... 5
 - 2.2.5 Parking Facilities 6
 - 2.3 Traffic Characteristics 6
- 3. Proposed Development..... 11
 - 3.1 Site Plan 11
 - 3.2 Proposed Land Use(s) and Intensity 11
 - 3.3 Proposed Site Access Locations 11
 - 3.4 Project Phasing and Estimated Time Schedule 11
 - 3.5 On-site Parking Facility 11
- 4. Future (2022) Traffic 13
 - 4.1 Background Traffic Growth..... 13
 - 4.2 Trip Generation and Modal Split..... 13
 - 4.3 Trip Distribution 14
 - 4.4 Total Future (2022) Traffic Volumes 15
- 5. Traffic Analysis 20
 - 5.1 Methodology and Level of Service Description..... 20
 - 5.2 Existing and Future Capacity Analyses 20
 - 5.3 Existing and Future 95% Queues 26
 - 5.4 Discussion and Recommendations 28
- 6. Conclusion 29

Appendix A Proposed Site Plan

Appendix B Traffic Counts

Appendix C Signal Timing Permits

Appendix D Synchro Results

Appendix E Signal Warrant Analysis

Appendix F Turning Movement Diagrams (AutoTurn)

Appendix G Growth Factor from Chicago Metropolitan Agency for Planning (CMAP)

Figures

Figure 1: Site location with Respect to the Surrounding Street System	2
Figure 2: Public Transportation routes near JPSTC Site (Route 66 and 54)	5
Figure 3: Study Intersections.....	6
Figure 4: Lane Configurations at Study Intersections	8
Figure 5: Existing (2020) Peak Hour Vehicle Traffic Volumes	9
Figure 6: Existing (2020) Peak Hour Pedestrian and Bicycle Traffic Volumes.....	10
Figure 7: Directional Distribution of Site-Generated Trips (Restaurants)	16
Figure 8: Directional Distribution of Site-Generated Trips (Training Building)	17
Figure 9: Site-Generated Traffic Volumes.....	18
Figure 10: Total Future (2022) Projected Traffic Volumes	19

Tables

Table 1. Existing AADT of Major Study Corridors	7
Table 2. Estimated Site-Generated Traffic Volumes.....	14
Table 3 Morning peak hour selection.....	15
Table 4. LOS Criteria at Intersections.....	20
Table 5. Intersection Delay and LOS Results by Movement #1 - N Kilbourne Ave (West) & Chicago Ave.....	21
Table 6. Intersection Delay and LOS Results by Movement #3 - N Kostner Ave & Chicago Ave	22
Table 7. Intersection Delay and LOS Results by Movement #4 – N Kolin Ave/CTA Drive & Chicago Ave (TWSC).....	23
Table 8. Intersection Delay and LOS Results by Movement #5 - N Kilbourne Ave & W Ohio St (AWSC)	24
Table 9. Intersection Delay and LOS Results by Movement #6 - N Kilbourne Ave & W Lake St.....	25
Table 10. 95 th Percentile Queue Lengths – AM Peak Hour	26
Table 11. 95 th Percentile Queue Lengths – PM Peak Hour	27

1. Introduction

1.1 Project Background

The City of Chicago has contracted the Public Safety and Community Builders Joint Venture to design and build the new Joint Public Safety Training Campus for the City's first responders. The 30-acre project site is located at 4301 W. Chicago Avenue and will provide Chicago Fire and Police departments (CFD and CPD) with a modern facility where scenario-based training can occur. The campus is located east of N Kilbourn Ave and south of W Chicago Ave. The campus will consist of a 185,000 square foot primary training and office building, approximately 380 off-street parking spaces, and an outdoor training facility which will include a mock streetscape, a six-story burn tower, and a drive training pad. An outdoor plaza space, approximately 16,000 square foot, has been dedicated for community use and programming. The plaza will have a prime location on Chicago Avenue and will be located in between the primary training building and the development lots.

The proposed Chicago Avenue development will also contain two restaurants on positioned on lots which front Chicago Avenue. One restaurant is 9,000 square foot with no drive-through service (/Peaches). The other restaurant is a 7,000 square foot fast casual restaurant (Culver's) with drive-through service.

1.2 Purpose and Objectives

The purpose of this report is to summarize and evaluate the following:

- **Existing Conditions (2020)** - Section 2 provides a description of the existing road network, transit service, and traffic volumes of vehicles, bikes and pedestrians at study intersections.
- **Proposed Development.** Section 3 presents the proposed development plan including vehicle trip generation and distribution.
- **Future Conditions (2022).** Section 4 presents estimated total traffic volumes in the full build out year (2022). This traffic is the sum of background traffic growth and the site generated trips.
- **Traffic Analysis.** Section 5 reports the results from existing (2020) and future (2022) traffic analysis, including delays, LOS and 95th-percentile queue length from Synchro evaluations.
- **Conclusion** Section 6 summarizes the key assumptions and findings of this traffic study.

The objective of this study is to evaluate and mitigate the impacts of the proposed development on the nearby street network.

2. Existing (2020) Conditions

This section provides a description of the existing road network in the vicinity of the proposed JPSTC site, existing transit service that serves the site, and collected traffic volumes of vehicles, bikes and pedestrians at study intersections.

2.1 Site Location and Study Area

The proposed JPSTC is located at 4301 W Chicago Ave in Chicago, Illinois, east of N Kilbourn Ave and south of W Chicago Ave. The 30-acre site is currently undeveloped and is surrounded by residential, commercial and manufacturing land uses. There are no nearby planned developments at this time.



Figure 1: Site location with Respect to the Surrounding Street System

2.2 Transportation System

2.2.1 Roadway Characteristics

The study area is comprised of the following streets:

W Chicago Avenue is a 30-mph minor arterial four lane cross section with two 11' lanes in the eastbound direction and two 11' lanes in the westbound direction. Left turn lanes are provided at major cross streets such as N Kostner Avenue. At the West N Kilbourn Avenue intersection, Chicago Ave narrows from a four-lane section to a two-lane section to accommodate the narrow Belt Ry. Co. of Chicago (BRC)² railway viaduct.

IDOT function class: Minor Arterial

CDOT classification: Thoroughfare

Jurisdiction: CDOT

N Kilbourn Avenue is a 30-mph north-south street separated by Chicago Avenue into two segments. N Kilbourn Avenue to the south of Chicago Avenue is a two-lane two-way street connecting Chicago Avenue and Lake Street. N Kilbourn Avenue to the north of Chicago Avenue is a one-way northbound street. Within the study area N Kilbourne Avenue passes predominantly through industrial developments.

IDOT function class: Local Road

CDOT classification: Neighborhood Street

Jurisdiction: CDOT

N Kostner Avenue is a 30-mph two-lane cross section with one lane in the northbound direction and one lane in the southbound direction. The segment south of Chicago Avenue (also called CTA Access Road) provides access to CTA's Chicago Avenue Garage. The CTA utilizes this garage daily. N Kostner Avenue is surrounded by mostly residential developments and provides access to the local street network.

IDOT function class: Local Road

CDOT classification: Neighborhood Street

Jurisdiction: CDOT

N Kolin Avenue is a 30-mph residential one-way southbound roadway. It provides parking on both sides of the corridor. N Kolin Avenue provides access to the driveways of the residential developments.

IDOT function class: Local Road

CDOT classification: Neighborhood Street

Jurisdiction: CDOT

² http://www.idot.illinois.gov/Assets/uploads/files/Transportation-System/Maps-&-Charts/RailRoad-Maps/2015_RR_MAP_CHICAGO_STLOUIS_AREA.pdf

W Ohio Street is a 30-mph east-west roadway serving an industrial development, which is generally comprised of two lanes, one in each direction, and parking on both sides of the corridor.

IDOT function class: Local Road or Street

CDOT classification: Neighborhood Street

Jurisdiction: CDOT

W Lake Street is a 30-mph major east-west arterial that runs in parallel with CTA's Green Line service. The roadway is comprised of four lanes, two lanes each direction with bike lanes and parking on both sides of the corridor. The piers of the elevated track separate the travel lanes of the same direction.

IDOT function class: Major Arterial

CDOT classification: Thoroughfare

Jurisdiction: CDOT

2.2.2 Public Transportation

- CTA Bus Route 66 runs along Chicago Avenue serving the study area and future development site. Route 66 operates between Navy Pier and Austin Boulevard with connections to the CTA Blue, Brown, Red, and Purple lines. Service is provided seven days a week.
- CTA Bus Route 54 also operates through nearby areas of the proposed site (Cicero & Chicago (North), Stop ID: 10301/15299, approx. 0.3 mile from proposed JPSTC) and serves areas between Cicero and W Chicago Avenue along N Cicero Avenue.

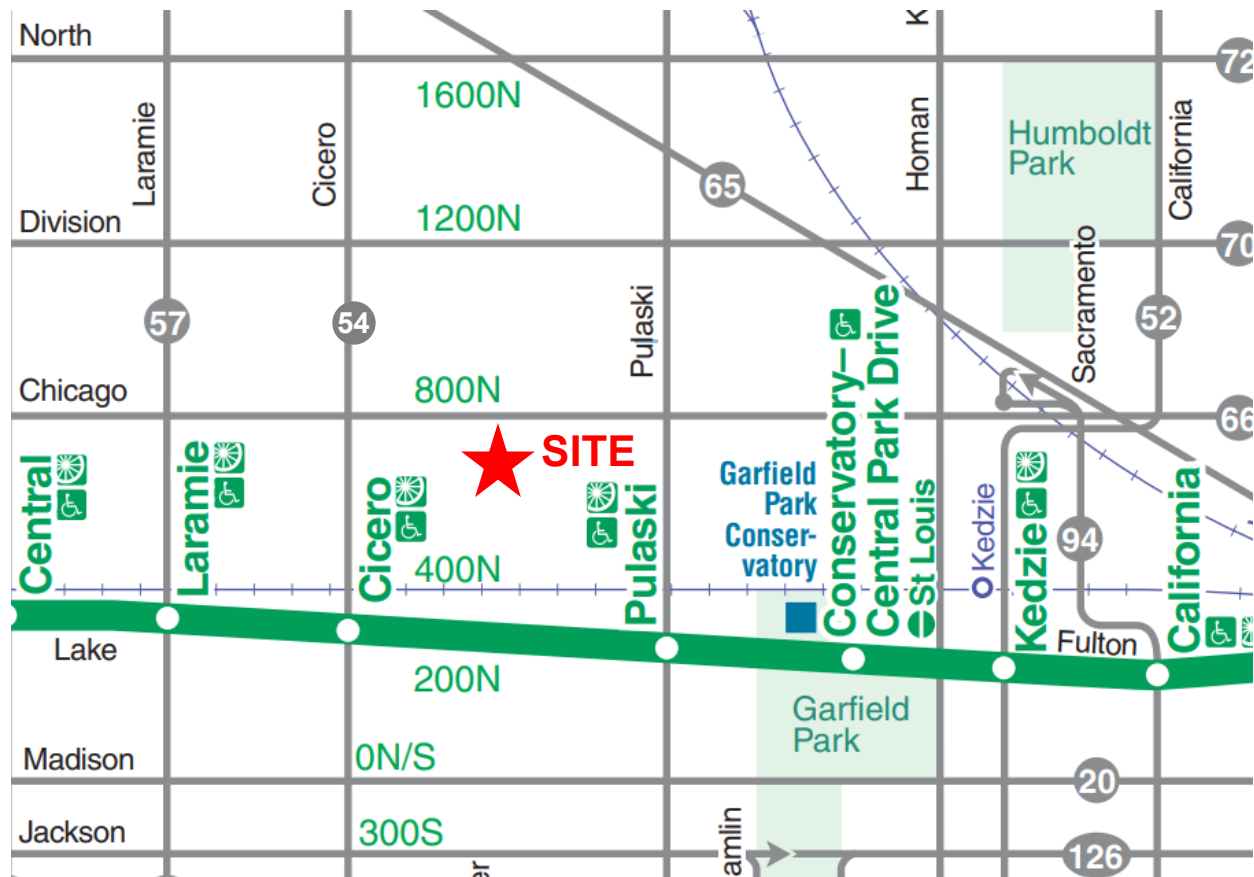


Figure 2: Public Transportation routes near JPSTC Site (Route 66 and 54)

2.2.3 Pedestrian Network

Pedestrian sidewalks (approximately 7 feet wide) are generally provided on both sides of all major streets within the study area.

2.2.4 Bicycle Network

A buffered bike lane is provided along Lake Street. Lake Street is considered a spoke route of Chicago’s bicycle network. There are no other dedicated or shared bike lanes provided on any streets within the study area.

2.2.5 Parking Facilities

On-street parallel parking is available on both sides of the W Chicago Avenue east of N Kilbourne Ave (East) intersection. This on-street parking is 8 feet wide. Parallel parking is also permitted on both sides of N Kilbourne Avenue.

2.3 Traffic Characteristics

2.3.1 Peak Hour Turning Movement Counts

Traffic data was collected on Tuesday, March 3, 2020 at six intersections as shown in **Figure 3**. It is important to note that the traffic data captured occurred before any shelter-in-place directions were put in place. As such, we are of the considered opinion that the data captured represents typical traffic data.

1. W Chicago Avenue and N Kilbourn Avenue (West) – Signalized and W Chicago Avenue and N Kilbourn Avenue (East) – Unsignalized³
2. W Chicago Avenue and N Kostner Avenue - Signalized
3. W Chicago Avenue and N Kolin Avenue – Unsignalized (TWSC)
4. N Kilbourn Avenue and W Ohio Street – Unsignalized (AWSC)
5. N Kilbourn Avenue and W Lake Street – Signalized

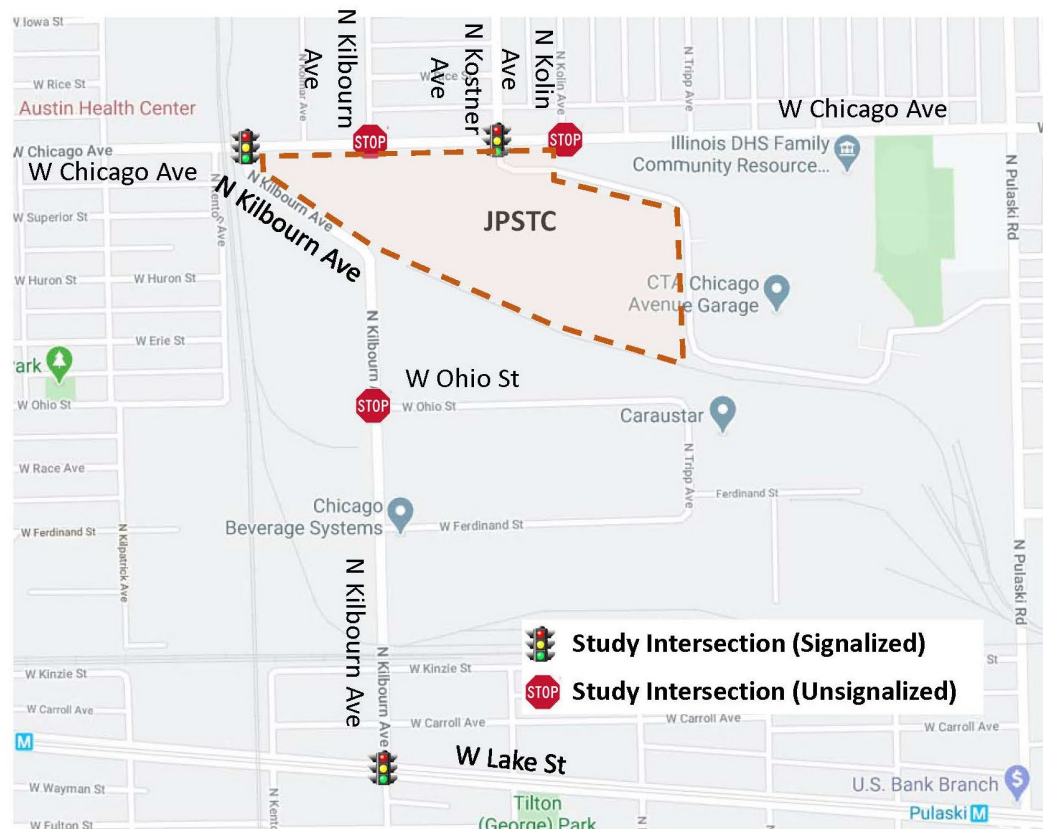


Figure 3: Study Intersections

Turning movement counts were collected for passenger cars, heavy vehicles, pedestrians and bicyclists during the AM peak hours (7am – 9am) and PM peak hours (3pm – 6pm). Additional

³ Third leg at this intersection is one-way so, no conflicting movement from third leg approaching this intersection and no stop sign. Eastbound left operates permissive.

data was collected from 6 am-7 am at the intersection of Kolin Avenue and Chicago Avenue to facilitate signal warrant analysis. **Based on the traffic counts, the AM peak hour for the study area is between 7:15 am and 8:15 am. The PM peak hour is between 3:45 pm and 4:45 pm.**

Figure 5 shows the existing peak hour vehicle traffic volumes. **Figure 6** shows the existing peak hour pedestrian and bicycle traffic volumes. Traffic count details are shown in **Appendix B**.

2.3.2 Average Annual Daily Traffic

Annual average daily traffic (AADT) data for all streets within the study area was obtained from the Illinois Department of Transportation's online traffic count database system.

Table 1 shows the existing AADT of major corridor segments within the study area.

Table 1. Existing AADT of Major Study Corridors

Corridor	AADT (vpd)
W Chicago Avenue	17,800
N Kilbourn Avenue (South)	6,350
N Kilbourn Avenue (North)	N/A
N Kostner Avenue	7,250
N Kolin Avenue	N/A
W Ohio Street	N/A
W Lake Avenue	13,100

Source: IDOT Website (<http://www.gettingaroundillinois.com/gai.htm?mt=aadt>)

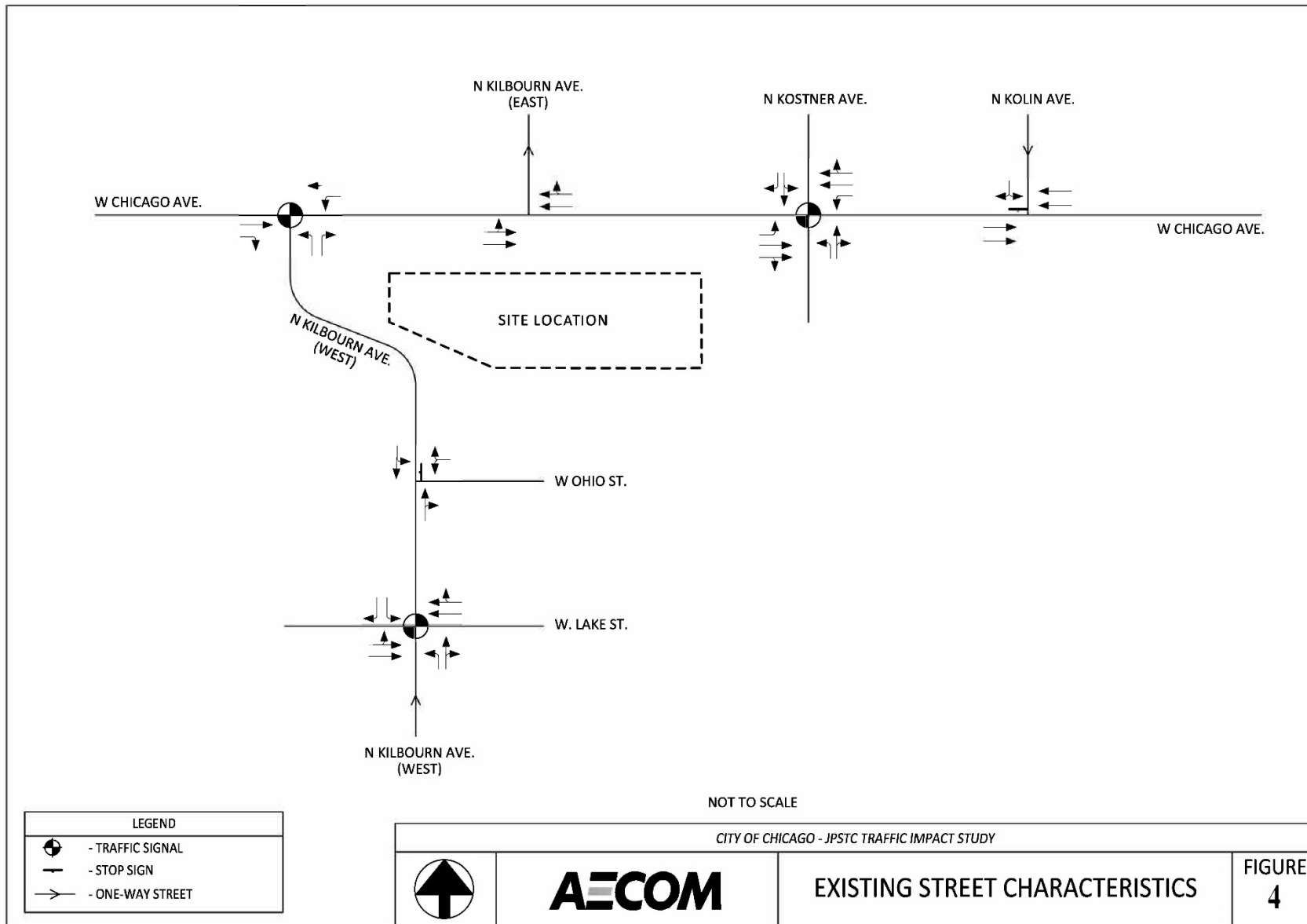


Figure 4: Lane Configurations at Study Intersections

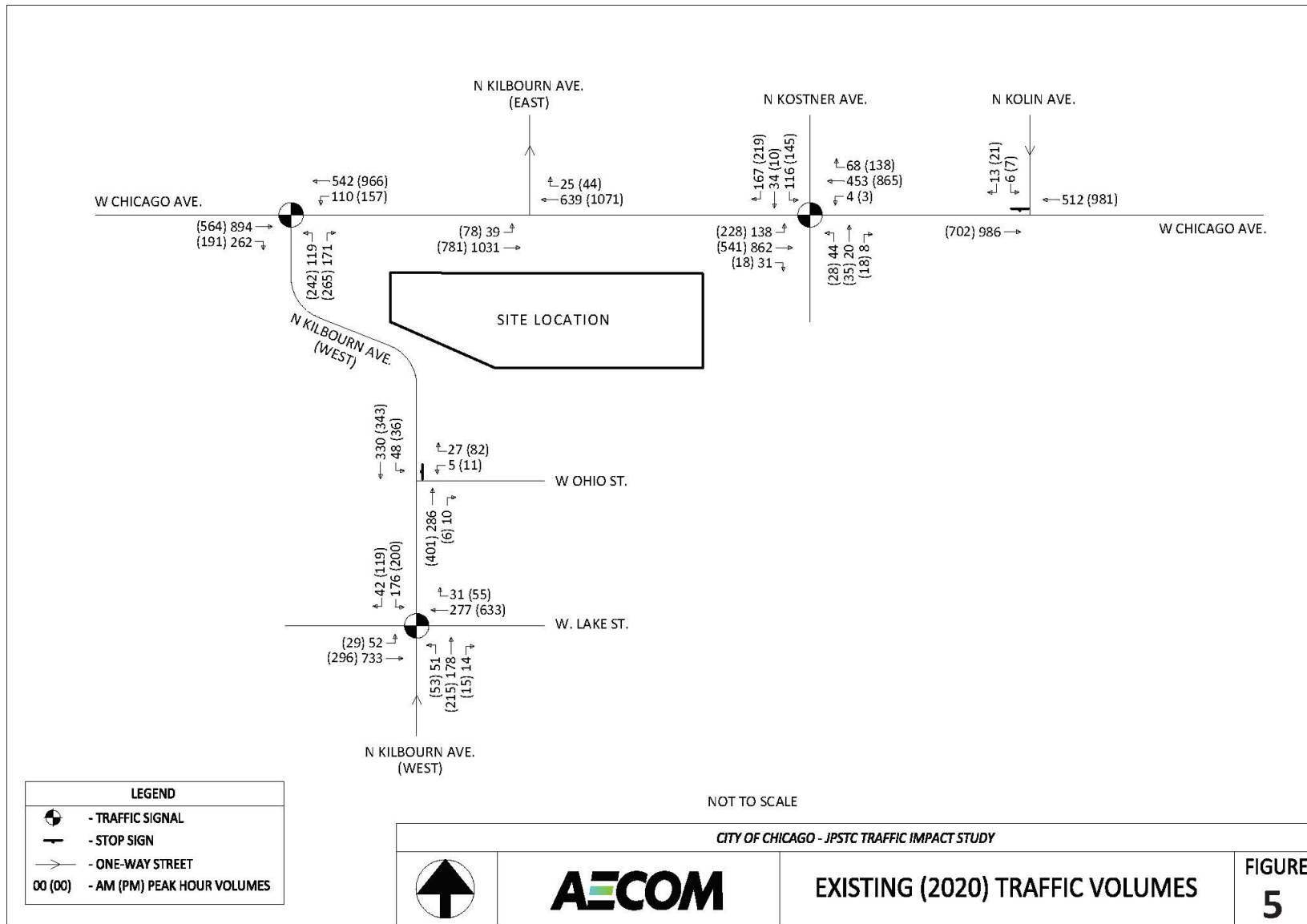


Figure 5: Existing (2020) Peak Hour Vehicle Traffic Volumes

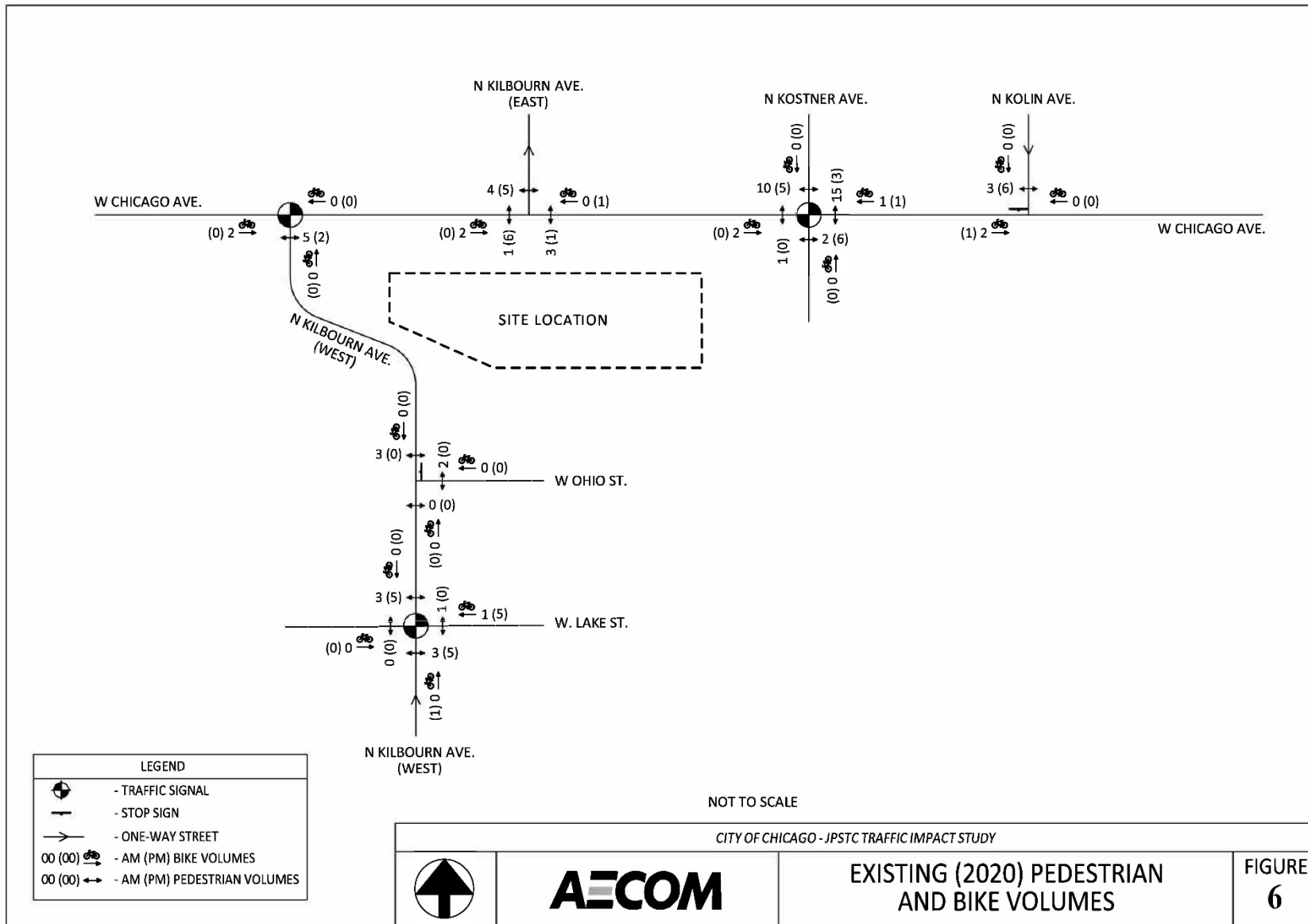


Figure 6: Existing (2020) Peak Hour Pedestrian and Bicycle Traffic Volumes

3. Proposed Development

3.1 Site Plan

Appendix A shows the proposed site plan for the campus.

3.2 Proposed Land Use(s) and Intensity

The campus will consist of a 185,000 square foot primary training and office building, approximately 380 off-street parking spaces and an outdoor training facility which will include a mock streetscape, a six-story burn tower, and a drive training pad.

An outdoor plaza space, approximately 16,000 square foot, has been dedicated for community use and programming. The plaza will have a prime location on Chicago Avenue and will be located in between the primary training building and the development lots.

The campus will also have two restaurants on site. One restaurant is 9,000 square feet with no drive-through service (Peaches). The other is a 7,000 square foot fast casual restaurant (Culver's) with drive-through service.

3.3 Proposed Site Access Locations

The City of Chicago has contracted the Public Safety and Community Builders Joint Venture (PSCB) to design and build the new Joint Public Safety Training Campus for the City's first responders. The 32-acre project site is located at 4301 W. Chicago Avenue and will provide Chicago Fire and Police departments with a modern facility where scenario-based training can occur.

The current site plan offers 380 off-street parking spaces for the training facility. Vehicles access to the surface parking lot for the main training building is from N Kilbourn Avenue and access to the small 32 spaces visitor parking is through a driveway on W Chicago Avenue expected to be used during off-peak hours by relatively small number of the visitors. Vehicles access to both of the restaurants is through the intersection at N Kostner Avenue and W Chicago Avenue.

Bike racks are proposed on the west side of the training building close to the entrance. Pedestrians could access the campus via the existing sidewalks along W Chicago Avenue and N Kilbourn Avenue. The loading dock is proposed to be located on the south side of the training building. Trucks will access the loading dock via N Kilbourn Avenue.

The CTA Access Road that aligns with Kostner Avenue in existing conditions will be shifted east and realigned with Kolin Avenue due to the campus development.

3.4 Project Phasing and Estimated Time Schedule

The construction of the campus will have one phase with estimated groundbreaking in November 2020 and completion in December 2022.

3.5 On-site Parking Facility

The current site plan offers 380 off-street parking spaces for the training facility.

However, the City has advised that there are potential options for additional off-street parking to assist in accommodating the end users for this facility.

1. The City has developed a phased master plan for the neighbor which considers additional scope being added to the current planned JPSTC Development. In Phase III of their four phases plan the City is considering the purchase of property directly to the south of the JPSTC site located on the east side of N. Kilbourn Avenue. The intent is that this property will be used for additional parking. This addition would help to address any shortfall in onsite parking.
2. The City has evaluated the possibility of converting the paved portion of the City owned transfer station, southwest of the project site (also on N. Kilbourn Ave), into overflow JPSTC dedicated parking. In the initial concept this potential lot could accommodate an additional +290 parking space.

4. Future (2022) Traffic

Future (2022) traffic volumes within the study area include the background traffic growth due to regional population or employment changes, and generated traffic volumes from proposed site development. This study has not considered other potential development sites and/or projects within the study area.

4.1 Background Traffic Growth

Chicago Metropolitan Agency for Planning (CMAP) provided 2050 ADT projections for the study area. CMAP developed traffic projections for 2050 using existing traffic volumes and the results from the October 2019 CMAP Travel Demand Analysis. The regional travel model uses CMAP 2050 socioeconomic projections and assumes the implementation of the ON TO 2050 Comprehensive Regional Plan for the Northeastern Illinois area. **Appendix G** shows the detailed growth rate information provided by CMAP.

Based on the information from CMAP a total growth rate of 1% was derived and applied to existing (2020) traffic volumes at all study intersections to estimate future (2022) background traffic volumes due to regional developments.

4.2 Trip Generation and Modal Split

For the JPSTC training building, the city estimated a maximum of 910 attendees would arriving or departing the campus within following timetable:

1. CPD
 - a. AM: 0600-0700 hrs
 - b. PM: 1530-1630 hrs
 - c. Assume 65% of 910 total attendees
2. CFD
 - a. AM: 0600-0700 hrs
 - b. PM: 1500-1600 hrs
 - c. Assume 35% of 910 total attendees

Since this incoming traffic is outside of the observed AM peak hour of the surrounding street network (7:15 am and 8:15 am), these morning trips are not considered as part of this traffic analysis.

Since part of this departing traffic falls within the PM peak hour (3:45 pm to 4:45 pm) of surrounding street networks, these trips are included as part of the PM peak analysis as per following:

- Due to the location of this facility within the neighborhood, it is assumed that 80% of the attendees arrive/leave by driving alone and the remaining 20% use other modes such as public transport, walking, biking or carpooling. This converts to 728 car trips.
- CPD: conservatively, all 65% assumed travelling during the observed PM peak hour '3:45 to 4:45PM'
- CFD: only a quarter of the 35% assumed traveling during the observed PM peak '3:45 - 4:45PM'
- JPSTC - total 65% + 9% = 74% added on '3:45 - 4:45PM'
- 74% of 728 cars = 539 cars are added on the street network for '3:45 - 4:45PM'

The generated vehicle trips from the two restaurants are estimated based on trip generation rates contained in the Trip Generation Manual, 10th Edition, published by the Institute of Transportation Engineers (ITE). **Table 2** summarizes the estimated entering and exiting trips during the AM and PM peak hour.

Table 2. Estimated Site-Generated Traffic Volumes

ITE Code	ITE Category	Quantity	Total	AM		Total	PM	
				In	Out		In	Out
Restaurants								
930	Fast Casual Restaurant (Culver's)	7,000 square foot	14	9	5	99	54	45
932	High-Turnover (Sit-Down) Restaurant (Peaches)	9,000 square foot	89	49	40	Restaurant is expected to close at 3PM.		
Subtotal			103	58	45	99	54	45
JPSTC Training Facility			0	0	0	539	0	539 ^a
Total			103	58	45	638	54	584

Note:

a. 74% of 80% of 911 attendees who will leave by cars during PM peak hour ($911 * 80% * 74% = 539$).

4.3 Trip Distribution

The restaurant generated trips are assigned to the traffic network based on the existing traffic patterns at adjacent intersections. However, the training facility trips have a different distribution from the restaurants as the training building serves as a major attraction for the work-based trips in the region. It is assumed that 50% of the trips will use I-290 to access the site via Kilbourn Avenue, and 50% of trips use Chicago Avenue. At a high level, the trips from I-290 capture trips which typically originate from the south and west while Chicago Avenue captures trips originating from the north and east; **Figure 7** and **Figure 8** shows the directional distribution of trips generated from the restaurants and the JPSTC training building, respectively. **Figure 9** shows the assignment of site-generated trips.

4.4 Total Future (2022) Traffic Volumes

Total future (2022) traffic volumes within the study area include the background traffic growth due to regional population or employment changes and generated traffic volumes from proposed site development. **Figure 10** shows total future (2022) projected traffic volumes.

Please note the decision to model the AM peak period from 7:15-8:15 AM (considered as 7 AM – 8 AM from IDOT TCDS) versus 6:00-7:00 AM which would coincide with the CPD/CFD break was based on historical count data from Illinois' Traffic Count Database System 2018 counts. The existing traffic volumes along Chicago Avenue from 6:00-7:00 AM are significantly lower than 7:00-8:00 AM. So much so that the existing 6:00-7:00 AM count volumes and CPD/CFD traffic combined is less than the 7:00-8:00 volumes. Please see **Table 3** for comparison of two peak hours during the morning peak period.

Table 3 Morning peak hour selection

Hour	Direction (Chicago Avenue)	Existing Traffic (IDOT TCDS)	JPSTC Training Facility	Restaurants	Total
6:00-7:00⁴	EB	575	182 ⁵	0 ⁶	757
	WB	355	182	0	537
7:00-8:00⁷	EB	1,109	0	35 ⁸	1137
	WB	594	0	20 ⁹	607

This table illustrates that the greatest burden on the street network is realized at a later time period than the CPD/CFD AM peak.

⁴ Volumes from <https://idot.ms2soft.com/tcds/tsearch.asp?loc=idot&mod=>

⁵ 728 cars (80% of 911 attendees) X 25% on each of eastbound and westbound Chicago Avenue

⁶ Restaurants are not expected to attract additional significant (other than pass by/destine) traffic during 6AM to 7AM.

⁷ Volumes from <https://idot.ms2soft.com/tcds/tsearch.asp?loc=idot&mod=>

⁸ Eastbound on Chicago Avenue between N Kilbourne West and N Kostner Ave

⁹ Westbound on Chicago Avenue between N Kilbourne East and N Kostner Ave

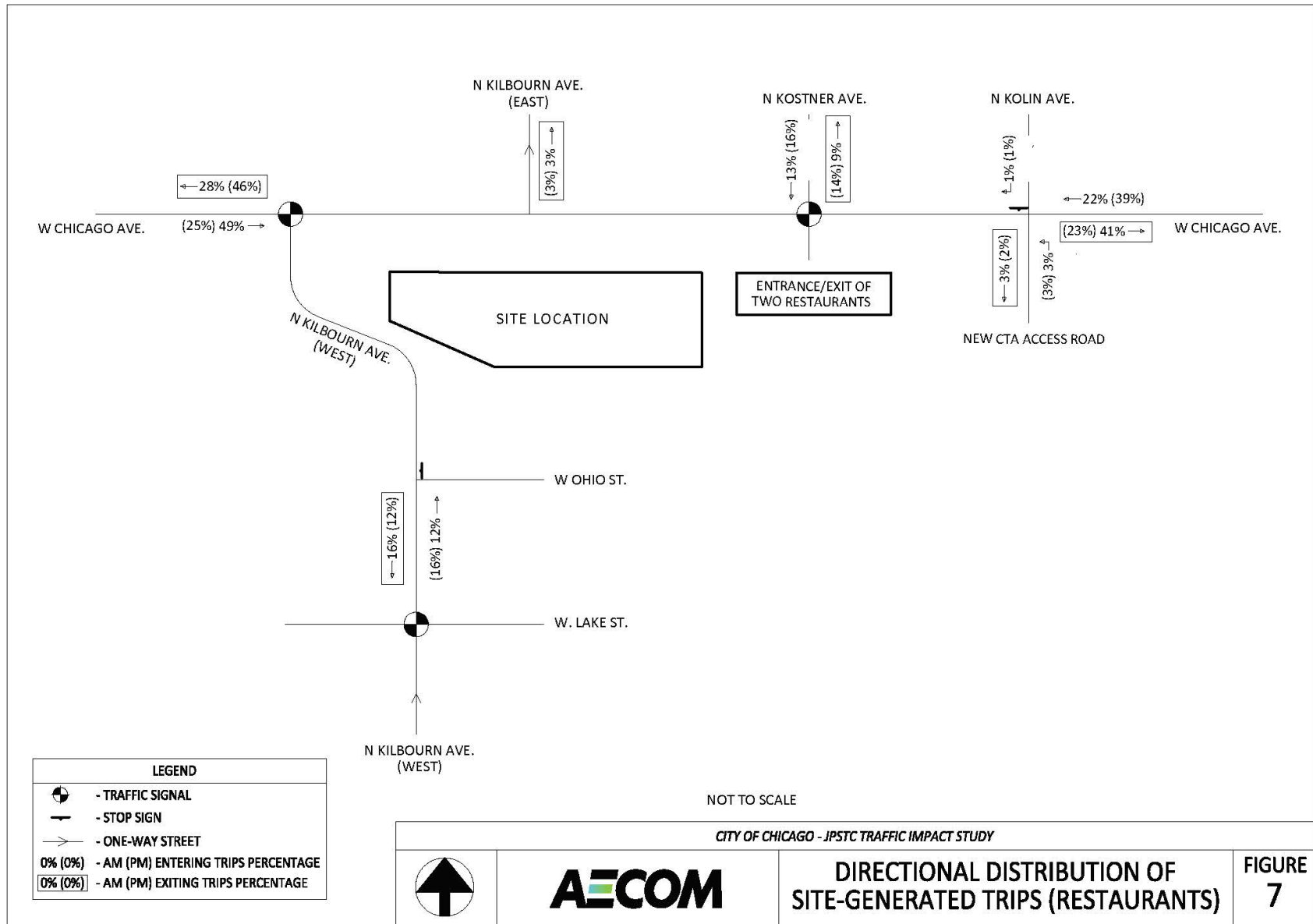


Figure 7: Directional Distribution of Site-Generated Trips (Restaurants)

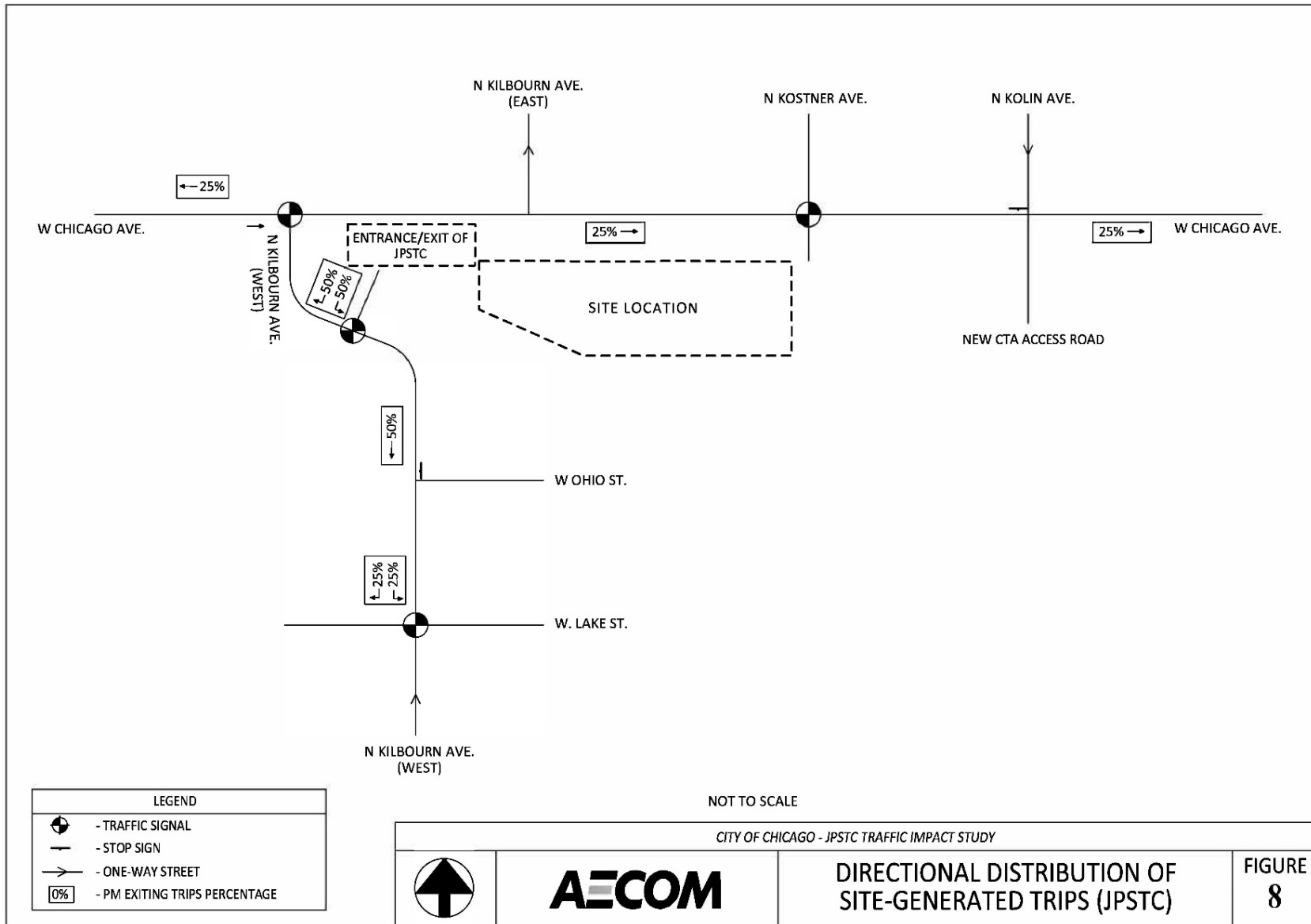


Figure 8: Directional Distribution of Site-Generated Trips (Training Building)

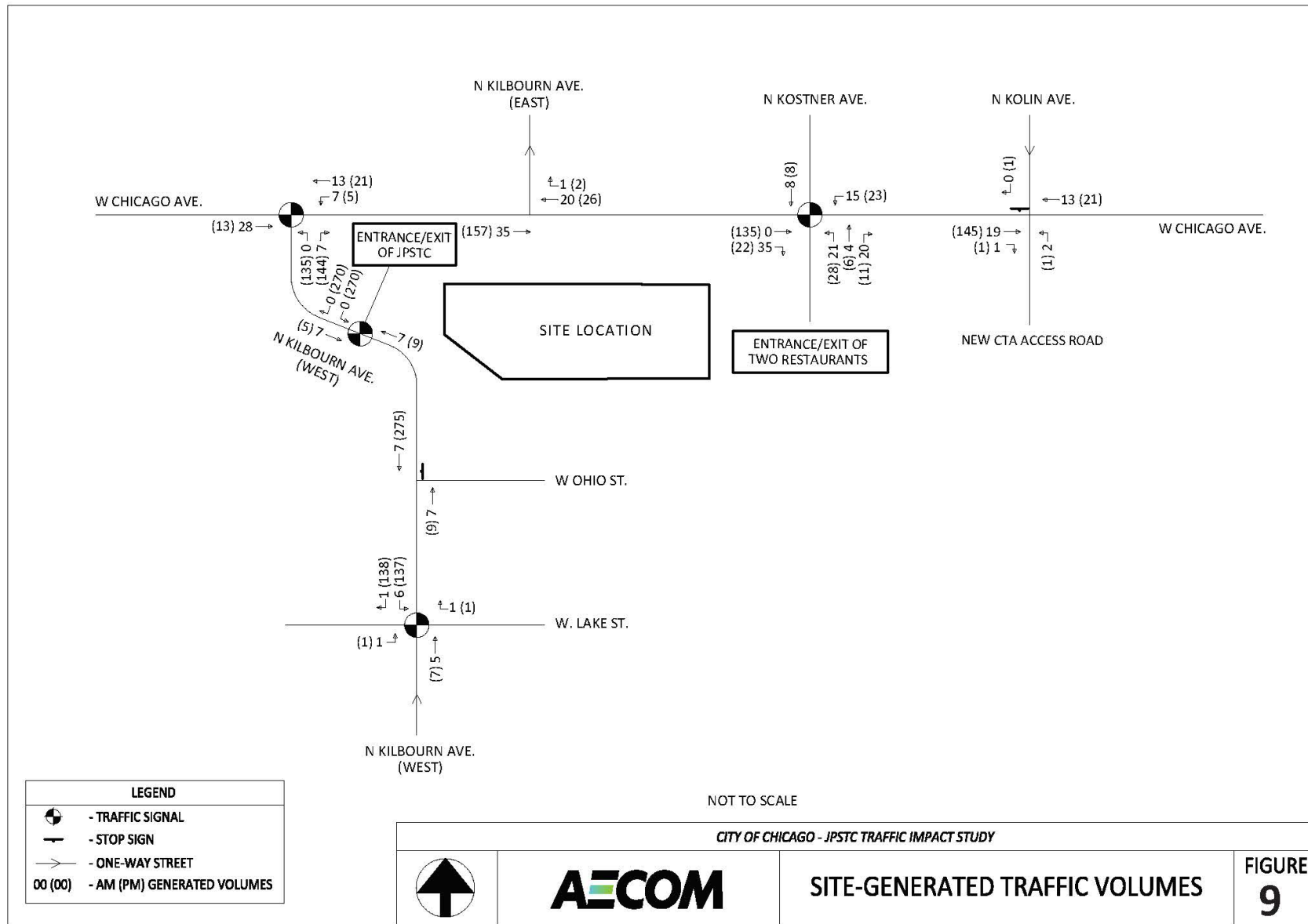


Figure 9: Site-Generated Traffic Volumes

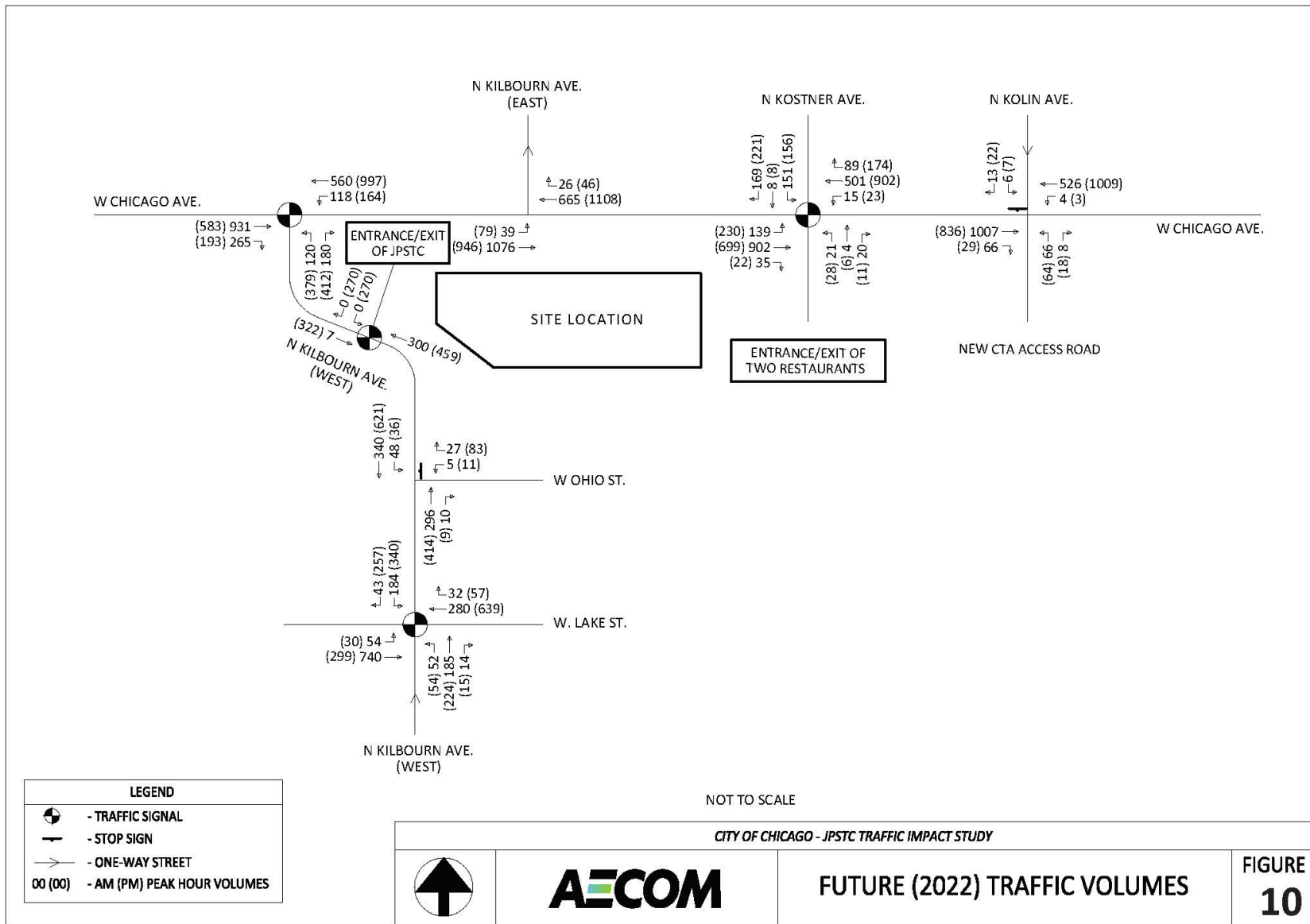


Figure 10: Total Future (2022) Projected Traffic Volumes

5. Traffic Analysis

5.1 Methodology and Level of Service Description

In order to quantify intersection traffic operations at the study area intersections, LOS values were determined using the industry-standard methodology presented in the *Highway Capacity Manual* (6th Edition)¹⁰, published by the Transportation Research Board (TRB). Synchro traffic analysis software (version 11), based on the *Highway Capacity Manual* (6th Edition) methodologies, was used to perform the analysis.

The term “level of service” (LOS) denotes how well (or poorly) a traffic movement operates under given traffic demands, lane configurations, and traffic controls. Each level is determined by the average amount of control delay per vehicle. Control delay is the total delay associated with stopping for a traffic signal or stop sign, and includes four components: deceleration delay, queue move up time, stopped delay, and final acceleration delay.

Table 3 shows the LOS criteria for signalized and unsignalized intersections per HCM 6th Edition. LOS A indicates small average control delays (less than 10 seconds per vehicle), whereas LOS F indicates intersection failure, resulting in extensive vehicular queues and long delays (over 80 seconds per vehicle at a signalized intersection). For the signalized intersections, the intersection delay represents the average delay of all the vehicles accessing the intersection within one hour. For the two-way stop-controlled intersections, the movement with the highest delay was used to represent the intersection delay.

Table 4. LOS Criteria at Intersections

Level of Service	Signalized Intersections (sec)	Unsignalized Intersections (sec)
A	<10	<10
B	10 – 20	10 – 15
C	20 – 35	15 – 25
D	35 – 55	25 – 35
E	55 – 80	35 – 50
F	>80	>50

Source: HCM 6th Edition

Existing signal timing at signalized intersections were provided by CDOT and used in Synchro models for this traffic analysis. **Appendix C** shows the existing signal timing plans from CDOT.

5.2 Existing and Future Capacity Analyses

Table 4 shows the intersection delay and LOS during the AM and PM peak hours for existing (2020) and future (2022) conditions. A summary of the intersection delay and LOS results by individual movements for each of the study intersections in the existing and future conditions are presented in **Table 5** to **Table 9**. Detailed Synchro outputs are documented in **Appendix D**.

¹⁰ Wherever HCS 6th edition results are not possible (such as Non-NEMA Phasing), Synchro results have been provided.

Table 5. Intersection Delay and LOS Results by Movement #1 - N Kilbourne Ave (West) & Chicago Ave

		Signalized	Total	Eastbound		Westbound		Northbound		
				Chicago Ave		Chicago Ave		N Kilbourne Ave (West)		
				T	R	L	T	L	R	
AM Peak Hour	SC1_Existing 2020	Delay (s/veh)	37	-	70.8	10.6	18.3	8.5	31	7.1
		LOS	D	-	E	B	B	A	C	A
	SC2_No Build 2022	Delay (s/veh)	25.4	-	44.8	8.4	17.6	6	36.9	8.8
		LOS	C	-	D	A	B	A	D	A
	SC3_Build 2022	Delay (s/veh)	33.6	-	52.6	8.5	19.4	6.6	36.9	8.8
		LOS	C	-	D	A	B	A	D	A
PM Peak hour	SC1_Existing 2020	Delay (s/veh)	26.4	-	32.9	12	12.4	29.9	38.6	6.9
		LOS	C	-	C	B	B	C	D	A
	SC2_No Build 2022	Delay (s/veh)	26.7	-	33.5	12.1	12.4	30.2	38.8	7
		LOS	C	-	C	B	B	C	D	A
	SC3_Build 2022	Delay (s/veh)	33.6	-	42	13.5	16.6	41	42.3	12.2
		LOS	C	-	D	B	B	D	D	B

LOS = Level of Service

Table 6. Intersection Delay and LOS Results by Movement #3 - N Kostner Ave & Chicago Ave

Signalized		Total	Eastbound		Westbound		Northbound		Southbound		
			Chicago Ave		Chicago Ave		N Kostner Ave		N Kostner Ave		
			L	TT/R	L	TT/R	L	T/R	L/T	R	
AM Peak Hour	SC1_Existing 2020	Delay (s/veh)	17.5	16.9	20.5	12.5	14.4	22.3	16	24.5	4.8
		LOS	B	B	C	B	B	C	B	C	A
	SC2_No Build 2022	Delay (s/veh)	17.2	16.3	19.9	12.5	14.4	22.3	16	24.6	4.7
		LOS	B	B	B	B	B	C	B	C	A
	SC3_Build 2022	Delay (s/veh)	17.4	16.4	20.1	13.6	14.9	20.8	10	25.6	4.7
		LOS	B	B	C	B	B	C	A	C	A
PM Peak hour	SC1_Existing 2020	Delay (s/veh)	16.3	39.4	8.1	9.7	15	24.5	17.9	31.9	6.9
		LOS	B	D	A	A	B	C	B	C	A
	SC2_No Build 2022	Delay (s/veh)	16.6	41.4	8.2	9.7	15.1	24.5	17.9	32	7.2
		LOS	B	D	A	A	B	C	B	C	A
	SC3_Build 2022	Delay (s/veh)	17.3	49.5	8.8	10.6	15.7	24.5	14.6	32	7.7
		LOS	B	D	A	B	B	C	B	C	A

Table 7. Intersection Delay and LOS Results by Movement #4 – N Kolin Ave/CTA Drive & Chicago Ave (TWSC)

TWSC ¹¹		Total	Eastbound			Westbound			Northbound		Southbound					
			Chicago Ave			Chicago Ave			CTA Drive		N Kolin Ave					
			L	TT/R	-	L/T	T	-	L	R	L/T/R					
AM Peak Hour	SC1_Existing 2020	LOS	B	0	0	-	0	0	-	Movements not available during Ex/No-Build.		-	B	-	-	
		Delay (s/veh)	14	0	0	-	0	0	-			-	14	-	-	
	SC2_No Build 2022	LOS	B	0	0	-	0	0	-			-	B	-	-	
		Delay (s/veh)	14.1	0	0	-	0	0	-			-	14.1	-	-	
	SC3_Build 2022	LOS	F	0	0	-	B	0	-	F			-	C	-	-
		Delay (s/veh)	94.8	0	0	-	10	0	-	94.8			-	16	-	-
PM Peak hour	SC1_Existing 2020	LOS	C	0	0	-	0	0	-	Movements not available during Ex/No-Build.		-	C	-	-	
		Delay (s/veh)	18.7	0	0	-	0	0	-			-	18.7	-	-	
	SC2_No Build 2022	LOS	C	0	0	-	0	0	-			-	C	-	-	
		Delay (s/veh)	18.8	0	0	-	0	0	-			-	18.8	-	-	
	SC3_Build 2022	LOS	F	0	0	-	A	0	-	F			-	C	-	-
		Delay (s/veh)	105.1	0	0	-	10	0	-	105.1			-	24.2	-	-

¹¹ For unsignalized intersection, movement with highest delay is shown to represent the intersection delay for two-way stop-controlled intersection.

Table 8. Intersection Delay and LOS Results by Movement #5 - N Kilbourne Ave & W Ohio St (AWSC)

AWSC ¹²		Westbound			Northbound			Southbound			
		W Ohio St			N Kilbourne Ave			N Kilbourne Ave			
		L/T			T/R			L/T			
AM Peak Hour	SC1_Existing 2020	LOS	A	-	-	B	-	-	B	-	-
		Delay (s/veh)	8.6	-	-	11.3	-	-	13.1	-	-
	SC2_No Build 2022	LOS	A	-	-	B	-	-	B	-	-
		Delay (s/veh)	8.6	-	-	11.4	-	-	13.2	-	-
	SC3_Build 2022	LOS	A	-	-	B	-	-	B	-	-
		Delay (s/veh)	8.7	-	-	11.6	-	-	13.5	-	-
PM Peak hour	SC1_Existing 2020	LOS	A	-	-	B	-	-	B	-	-
		Delay (s/veh)	9.6	-	-	15	-	-	14.5	-	-
	SC2_No Build 2022	LOS	A	-	-	C	-	-	B	-	-
		Delay (s/veh)	9.7	-	-	15.2	-	-	14.7	-	-
	SC3_Build 2022	LOS	B	-	-	C	-	-	F ¹³	-	-
		Delay (s/veh)	10.8	-	-	18.7	-	-	61.6	-	-

¹² For unsignalized intersection, movement with highest delay is shown to represent the intersection delay for two-way stop-controlled intersection.

¹³ This intersection is recommended to be converted to Two-Way Stop Controlled 'TWSC' and delay for TWSC on westbound (Ohio St) is LOS B with 12 Seconds delay and LOS C with 15 Seconds delay for AM peak hour and PM peak hour respectively for Build 2022 condition. The delay on Northbound and Southbound (N Kilbourne Ave) for TWSC is 0 second.

Table 9. Intersection Delay and LOS Results by Movement #6 - N Kilbourne Ave & W Lake St

		Signalized	Total	Eastbound	Westbound	Northbound		Southbound	
				W Lake St	W Lake St	N Kilbourne Ave		N Kilbourne Ave	
				L/TT	TT/R	L	T/R	L	R
AM Peak Hour	SC1_Existing 2020	Delay (s/veh)	13.0	10.6	7.7	14.4	17.6	29.6	4.7
		LOS	B	B	A	B	B	C	A
	SC2_No Build 2022	Delay (s/veh)	13.1	10.7	7.7	14.3	17.6	30	4.7
		LOS	B	B	A	B	B	C	A
	SC3_Build 2022	Delay (s/veh)	13.4	10.9	7.8	14.2	17.5	31.1	4.6
		LOS	B	B	A	B	B	C	A
PM Peak hour	SC1_Existing 2020	Delay (s/veh)	12.9	8.7	9.6	13.9	18	30.3	3.7
		LOS	B	A	A	B	B	C	A
	SC2_No Build 2022	Delay (s/veh)	12.9	8.7	9.6	13.9	17.9	30.7	3.6
		LOS	B	A	A	B	B	C	A
	SC3_Build 2022	Delay (s/veh)	17.7	11.2	12.5	11.4	14.1	45.3	7.8
		LOS	B	B	B	B	B	D	A

5.3 Existing and Future 95% Queues

A summary of the 95th-percentile queue lengths for the study intersections in the existing (2020) and future conditions (2022) are presented in **Table 10** and **Table 11**. Detailed Synchro outputs are documented in **Appendix D**.

Table 10. 95th Percentile Queue Lengths – AM Peak Hour

Intersection	Scenario	95 th Percentile Queue by Movement (Feet) ^a											
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
W Chicago Avenue and N Kilbourn Avenue (West) - Signalized	Ex AM	-	814	116	77	211	-	111	-	51	-	-	-
	Future AM	-	815	102	85	171	-	119	-	56	-	-	-
W Chicago Avenue and N Kostner Avenue - Signalized	Ex AM	67	230	230	7	130	130	45	27	27	119	119	42
	Future AM	65	256	256	16	148	148	26	19	19	128	128	43
W Chicago Avenue and N Kolin Avenue – Unsignalized (TWSC)	Ex AM	-	-	-	-	-	-	-	-	-	-	-	3
	Future AM	-	0	0	0	0	-	57	-	1	-	-	3
N Kilbourn Avenue and W Ohio Street - Unsignalized (AWSC)	Ex AM	-	-	-	3	-	3	-	35	35	53	53	-
	Future AM	-	-	-	3	-	3	-	37	37	55	55	-
N Kilbourn Avenue and W Lake Street - Signalized	Ex AM	185	185	-	-	62	62	31	92	92	109	-	16
	Future AM	188	188	-	-	63	63	32	96	96	116	-	16

Note:

^aChicago Ave, Ohio Street and Lake Street are eastbound/westbound. All other roadways are northbound/southbound.

Table 11. 95th Percentile Queue Lengths – PM Peak Hour

Intersection	Scenario	95 th Percentile Queue by Movement (Feet) ^a											
		Eastbound			Westbound			Northbound			Southbound		
		L	T	R	L	T	R	L	T	R	L	T	R
W Chicago Avenue and N Kilbourn Avenue (West) - Signalized	Ex PM	-	455	92	101	685	-	204	-	61	-	-	-
	Future PM	-	502	99	113	793	-	340	-	144	-	-	-
W Chicago Avenue and N Kostner Avenue - Signalized	Ex PM	111	109	109	5	250	250	34	43	43	137	137	60
	Future PM	124	142	142	19	277	277	34	18	18	143	143	66
W Chicago Avenue and N Kolin Avenue – Unsignalized (TWSC)	Ex PM	-	-	-	-	-	-	-	-	-	5	-	5
	Future PM	-	0	0	0	0	-	61	-	1	8	-	8
N Kilbourn Avenue and W Ohio Street – Unsignalized (AWSC) ¹⁴	Ex PM	-	-	-	12	-	12	-	63	63	57	57	-
	Future PM	-	-	-	14	-	14	-	81	81	264	264	-
N Kilbourn Avenue and W Lake Street - Signalized	Ex PM	67	67	-	-	141	141	31	106	106	120	-	26
	Future PM	68	68	-	-	143	143	31	109	109	269	-	76

Note:

^aChicago Ave, Ohio Street and Lake Street are eastbound/westbound. All other roadways are northbound/southbound.

¹⁴ This intersection is recommended to be converted to Two-Way Stop Controlled 'TWSC' and 95th percentile queue length for TWSC on westbound (Ohio St) is LOS B with 5 feet and LOS C with 20 feet 95th percentile queue length for AM peak hour and PM peak hour respectively for Build 2022 condition. The delay on Northbound and Southbound (N Kilbourne Ave) for TWSC is 0 second.

5.4 Discussion and Recommendations

W Chicago Avenue and N Kilbourn Avenue (West)

This intersection is operating at a LOS D in existing condition (2020) during the AM peak hour and a LOS C in the PM peak hour with the lowest LOS experienced by the eastbound through (EBT) movement at LOS E during the AM peak hour. The 95th percentile queues along W Chicago Avenue are greatest in the EB direction during the AM peak (approximately 800 feet) and in the WB direction during the PM peak (approximately 700 feet). The long queues are created by reducing the four-lane cross section to a two-lane cross section at this intersection due to the viaduct constraint.

In the 2022 Build condition, this intersection is expected to operate at a LOS C and LOS D in the AM and PM, respectively, with signal timing adjustment. All individual movements operate at a LOS D or better indicating no significant impact from proposed development. However, restriping the westbound approach at N Kilbourne and Chicago Avenue to provide a left turn lane to improve safety for this movement is recommended as part of this study.

This intersection does not have any pedestrian facility and all three legs/corners have pedestrian barricades/railing restricting pedestrian to cross any roadways at this location.

W Chicago Avenue and N Kilbourn Avenue (East) intersection has three legs, but third leg is one-way and hence, no signal or stop sign at this intersection. This intersection has continental crosswalks on all three legs without pedestrian signal heads or crosswalk regulatory signage.

W Chicago Avenue and N Kostner Avenue

This intersection is operating at a LOS B in existing (2020), no-build (2022) and build (2022) conditions during the AM peak hour and a LOS B in the PM peak hour with the lowest LOS experienced by the eastbound left turn (EBL) movement during the AM Peak hour at LOS D. The 95th percentile queues along W Chicago Avenue are moderate in the EB direction during the AM peak (approximately 250 feet) and in the WB direction during the PM peak (approximately 300 feet).

This intersection has continental crosswalks on all four legs with pedestrian signal heads / flashing hand and countdown timer.

W Chicago Avenue and N Kolin Avenue

Due to the realignment of the CTA Access Road, the northbound approach at this intersection is expected to operate a LOS F during the 2022 Build condition. The northbound left turn will experience an average delay of 95 seconds in the AM peak and 105 seconds in the PM peak compared to an existing 25 seconds of delay. Although northbound approach experiences such a high delay, the 95th percentile queues will not be longer than 4 vehicles at this approach. A signal warrant analysis was performed for this intersection to determine if the intersection warrants a traffic signal in 2022. Based on the analysis, the W Chicago Avenue and N Kolin Avenue intersection does not warrant a traffic signal in 2022. That said the implementation of a signal would improve the LOS for this intersection and likely improve on the queue length for the CTA. A decision to place a signal at this intersection should be discussed between CDOT and the CTA.

Appendix E shows the results of signal warrant analysis working sheet.

N Kilbourne Avenue and Ohio Street

All-Way Stop Controlled (AWSC) Intersection on N Kilbourne Avenue at Ohio St and Lake St is operating with LOS C or better in the existing and 2022 no-build conditions, and LOS F for southbound movement during PM peak hour during 2022 build condition with approx. 250 feet queue lengths. Once, development is in place, it is expected to add northbound/southbound traffic on N Kilbourne Avenue and hence, conversion of 'Two-Way Stop Controlled (TWSC)' will improve this intersection to LOS C or better for 2022 build condition. N Kilbourne and Ferdinand St intersection is approx. 650 feet from this studied intersection with AWSC and hence, the same recommendation is extended to Ferdinand St intersection as well.

N Kilbourne and Lake St

The N Kilbourne Avenue at Lake St intersection is operating at LOS D or better for the existing, 2022 no-build and 2022 build conditions with reasonable queue lengths. It has continental marked crosswalks on all four legs with pedestrian signal heads / flashing hand.

It is expected that loading area and service areas located near to the N Kilbourne Avenue entrance will be used during off-peak hours for loading and unloading activities and will not have any negative impact on existing street network. **Appendix F** shows turning movement diagrams with WB-40 (intermediate semi-trailer – 45 feet long) near the entrance and the service area.

The development of JPSTC has marginal traffic impacts on the existing network.

6. Conclusion

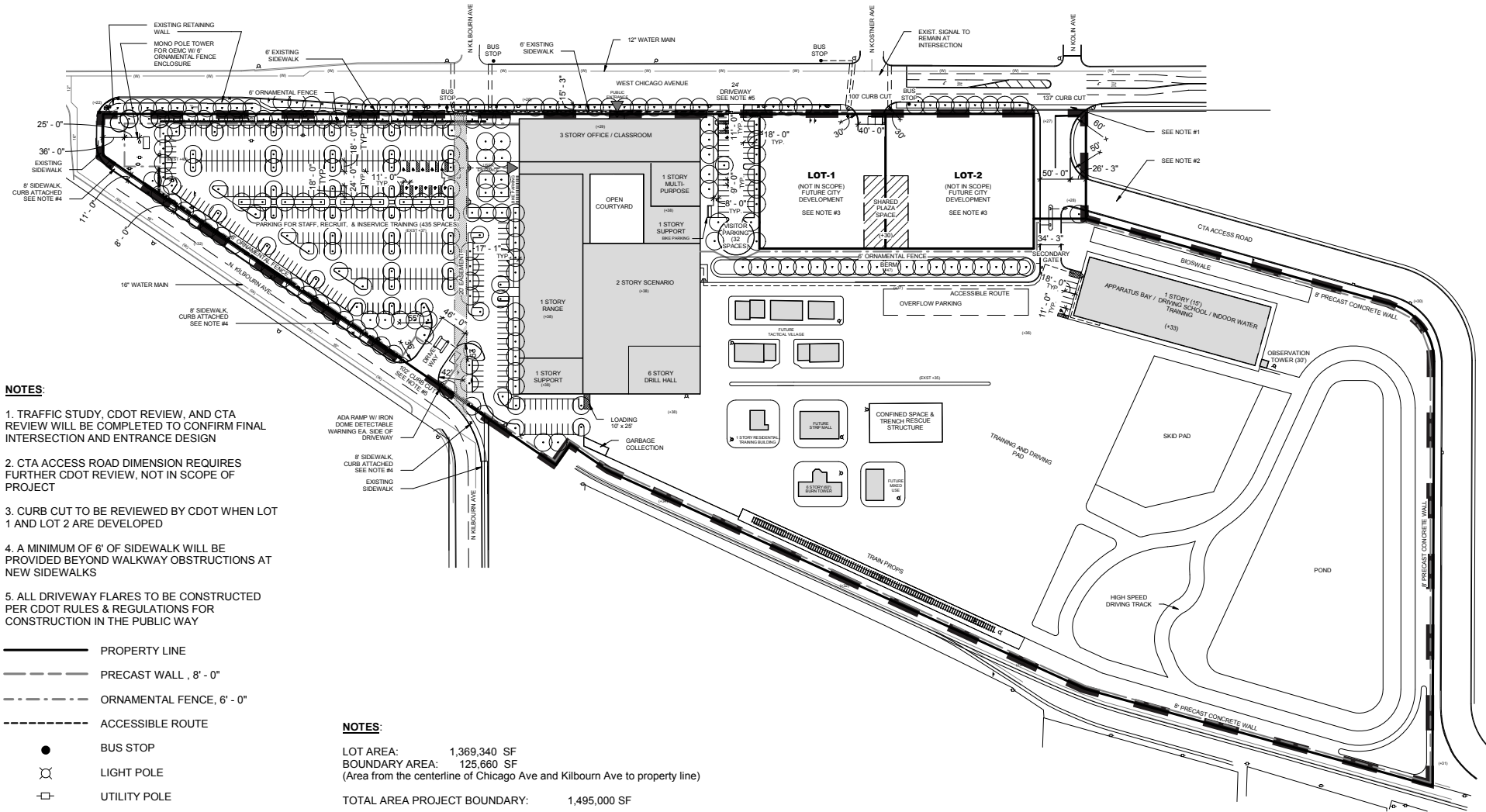
The City of Chicago intends to construct a Joint Public Safety Training Campus (JPSTC) at 4301 W Chicago Ave in Chicago, Illinois. The proposed campus contains a main training building and two restaurants. One restaurant is 9,000 square foot with no drive-through service (Peaches). The other restaurant is a 7,000 square foot fast casual restaurant (Culver's) with drive-through service. The construction of the campus will have one phase with estimated groundbreaking in November 2020 and completion in December 2022.

Based on the analyses, the study recommends the following:

- Approval of this traffic study for JPSTC campus development as traffic generated by the proposed development can be accommodated on the surrounding road network with majority of the movements within acceptable level of service.
- Restripe the westbound approach at N Kilbourne and Chicago Avenue to provide a left turn lane to improve the safety of this movement.
- Realigning the Northbound movement of the CTA Access drive to the stop-controlled N Kolin Ave intersection will result in increases in delay. Whereas the signal analysis does not warrant the addition the implementation of a signal would improve the LOS for this intersection and likely improve on the queue length for the CTA. A decision to place a signal at this intersection should be discussed between CDOT and the CTA.
- N Kilbourne and Ohio St intersection (including Ferdinand St) to Two-Way Stop Control (TWSC).
- Provide pedestrian crossing regulatory signage (W11-2) at the pedestrian crossing at W Chicago Avenue and N Kilbourn Avenue (East) to improve pedestrian safety.

Appendix A

Proposed Site Plan



NOTES:

1. TRAFFIC STUDY, CDOT REVIEW, AND CTA REVIEW WILL BE COMPLETED TO CONFIRM FINAL INTERSECTION AND ENTRANCE DESIGN
2. CTA ACCESS ROAD DIMENSION REQUIRES FURTHER CDOT REVIEW, NOT IN SCOPE OF PROJECT
3. CURB CUT TO BE REVIEWED BY CDOT WHEN LOT 1 AND LOT 2 ARE DEVELOPED
4. A MINIMUM OF 6' OF SIDEWALK WILL BE PROVIDED BEYOND WALKWAY OBSTRUCTIONS AT NEW SIDEWALKS
5. ALL DRIVEWAY FLARES TO BE CONSTRUCTED PER CDOT RULES & REGULATIONS FOR CONSTRUCTION IN THE PUBLIC WAY

- PROPERTY LINE
- - - - PRECAST WALL, 8' - 0"
- - - - ORNAMENTAL FENCE, 6' - 0"
- - - - ACCESSIBLE ROUTE
- BUS STOP
- LIGHT POLE
- UTILITY POLE
- ⊥ SIGN
- ⊕ FIRE HYDRANT

NOTES:

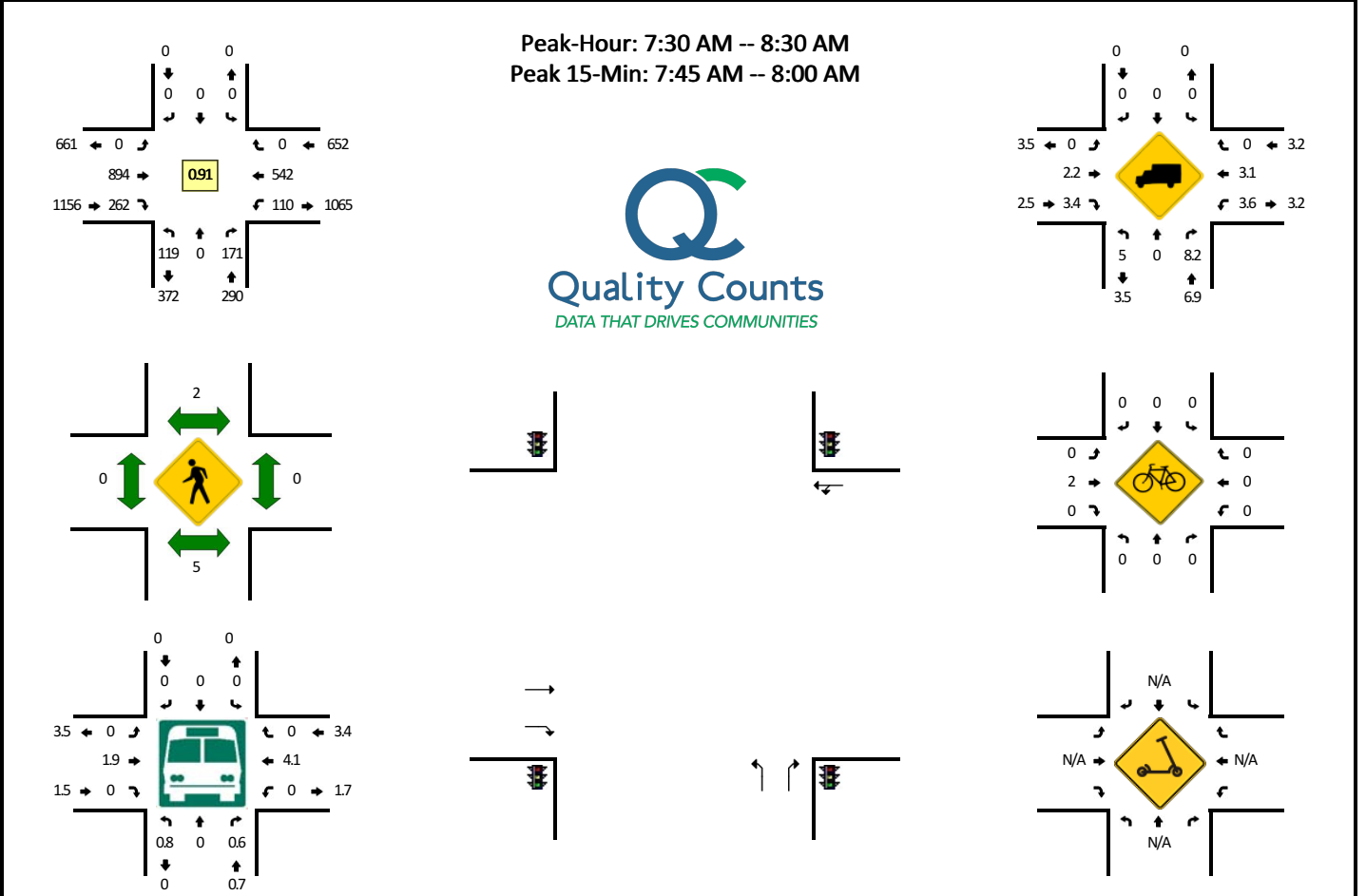
LOT AREA: 1,369,340 SF
 BOUNDARY AREA: 125,660 SF
 (Area from the centerline of Chicago Ave and Kilbourn Ave to property line)
 TOTAL AREA PROJECT BOUNDARY: 1,495,000 SF

PROPOSED SITE PLAN

Appendix B Traffic Counts

LOCATION: N Kilbourne Ave (West) -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023907
DATE: Tue, Mar 3 2020

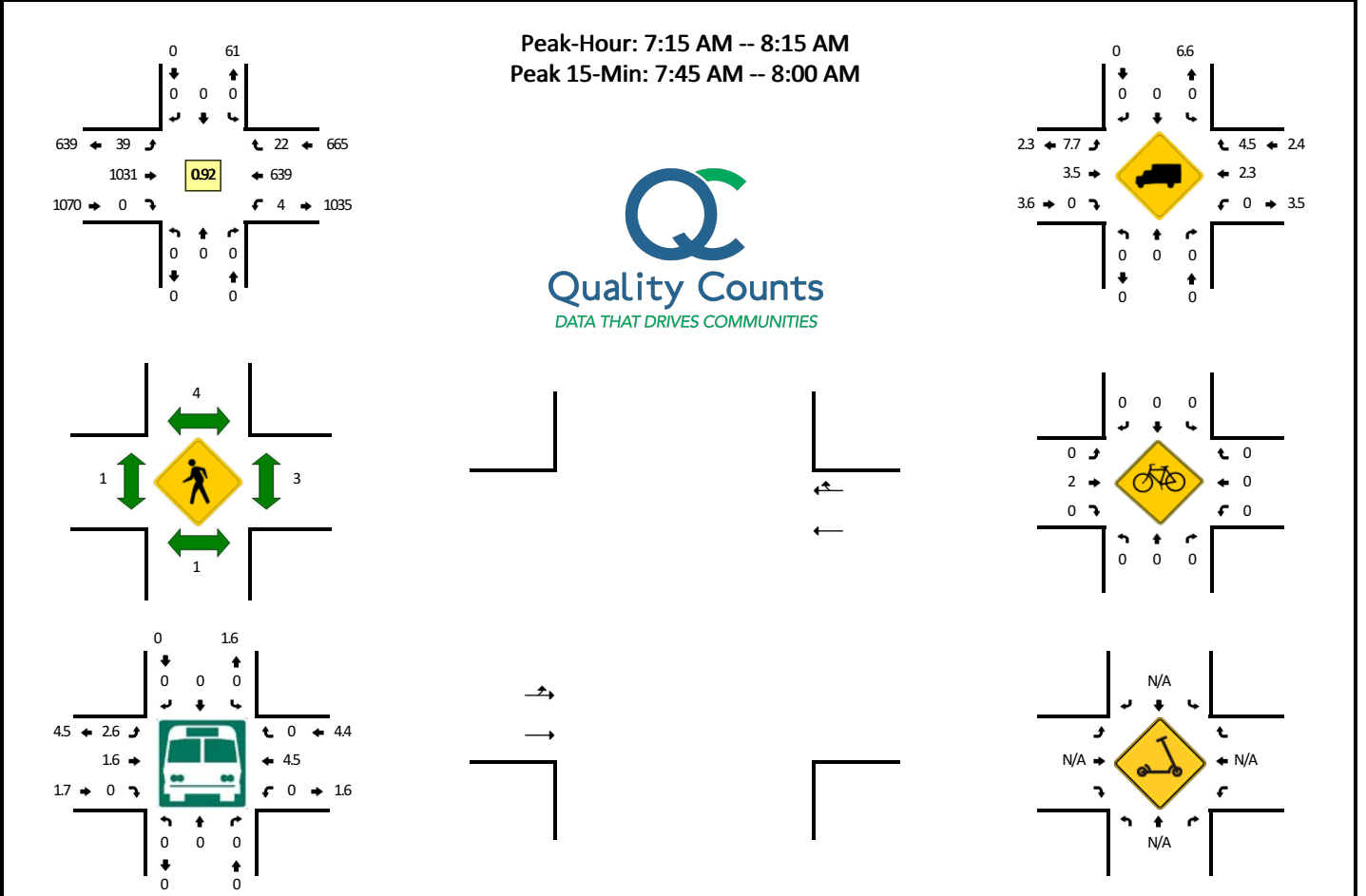


15-Min Count Period Beginning At	N Kilbourne Ave (West) (Northbound)				N Kilbourne Ave (West) (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	22	0	24	0	0	0	0	0	0	195	34	0	22	86	0	0	383	
7:15 AM	24	0	30	0	0	0	0	0	0	240	59	0	22	112	0	0	487	
7:30 AM	19	0	44	0	0	0	0	0	0	264	61	0	24	132	0	0	544	
7:45 AM	39	0	43	0	0	0	0	0	0	224	77	0	35	158	0	0	576	1990
8:00 AM	32	0	40	0	0	0	0	0	0	187	79	0	29	116	0	0	483	2090
8:15 AM	29	0	44	0	0	0	0	0	0	219	45	0	22	136	0	0	495	2098
8:30 AM	30	0	43	0	0	0	0	0	0	190	46	0	29	129	0	0	467	2021
8:45 AM	24	0	27	0	0	0	0	0	0	204	34	0	18	122	0	0	429	1874
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	156	0	172	0	0	0	0	0	0	896	308	0	140	632	0	0	2304	
Heavy Trucks	8	0	12	0	0	0	0	0	0	32	4	0	4	8	0	0	68	
Buses	0	0	4	0	0	0	0	0	0	24	0	0	0	24	0	0	52	
Pedestrians	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
Bicycles	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	4	
Scoters																		

Comments:

LOCATION: N Kilbourne Ave (East) -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023905
DATE: Tue, Mar 3 2020

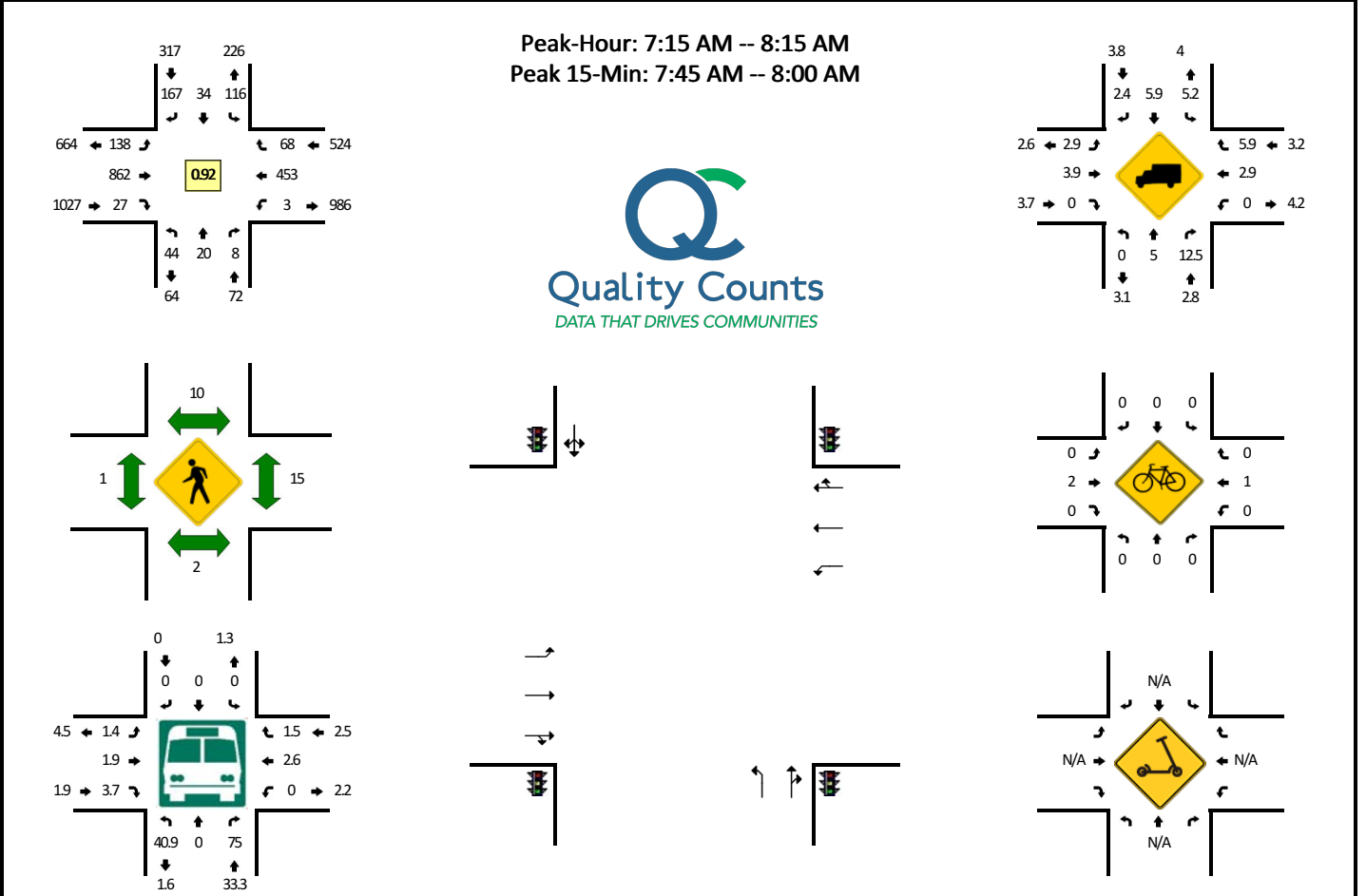


15-Min Count Period Beginning At	N Kilbourne Ave (East) (Northbound)				N Kilbourne Ave (East) (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	0	0	0	0	0	0	0	12	201	0	0	0	116	6	0	335	
7:15 AM	0	0	0	0	0	0	0	0	5	269	0	0	0	139	4	0	417	
7:30 AM	0	0	0	0	0	0	0	0	14	288	0	0	0	153	8	1	464	
7:45 AM	0	0	0	0	0	0	0	0	13	255	0	0	0	196	4	1	469	1685
8:00 AM	0	0	0	0	0	0	0	0	7	219	0	0	0	151	6	2	385	1735
8:15 AM	0	0	0	0	0	0	0	0	7	247	0	0	0	151	2	0	407	1725
8:30 AM	0	0	0	0	0	0	0	0	10	227	0	0	0	159	5	0	401	1662
8:45 AM	0	0	0	0	0	0	0	0	11	214	0	0	0	135	4	0	364	1557
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	0	0	0	0	52	1020	0	0	0	784	16	4	1876	
Heavy Trucks	0	0	0	0	0	0	0	0	0	48	0	0	0	16	0	0	64	
Buses	0	0	0	0	0	0	0	0	0	24	0	0	0	24	0	0	48	
Pedestrians			4				4			0				0			8	
Bicycles	0	0	0		0	0	0		0	4	0		0	0	0		4	
Scoters																		

Comments:

LOCATION: N Kostner Ave -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023903
DATE: Tue, Mar 3 2020

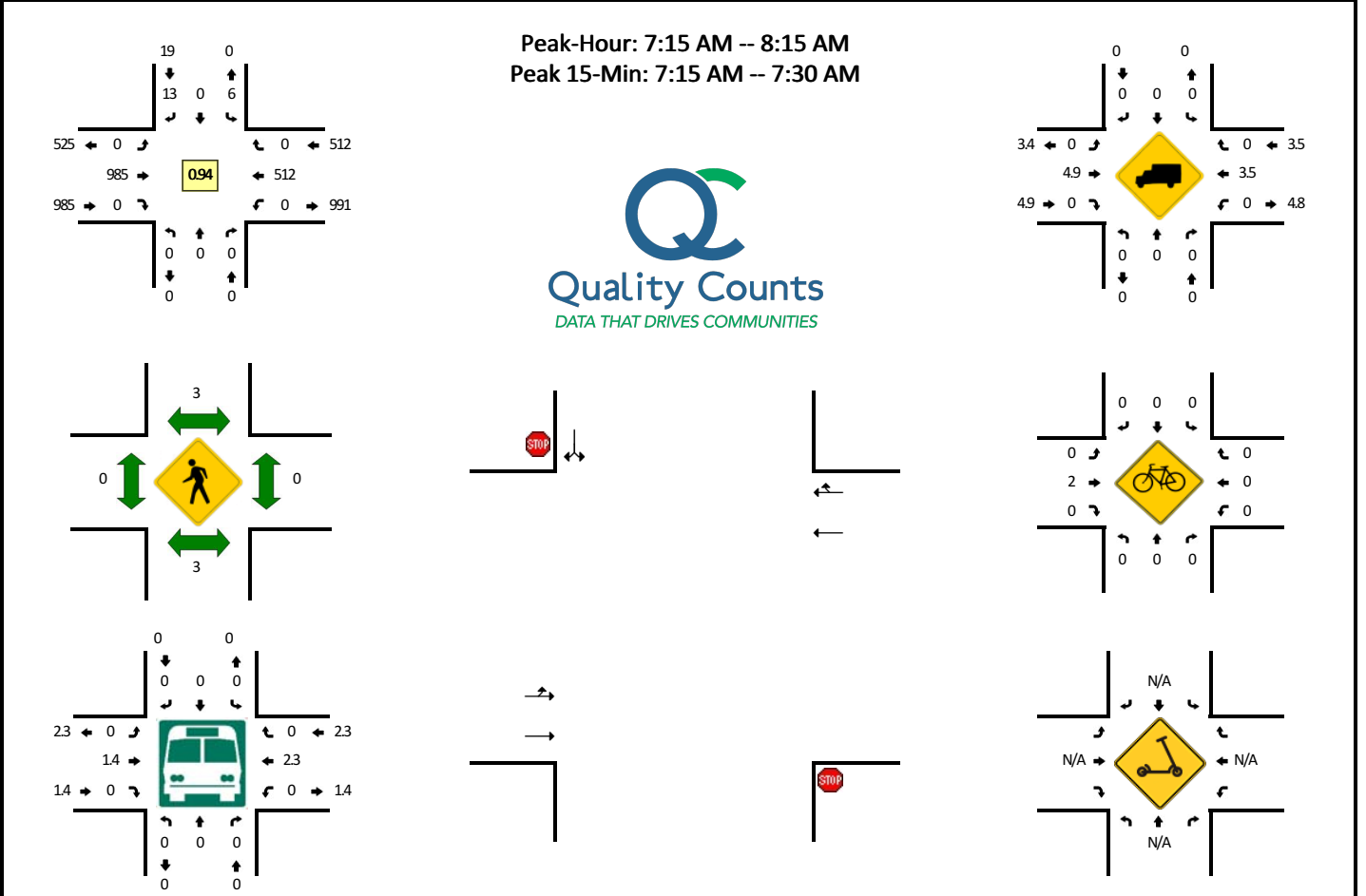


15-Min Count Period Beginning At	N Kostner Ave (Northbound)				N Kostner Ave (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	11	4	2	0	24	4	29	0	27	158	5	0	0	84	13	0	361	
7:15 AM	11	4	5	0	34	4	32	0	38	237	2	0	2	99	19	0	487	
7:30 AM	10	6	0	0	27	7	40	0	37	236	10	0	0	110	16	0	499	
7:45 AM	17	6	0	0	30	15	52	0	34	208	10	0	1	133	19	0	525	1872
8:00 AM	6	4	3	0	25	8	43	0	29	181	5	0	0	111	14	0	429	1940
8:15 AM	6	5	0	0	35	6	29	0	42	195	4	0	1	114	19	0	456	1909
8:30 AM	1	2	1	0	30	5	47	0	45	182	3	0	0	122	20	0	458	1868
8:45 AM	7	3	0	0	39	5	29	0	30	188	2	0	0	106	21	0	430	1773
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	68	24	0	0	120	60	208	0	136	832	40	0	4	532	76	0	2100	
Heavy Trucks	0	0	0	0	8	4	4	0	0	44	0	0	0	16	8	0	84	
Buses	12	0	0	0	0	0	0	0	0	28	4	0	0	8	0	0	52	
Pedestrians	0	4	0	0	0	32	0	0	0	4	0	0	0	28	0	0	68	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scoters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments:

LOCATION: N Kolin Ave -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023901
DATE: Tue, Mar 3 2020

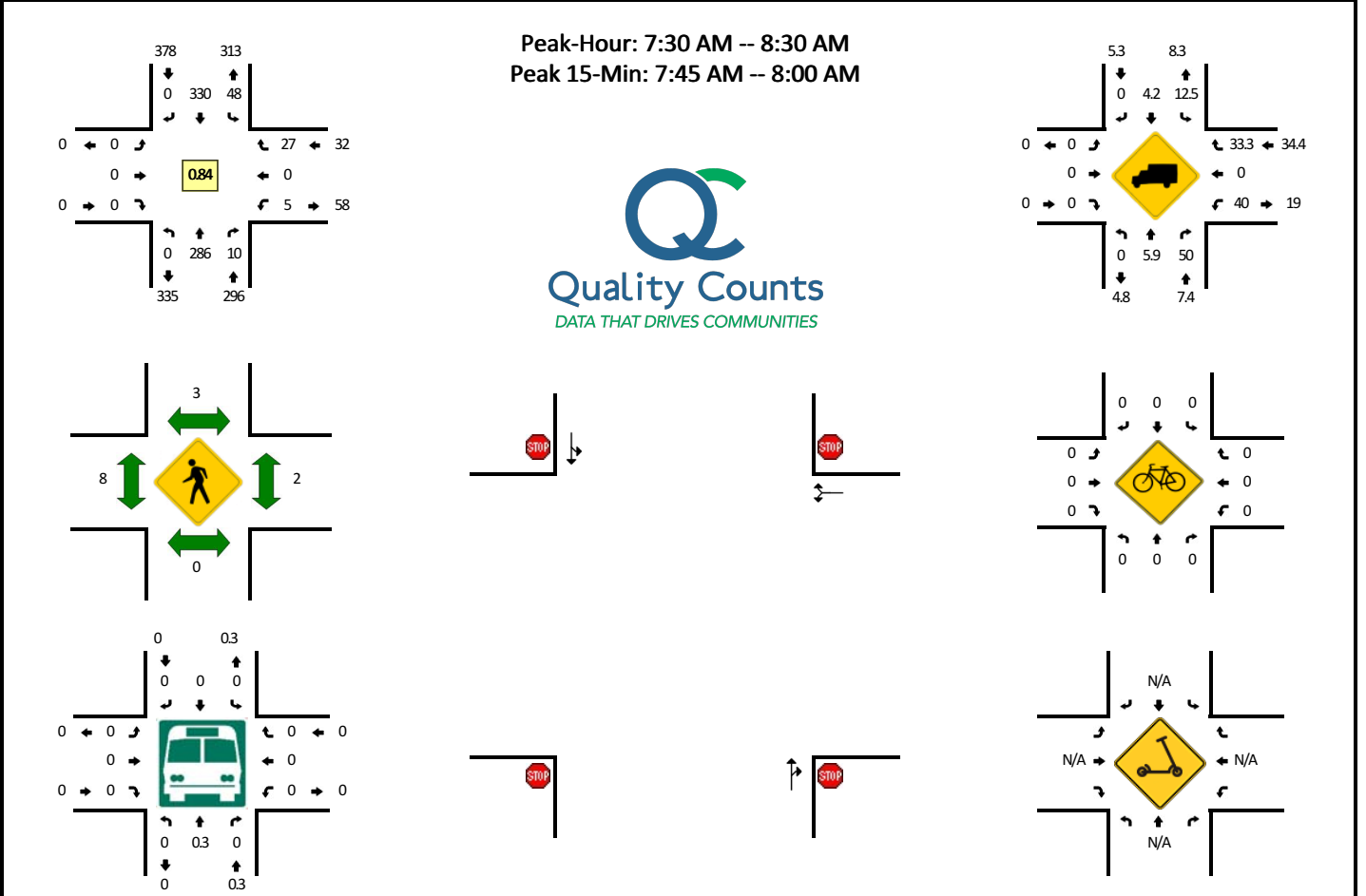


15-Min Count Period Beginning At	N Kolin Ave (Northbound)				N Kolin Ave (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
6:00 AM	0	0	0	0	6	0	2	0	0	88	0	0	0	61	0	0	157	
6:15 AM	0	0	0	0	1	0	0	0	0	101	0	0	0	85	0	0	187	
6:30 AM	0	0	0	0	2	0	2	0	0	120	0	0	0	124	0	0	248	
6:45 AM	0	0	0	0	2	0	0	0	0	172	0	0	0	108	0	0	282	874
7:00 AM	0	0	0	0	2	0	1	0	0	179	0	1	0	95	0	0	278	995
7:15 AM	0	0	0	0	1	0	4	0	0	277	0	0	0	120	0	0	402	1210
7:30 AM	0	0	0	0	1	0	2	0	0	264	0	0	0	121	0	0	388	1350
7:45 AM	0	0	0	0	3	0	3	0	0	236	0	0	0	156	0	0	398	1466
8:00 AM	0	0	0	0	1	0	4	0	0	208	0	0	0	115	0	0	328	1516
8:15 AM	0	0	0	0	7	0	4	0	0	235	0	0	0	140	0	0	386	1500
8:30 AM	0	0	0	0	0	0	2	0	0	216	0	0	0	130	0	0	348	1460
8:45 AM	0	0	0	0	1	0	1	0	0	225	0	0	0	128	0	0	355	1417
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	4	0	16	0	0	1108	0	0	0	480	0	0	1608	
Heavy Trucks	0	0	0	0	0	0	0	0	0	28	0	0	0	16	0	0	44	
Buses	0	0	0	0	0	0	0	0	0	28	0	0	0	12	0	0	40	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scoters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments:

LOCATION: N Kilbourn Ave -- W Ohio St
CITY/STATE: Chicago, IL

QC JOB #: 15023909
DATE: Tue, Mar 3 2020



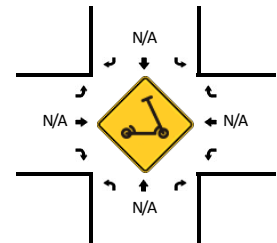
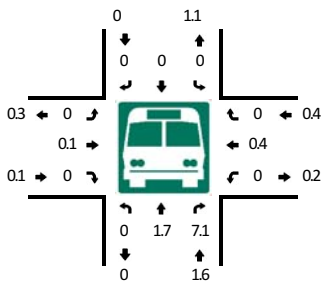
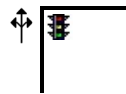
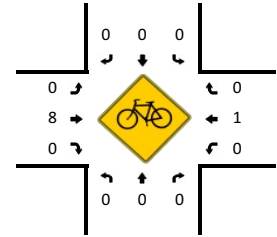
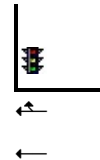
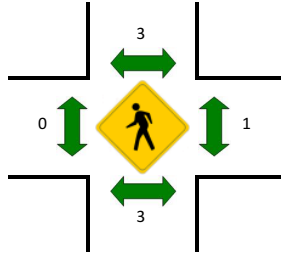
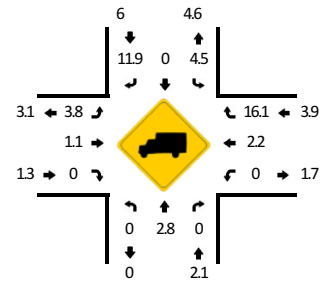
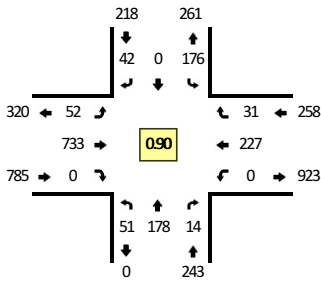
15-Min Count Period Beginning At	N Kilbourn Ave (Northbound)				N Kilbourn Ave (Southbound)				W Ohio St (Eastbound)				W Ohio St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	45	6	0	8	49	0	0	0	0	0	0	1	0	7	1	117	
7:15 AM	0	44	2	0	7	66	0	0	0	0	0	0	0	0	5	0	124	
7:30 AM	0	65	3	0	9	79	0	0	0	0	0	0	1	0	7	0	164	
7:45 AM	0	84	3	0	16	101	0	0	0	0	0	0	1	0	5	0	210	615
8:00 AM	0	61	0	0	12	93	0	0	0	0	0	0	1	0	9	0	176	674
8:15 AM	0	76	4	0	11	57	0	0	0	0	0	0	2	0	6	0	156	706
8:30 AM	0	71	2	0	11	60	0	0	0	0	0	0	4	0	4	0	152	694
8:45 AM	0	52	4	0	8	58	0	0	0	0	0	0	3	0	2	0	127	611
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	336	12	0	64	404	0	0	0	0	0	0	4	0	20	0	840	
Heavy Trucks	0	12	8		4	8	0		0	0	0		0	0	8		40	
Buses	0	0	0		0	0	0		0	0	0		0	0	0		0	
Pedestrians	0	0	0		0	4	0		0	0	0		0	0	0		4	
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0	
Scoters																	0	

Comments:

LOCATION: N Kilbourn Ave -- W Lake St
CITY/STATE: Chicago, IL

QC JOB #: 15023911
DATE: Tue, Mar 3 2020

Peak-Hour: 7:15 AM -- 8:15 AM
Peak 15-Min: 7:45 AM -- 8:00 AM



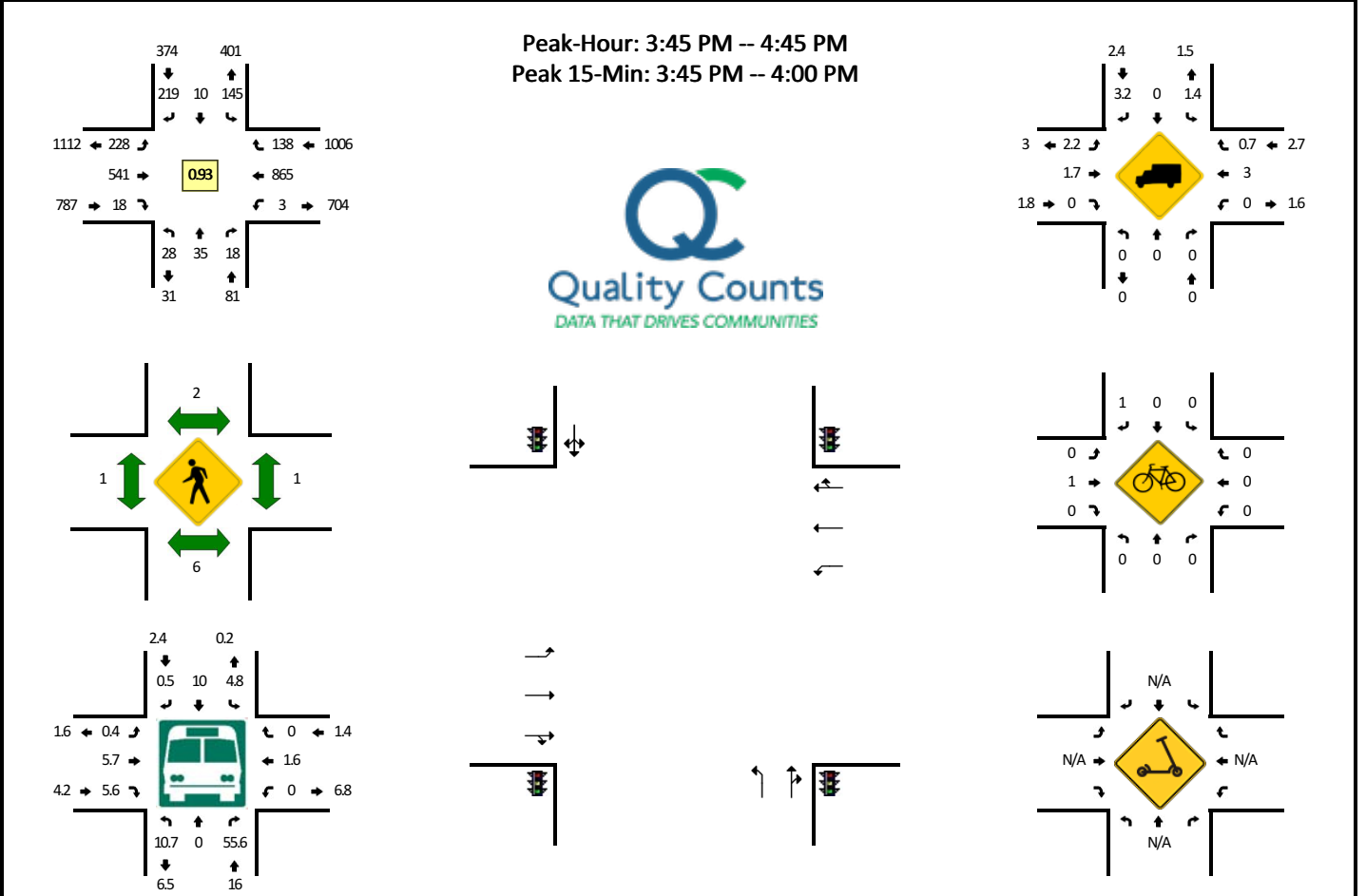
15-Min Count Period Beginning At	N Kilbourn Ave (Northbound)				N Kilbourn Ave (Southbound)				W Lake St (Eastbound)				W Lake St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	5	36	2	0	20	0	10	0	15	116	0	0	0	33	7	0	244	
7:15 AM	14	30	0	0	36	0	7	0	13	163	0	0	0	60	3	0	326	
7:30 AM	14	44	4	0	40	0	10	0	12	193	0	0	0	50	12	0	379	
7:45 AM	17	59	4	0	54	0	12	0	15	184	0	0	0	60	11	0	416	1365
8:00 AM	6	45	6	0	46	0	13	0	12	193	0	0	0	57	5	0	383	1504
8:15 AM	7	51	5	0	34	0	8	0	11	131	0	0	0	48	8	0	303	1481
8:30 AM	10	49	1	0	40	0	10	0	8	124	0	0	0	45	5	0	292	1394
8:45 AM	10	35	4	0	33	0	5	0	15	132	0	0	0	50	6	0	290	1268

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	68	236	16	0	216	0	48	0	60	736	0	0	0	240	44	0	1664
Heavy Trucks	0	0	0	0	4	0	0	0	4	4	0	0	0	0	0	0	12
Buses	0	8	4	0	0	0	0	0	0	4	0	0	0	0	0	0	16
Pedestrians	0	4	0	0	0	4	0	0	0	0	0	0	0	0	0	0	8
Bicycles	0	0	0	0	0	0	0	0	0	20	0	0	0	0	0	0	20
Scoters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Comments:

LOCATION: N Kostner Ave -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023904
DATE: Tue, Mar 3 2020

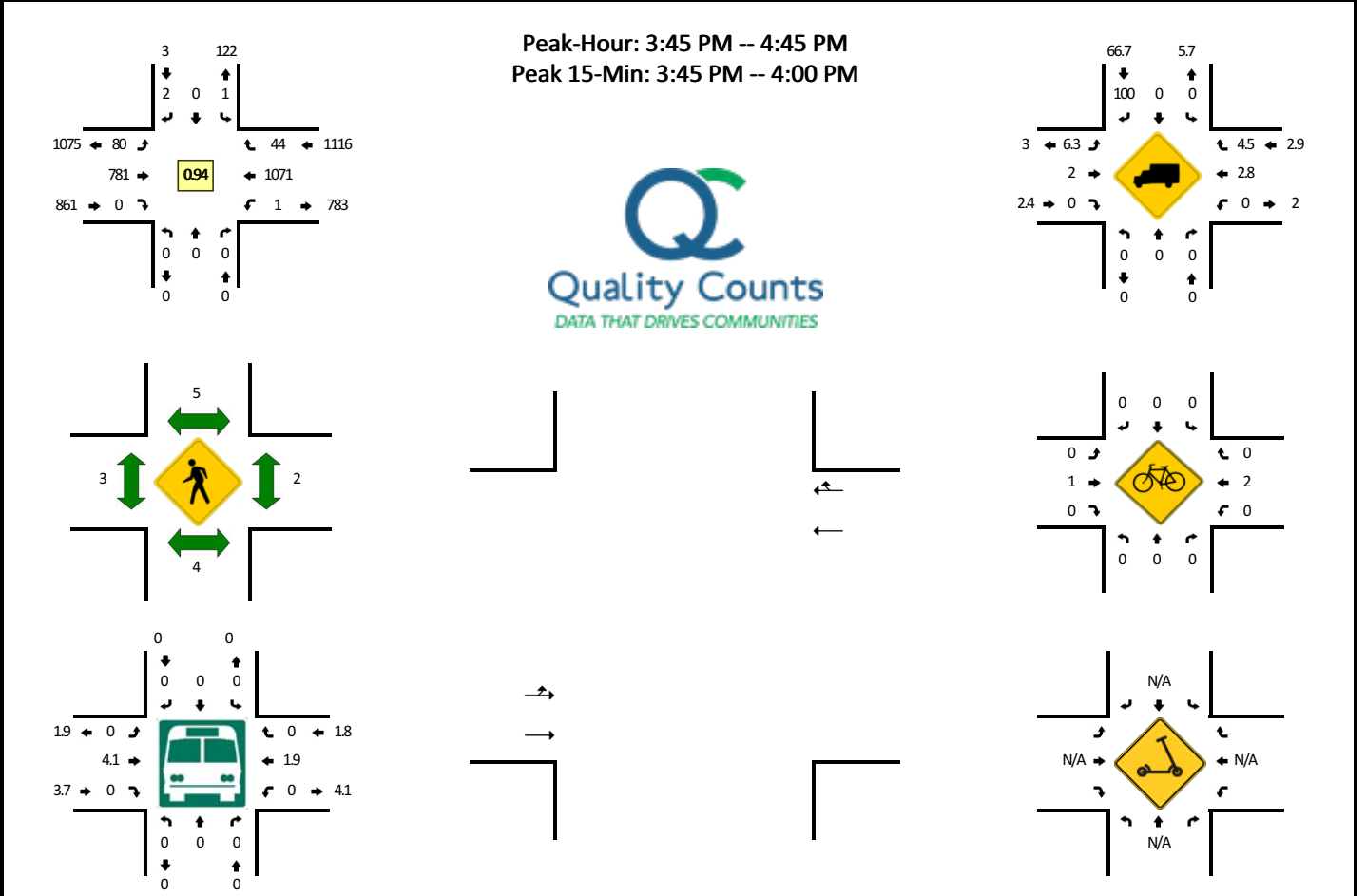


15-Min Count Period Beginning At	N Kostner Ave (Northbound)				N Kostner Ave (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	16	9	4	0	28	3	42	0	39	112	2	0	0	148	30	0	433	
3:15 PM	7	7	4	0	37	3	53	0	40	126	1	0	0	173	26	0	477	
3:30 PM	13	16	4	0	42	10	66	0	58	125	5	0	2	188	30	0	559	
3:45 PM	8	11	7	0	33	2	55	0	65	144	4	0	2	226	47	0	604	2073
4:00 PM	11	3	7	0	41	3	54	0	60	132	5	0	0	191	33	0	540	2180
4:15 PM	2	7	4	0	29	1	47	0	54	131	3	0	1	209	22	0	510	2213
4:30 PM	7	14	0	0	42	4	63	0	49	134	6	0	0	239	36	0	594	2248
4:45 PM	6	8	4	0	35	7	58	0	47	93	1	0	1	215	46	0	521	2165
5:00 PM	5	10	0	0	21	3	63	0	49	120	5	0	1	228	41	0	546	2171
5:15 PM	6	10	0	0	37	11	72	0	41	124	2	0	0	229	26	0	558	2219
5:30 PM	7	6	2	0	37	6	58	0	40	120	2	0	0	241	47	0	566	2191
5:45 PM	6	7	0	0	41	6	53	0	38	124	2	0	0	233	36	0	546	2216
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	32	44	28	0	132	8	220	0	260	576	16	0	8	904	188	0	2416	
Heavy Trucks	0	0	0	0	4	0	4	0	12	4	0	0	0	28	0	0	52	
Buses	4	0	20	0	4	0	0	0	4	8	0	0	0	16	0	0	56	
Pedestrians	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scoters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments:

LOCATION: N Kilbourne Ave (East) -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023906
DATE: Tue, Mar 3 2020

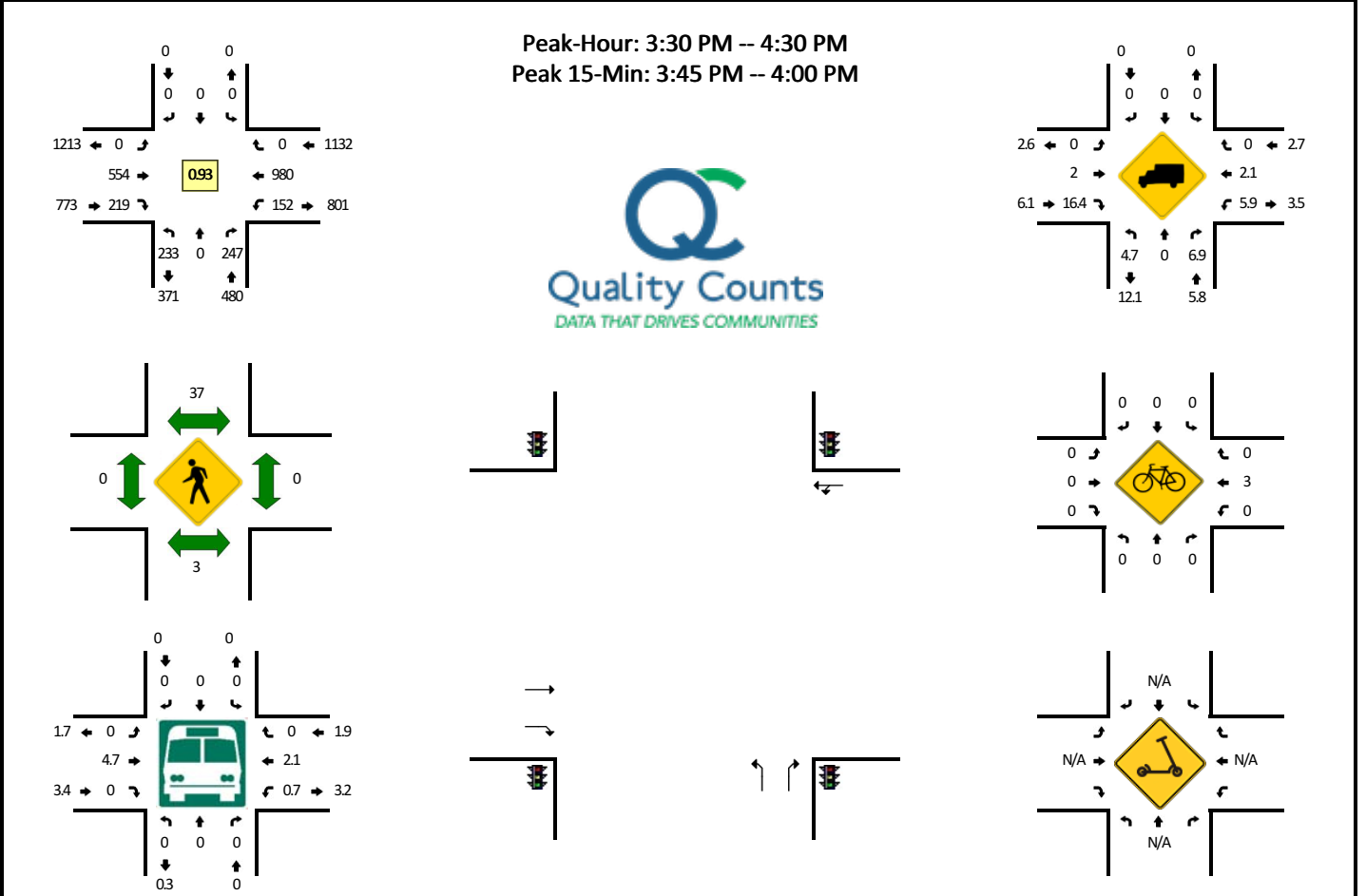


15-Min Count Period Beginning At	N Kilbourne Ave (East) (Northbound)				N Kilbourne Ave (East) (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	0	0	0	0	0	0	0	16	153	0	0	0	205	5	0	379	
3:15 PM	0	0	0	0	0	0	0	0	6	170	0	0	0	226	6	0	408	
3:30 PM	0	0	0	0	0	0	0	0	15	191	0	1	0	257	10	0	474	
3:45 PM	0	0	0	0	0	0	0	0	24	210	0	0	0	277	15	1	527	1788
4:00 PM	0	0	0	0	1	0	2	0	18	200	0	0	0	246	11	0	478	1887
4:15 PM	0	0	0	0	0	0	0	0	12	182	0	1	0	252	15	0	462	1941
4:30 PM	0	0	0	0	0	0	0	0	24	189	0	1	0	296	3	0	513	1980
4:45 PM	0	0	0	0	0	0	0	0	11	140	0	0	0	278	8	0	437	1890
5:00 PM	0	0	0	0	0	0	1	0	15	173	0	0	0	292	6	0	487	1899
5:15 PM	0	0	0	0	0	0	0	0	14	168	0	1	0	298	6	0	487	1924
5:30 PM	0	0	0	0	0	0	0	0	12	157	0	0	0	304	12	0	485	1896
5:45 PM	0	0	0	0	0	0	0	0	13	165	0	0	0	274	8	0	460	1919
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	0	0	0	0	96	840	0	0	0	1108	60	4	2108	
Heavy Trucks	0	0	0	0	0	0	0	0	8	20	0	0	0	28	4	0	60	
Buses	0	0	0	0	0	0	0	0	0	8	0	0	0	24	0	0	32	
Pedestrians	0	0	0	0	0	8	0	0	0	4	0	0	0	4	0	0	16	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	
Scooters	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	

Comments:

LOCATION: N Kilbourne Ave (West) -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023908
DATE: Tue, Mar 3 2020

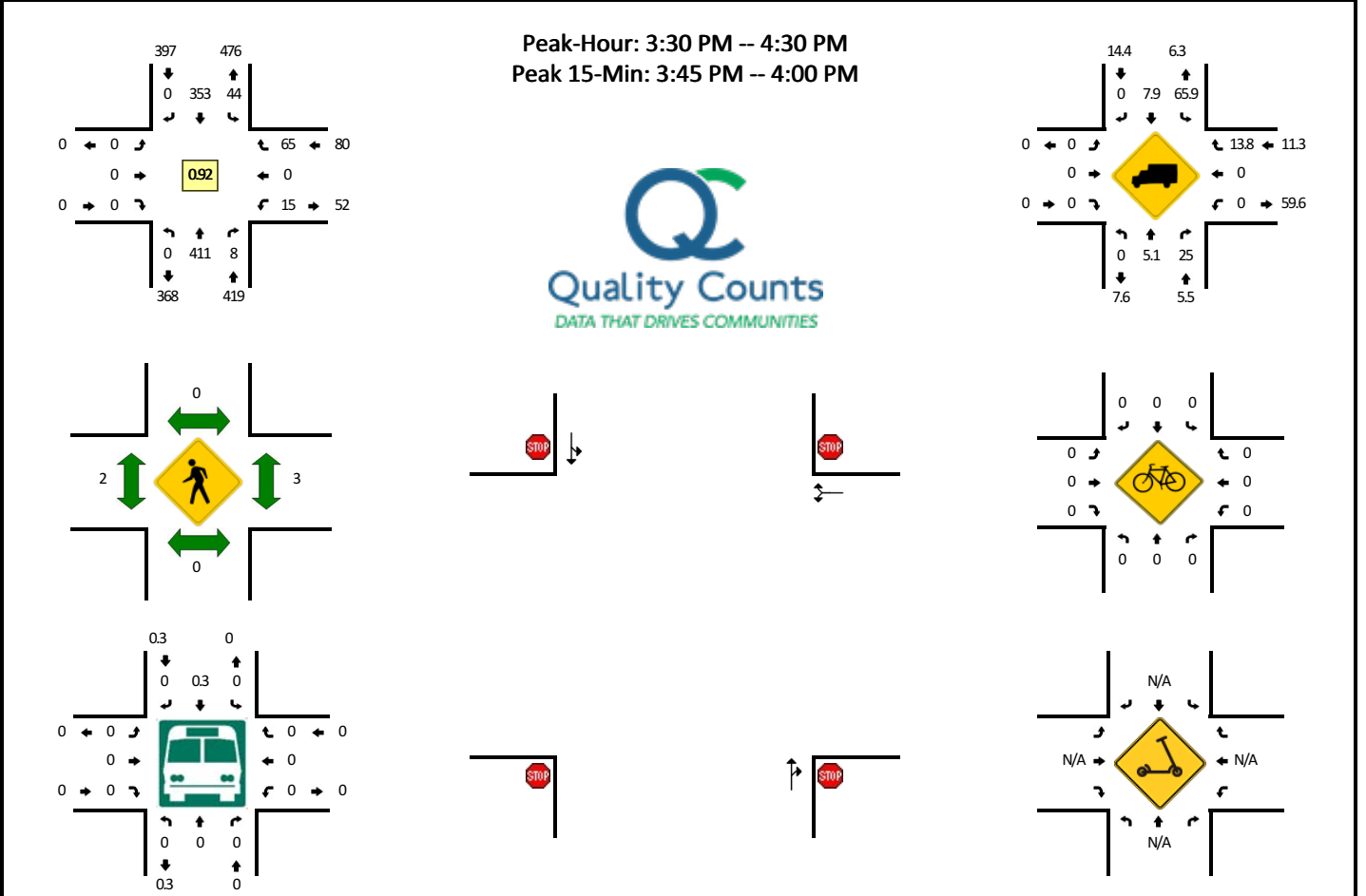


15-Min Count Period Beginning At	N Kilbourne Ave (West) (Northbound)				N Kilbourne Ave (West) (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	46	0	41	0	0	0	0	0	0	133	55	0	39	171	0	0	485	
3:15 PM	55	0	51	0	0	0	0	0	0	124	49	0	37	183	0	0	499	
3:30 PM	59	0	51	0	0	0	0	0	0	122	70	0	36	270	0	0	608	
3:45 PM	61	0	84	0	0	0	0	0	0	145	55	0	45	253	0	0	643	2235
4:00 PM	64	0	59	0	0	0	0	0	0	149	54	0	33	232	0	0	591	2341
4:15 PM	49	0	53	0	0	0	0	0	0	138	40	0	38	225	0	0	543	2385
4:30 PM	65	0	69	0	0	0	0	0	0	132	42	0	41	253	0	0	602	2379
4:45 PM	42	0	38	1	0	0	0	0	0	121	30	0	43	249	0	0	524	2260
5:00 PM	61	0	47	0	0	0	0	0	0	129	30	0	46	248	0	0	561	2230
5:15 PM	60	0	54	0	0	0	0	0	0	136	38	0	47	257	0	0	592	2279
5:30 PM	48	0	36	0	0	0	0	0	0	130	46	0	40	266	0	0	566	2243
5:45 PM	43	0	38	0	0	0	0	0	0	138	36	0	41	242	0	0	538	2257
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	244	0	336	0	0	0	0	0	0	580	220	0	180	1012	0	0	2572	
Heavy Trucks	16	0	24		0	0	0		0	4	52		12	24	0		132	
Buses	0	0	0		0	0	0		0	8	0		0	24	0		32	
Pedestrians		4				28				0				0			32	
Bicycles	0	0	0		0	0	0		0	0	0		0	8	0		8	
Scooters																		

Comments:

LOCATION: N Kilbourn Ave -- W Ohio St
CITY/STATE: Chicago, IL

QC JOB #: 15023910
DATE: Tue, Mar 3 2020

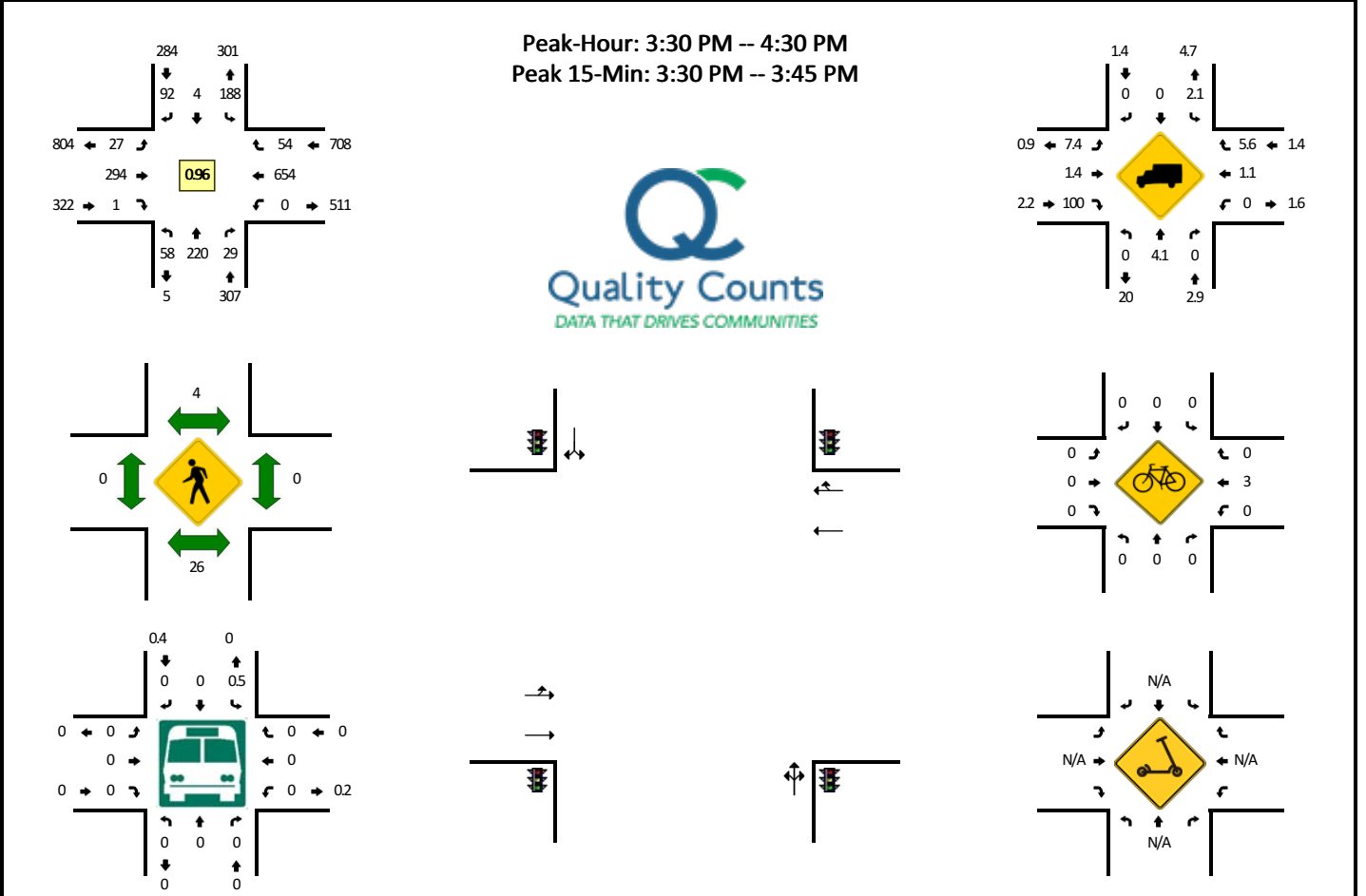


15-Min Count Period Beginning At	N Kilbourn Ave (Northbound)				N Kilbourn Ave (Southbound)				W Ohio St (Eastbound)				W Ohio St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	78	3	0	3	106	0	0	0	0	0	0	2	0	15	0	207	
3:15 PM	0	82	1	0	7	72	0	0	0	0	0	0	1	0	7	0	170	
3:30 PM	0	108	3	0	8	88	0	0	0	0	0	0	8	0	21	0	236	
3:45 PM	0	105	1	0	21	95	0	0	0	0	0	0	2	0	20	0	244	857
4:00 PM	0	105	0	0	11	91	0	0	0	0	0	0	3	0	16	0	226	876
4:15 PM	0	93	4	0	4	79	0	0	0	0	0	0	2	0	8	0	190	896
4:30 PM	0	98	1	0	0	78	0	0	0	0	0	0	4	0	38	0	219	879
4:45 PM	0	73	1	0	3	69	0	0	0	0	0	0	3	0	8	0	157	792
5:00 PM	0	83	3	0	3	82	0	0	0	0	0	0	5	0	14	0	190	756
5:15 PM	0	96	0	1	3	84	0	0	0	0	0	0	3	0	10	0	197	763
5:30 PM	0	73	0	0	8	77	0	0	0	0	0	0	3	0	9	0	170	714
5:45 PM	0	76	0	0	9	67	0	0	0	0	0	0	5	0	4	0	161	718
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	420	4	0	84	380	0	0	0	0	0	0	8	0	80	0	976	
Heavy Trucks	0	24	0	0	56	44	0	0	0	0	0	0	0	0	12	0	136	
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pedestrians	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scooters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments:

LOCATION: N Kilbourn Ave -- W Lake St
CITY/STATE: Chicago, IL

QC JOB #: 15023912
DATE: Tue, Mar 3 2020

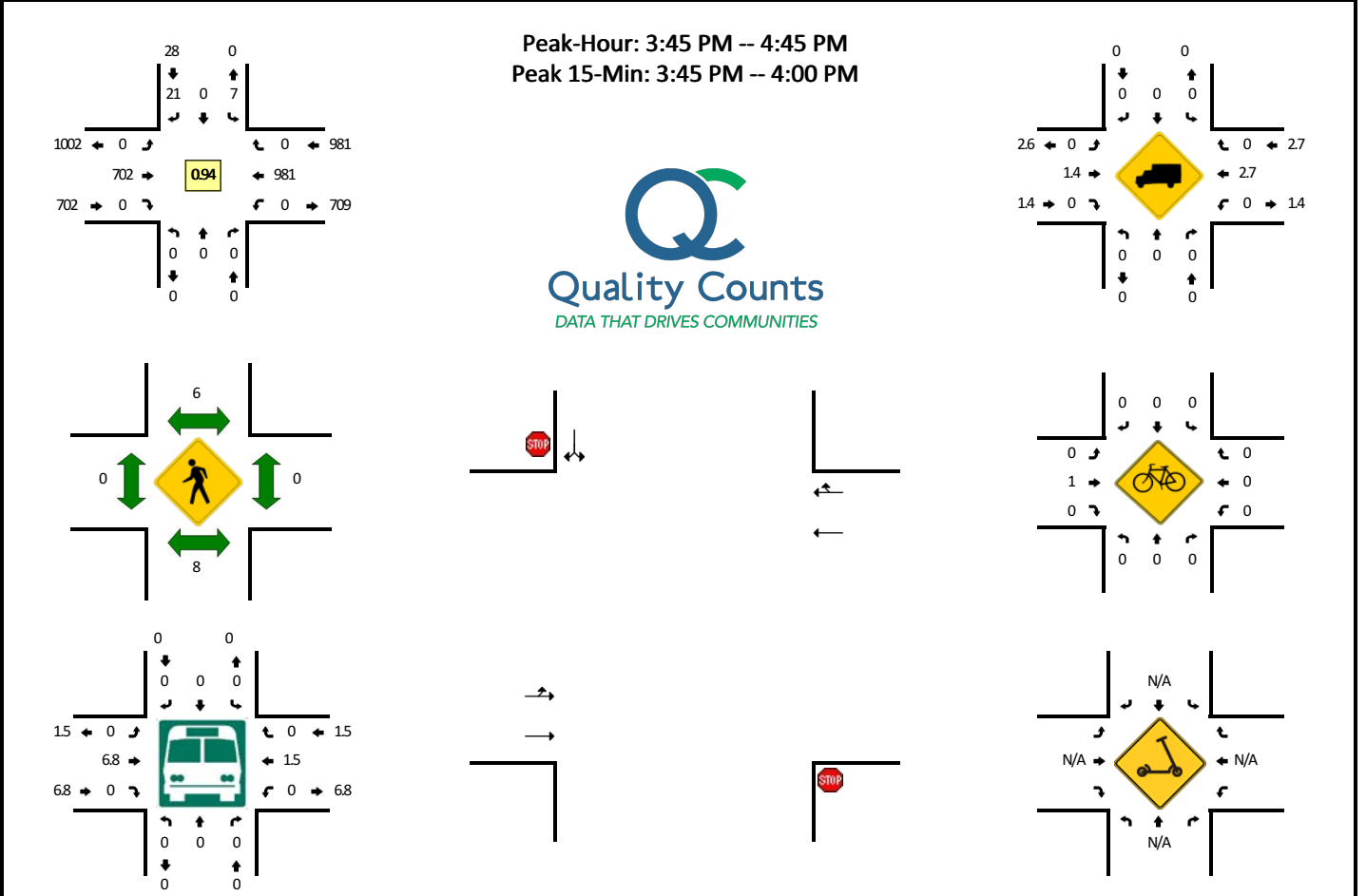


15-Min Count Period Beginning At	N Kilbourn Ave (Northbound)				N Kilbourn Ave (Southbound)				W Lake St (Eastbound)				W Lake St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	13	39	13	0	51	0	32	0	5	50	0	0	0	119	14	0	336	
3:15 PM	10	46	5	0	40	0	22	0	7	69	0	0	0	113	9	0	321	
3:30 PM	18	60	17	0	44	3	19	0	7	75	0	0	0	168	13	0	424	
3:45 PM	12	56	3	0	51	1	15	0	4	73	1	0	0	149	16	0	381	1462
4:00 PM	14	55	5	0	49	0	33	0	7	64	0	0	0	180	15	0	422	1548
4:15 PM	14	49	4	0	44	0	25	0	9	82	0	0	0	157	10	0	394	1621
4:30 PM	13	55	3	0	56	0	46	0	9	77	0	0	0	147	14	0	420	1617
4:45 PM	9	47	11	0	40	0	21	0	4	67	0	0	0	155	4	0	358	1594
5:00 PM	13	48	4	0	41	0	29	0	10	55	0	0	0	156	17	0	373	1545
5:15 PM	13	41	3	0	57	1	22	0	3	62	0	0	0	140	19	0	361	1512
5:30 PM	10	44	1	0	53	0	15	0	14	55	0	0	0	175	20	0	387	1479
5:45 PM	16	48	2	0	43	0	28	0	3	52	0	0	0	143	10	0	345	1466
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	72	240	68	0	176	12	76	0	28	300	0	0	0	672	52	0	1696	
Heavy Trucks	0	12	0	0	4	0	0	0	0	0	0	0	0	0	8	0	24	
Buses	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Pedestrians	0	84	0	0	0	12	0	0	0	0	0	0	0	0	0	0	96	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	4	
Scoters	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

Comments:

LOCATION: N Kolin Ave -- W Chicago Ave
CITY/STATE: Chicago, IL

QC JOB #: 15023902
DATE: Tue, Mar 3 2020



15-Min Count Period Beginning At	N Kolin Ave (Northbound)				N Kolin Ave (Southbound)				W Chicago Ave (Eastbound)				W Chicago Ave (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
3:00 PM	0	0	0	0	1	0	1	0	0	142	0	0	0	176	0	0	320	
3:15 PM	0	0	0	0	2	0	1	0	0	169	0	0	0	195	0	0	367	
3:30 PM	0	0	0	0	2	0	4	0	0	175	0	0	0	230	0	0	411	
3:45 PM	0	0	0	0	1	0	5	0	0	186	0	0	0	265	0	0	457	1555
4:00 PM	0	0	0	0	2	0	5	0	0	177	0	0	0	219	0	0	403	1638
4:15 PM	0	0	0	0	3	0	4	0	0	164	0	0	0	234	0	0	405	1676
4:30 PM	0	0	0	0	1	0	7	0	0	175	0	0	0	263	0	0	446	1711
4:45 PM	0	0	0	0	7	0	3	0	0	131	0	0	0	266	0	0	407	1661
5:00 PM	0	0	0	0	1	0	5	0	0	144	0	0	0	261	0	0	411	1669
5:15 PM	0	0	0	0	0	0	0	0	0	158	0	1	0	256	0	0	415	1679
5:30 PM	0	0	0	0	2	0	1	0	0	161	0	0	0	286	0	0	450	1683
5:45 PM	0	0	0	0	0	0	3	0	0	163	0	0	0	264	0	0	430	1706
Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total	
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
All Vehicles	0	0	0	0	4	0	20	0	0	744	0	0	0	1060	0	0	1828	
Heavy Trucks	0	0	0	0	0	0	0	0	0	4	0	0	0	24	0	0	28	
Buses	0	0	0	0	0	0	0	0	0	32	0	0	0	16	0	0	48	
Pedestrians		8				0				0				0			8	
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Scoters																	0	

Comments:

Appendix C

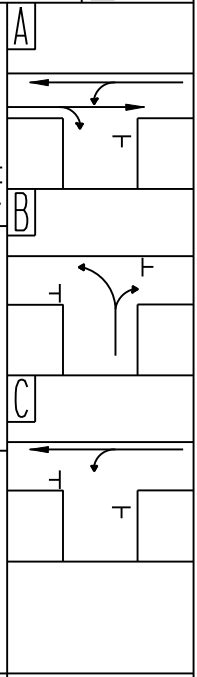
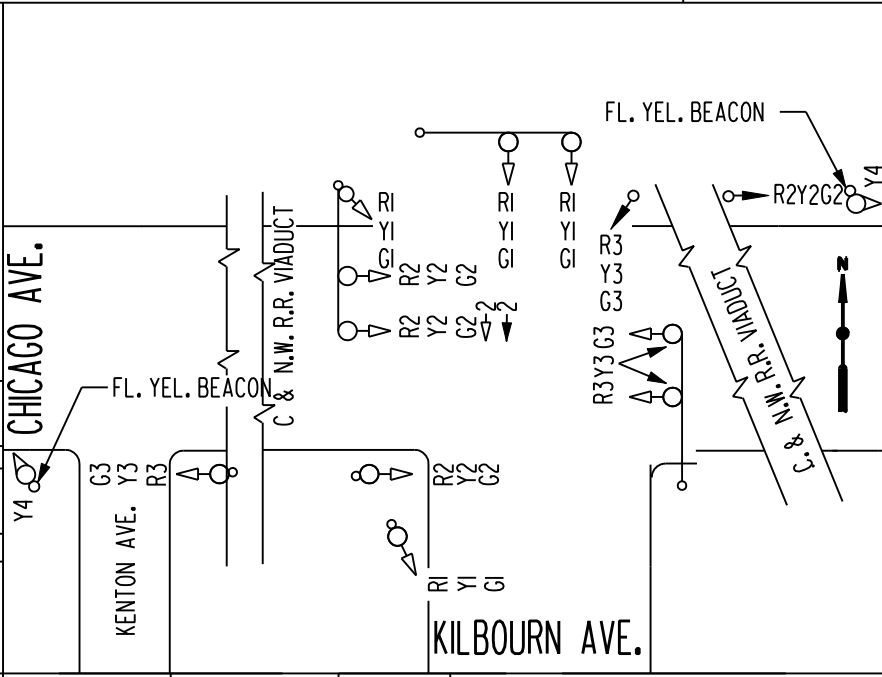
Signal Timing Permits

DRAWN: CRC
 DATE: 1-31-06
 CHECKED:
 DATE:

CITY OF CHICAGO
 DEPARTMENT OF TRANSPORTATION
 TRAFFIC SIGNAL TIMING SCHEDULE
 N. KILBOURN AVE. & W. CHICAGO AVE.

800 N./4550 W.
 APPROVED:
 TRAFFIC ENGINEER
 CITY TRAFFIC ENGINEER

Offset:	Times of Operation:							
	1	2	3	1	2	3	1	2
Did:	ALL OTHER TIMES							
	1	2	3	1	2	3	1	2
FLASH OPERATION:	65" 6:00 AM TO 10:00 AM							
	1	2	3	1	2	3	1	2
Flash Operation:	72" 6:00 AM TO 10:00 AM							
	1	2	3	1	2	3	1	2
Flash Operation:	M-F							
	1	2	3	1	2	3	1	2
Flash Operation:	75" 3:00 PM TO 7:00 PM							
	1	2	3	1	2	3	1	2
Flash Operation:	M-F							
	1	2	3	1	2	3	1	2



SIGNAL:	PHASE:	A			B			C	
INDICATIONS:	INTERVAL:	1	2	3	4	5	6	7	8
KILBOURN AVE.	G1				■	■			
"	Y1					■	■		
"	R1	■	■	■			■	■	■
CHICAGO AVE. (WB)	G2	■						■	■
"	Y2		■	■					
"	R2				■	■	■		
"	LT GA2							■	■
"	LT YA2								■
CHICAGO AVE. (EB)	G3	■							■
"	Y3		■	■					
"	R3				■	■	■		
FL. YEL. BEACONS	Y4	■	■	■	■	■	■	■	■

DIAL 1, ELAPSED TIME	43	46	47	66	69	70	82	85
SECONDS/INTERVAL	43	3	1	19	3	1	12	3
DIAL 2, ELAPSED TIME	35	38	39	58	61	62	82	85
SECONDS/INTERVAL	35	3	1	19	3	1	20	3

DATE:
 SENT:
 10-11-2013
 INSTALLED:
 AS BUILT REV.:

OEMC Drwg. No.

DRAWN: **CRC**
 DATE: **5-13-10**
 DESIGNED:
 DATE:

CITY OF CHICAGO
 OFFICE OF EMERGENCY MANAGEMENT & COMMUNICATION
 TRAFFIC MANAGEMENT AUTHORITY
 TRAFFIC SIGNAL TIMING SCHEDULE

800 N./4400 W.

PROJECT: **NICK AN**
 TRAFFIC ENGINEER

CITY TRAFFIC ENGINEER

N. KOSTNER AVE. & W. CHICAGO AVE.

PAGE 1 OF 1

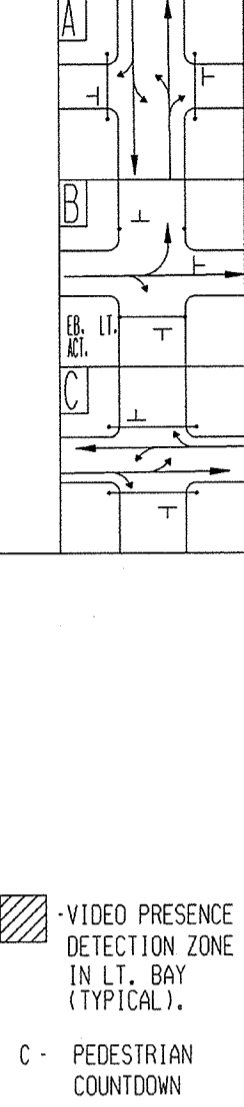
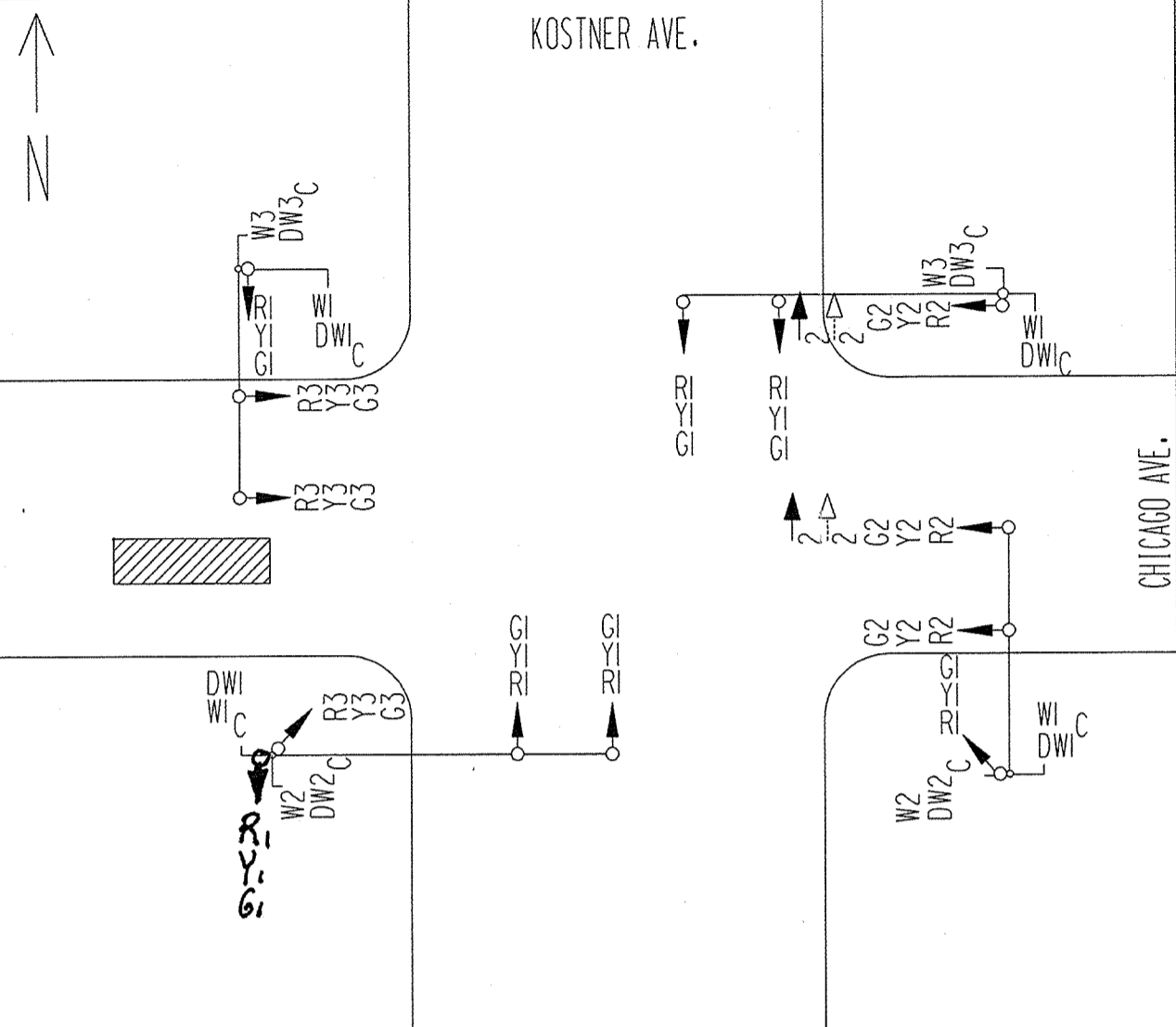
Times of Operation:

ALL OTHER TIMES
 6AM-10AM, MON. - FRI.
 3-7PM, MON. - FRI.

Offset: 1 24" 2 70" 3 79"

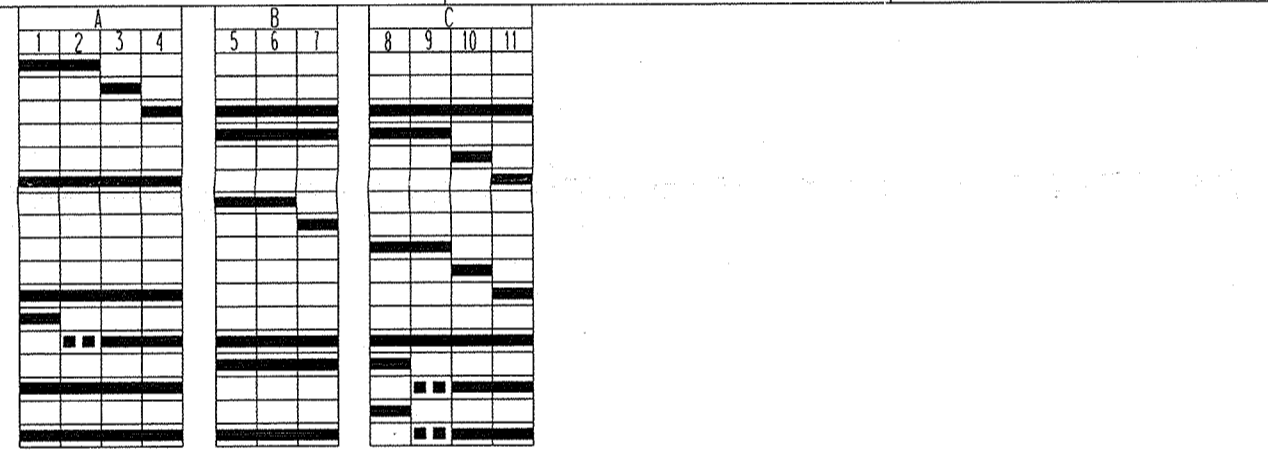
Dial: 1 85" 2 85"

FLASH OPERATIONS:
 R1, R2, R3;
 W., DW., 'S-OFF.



SIGNAL INDICATIONS:

INDICATION	PHASE INTERVAL
KOSTNER (NB./SB.)	G1
" "	Y1
" "	R1
CHICAGO (EB.)	G2
" "	Y2
" "	R2
" "	LT. GA ← 2
" "	LT. YA ← 2
CHICAGO (WB.)	G3
" "	Y3
" "	R3
WALK (E./W. XWALK)	W1
DON'T WALK	DW1
WALK (S. XWALK)	W2
DON'T WALK	DW2
WALK (N. XWALK)	W3
DON'T WALK	DW3



DATE:

SENT: **5-18-10**

INSTALLED: **04-05-11**

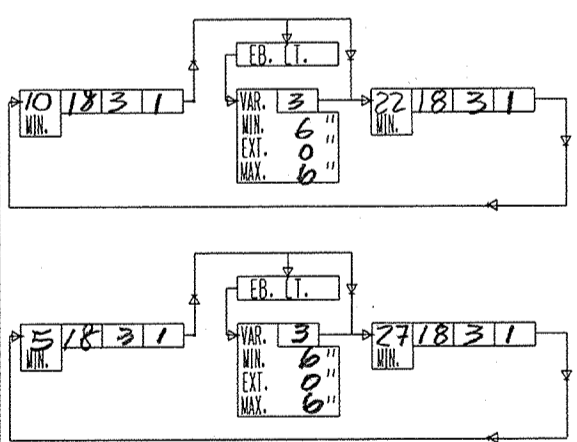
AS-BUILT REV.:

DIAL 1, SECONDS/INTERVAL

10	18	3	1
----	----	---	---

DIAL 2, SECONDS/INTERVAL

5	18	3	1
---	----	---	---



Boel Drawg. No. 14901

DRAWN: CRH/AS
 DATE: 02/20/2006
 CHECKED:
 DATE:

CITY OF CHICAGO
 OFFICE OF EMERGENCY MANAGEMENT AND COMMUNICATIONS
 TRAFFIC MANAGEMENT AUTHORITY
 TRAFFIC SIGNAL TIMING SCHEDULE
 N. KILBOURN & W. LAKE STREET

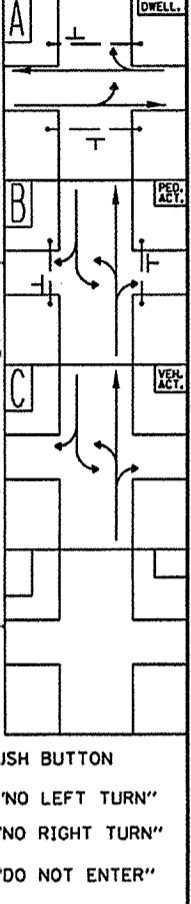
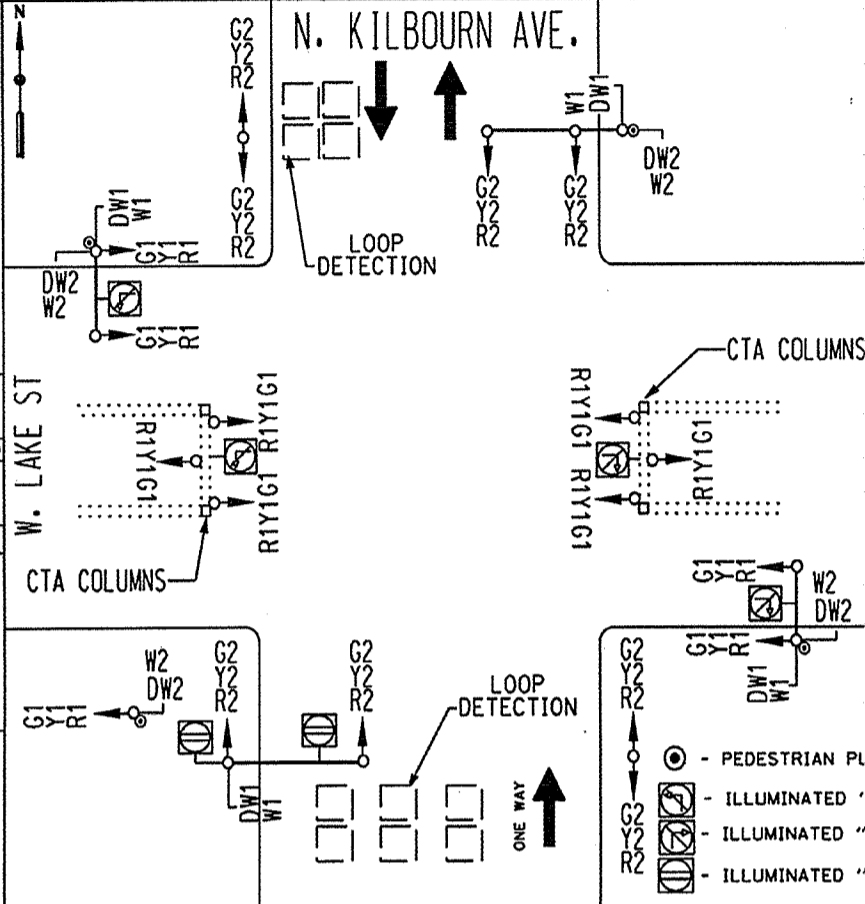
320 N./4500 W.
 APPROVED: NICK AN
 TRAFFIC ENGINEER
 CITY TRAFFIC ENGINEER

PAGE 1 OF 1

Dial: Offset: Times Of Operation:

1	0"	ALL TIMES.
2	12"	6:00AM TO 10:00AM: MON. - FRI.
3	47"	3:00PM TO 7:00PM: MON. - FRI.
1		
2		
3		
4		

FLASH OPERATION:
R1, R2;
W, DW - OFF



- - PEDESTRIAN PUSH BUTTON
- ⊗ - ILLUMINATED "NO LEFT TURN"
- ⊗ - ILLUMINATED "NO RIGHT TURN"
- ⊗ - ILLUMINATED "DO NOT ENTER"

SIGNAL:	PHASE:	INTERVAL:
LAKE STREET	G1	
" "	Y1	
" "	R1	
KILBOURN AVENUE	G2	
" "	Y2	
" "	R2	
WALK	W1	
DON'T WALK	DW1	
WALK	W2	
DON'T WALK	DW2	

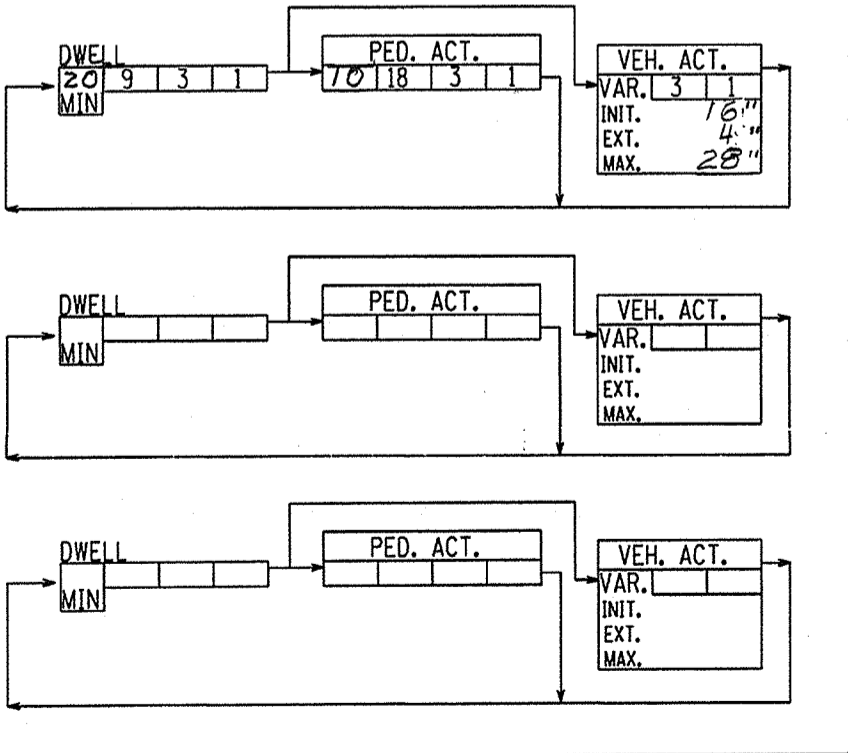
A				ALL RED	B				ALL RED	C			ALL RED
1	2	3	4		5	6	7	8		9	10	11	
█					█	█				█	█		

DATE:
 INSTALLED:

DIAL 1, SECONDS/INTERVAL

DIAL 2, SECONDS/INTERVAL

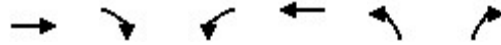
DIAL 3, SECONDS/INTERVAL



BOE. DRWG. NO.

Appendix D

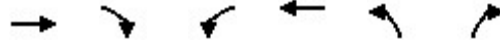
Synchro Results



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	894	262	110	542	119	171
Future Volume (vph)	894	262	110	542	119	171
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		50	100		0	100
Storage Lanes		1	1		1	1
Taper Length (ft)			50		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98	1.00			
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1827	1553	1687	1776	1671	1495
Flt Permitted			0.093		0.950	
Satd. Flow (perm)	1827	1514	165	1776	1671	1495
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		75				188
Link Speed (mph)	30			30	30	
Link Distance (ft)	715			346	921	
Travel Time (s)	16.3			7.9	20.9	
Confl. Peds. (#/hr)		5	5			
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	4%	4%	7%	7%	8%	8%
Adj. Flow (vph)	982	288	121	596	131	188
Shared Lane Traffic (%)						
Lane Group Flow (vph)	982	288	121	596	131	188
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	NA	Perm	D.P+P	NA	Prot	Perm
Protected Phases	2		1	1 2	4	
Permitted Phases		2	2			4
Detector Phase	2	2	1	1 2	4	4
Switch Phase						
Minimum Initial (s)	43.0	43.0	12.0		19.0	19.0
Minimum Split (s)	47.0	47.0	15.0		23.0	23.0
Total Split (s)	47.0	47.0	15.0		23.0	23.0
Total Split (%)	55.3%	55.3%	17.6%		27.1%	27.1%
Maximum Green (s)	43.0	43.0	12.0		19.0	19.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	0.0		1.0	1.0

Existing 2020
 1: N Kilbourn Ave (West) & W Chicago Ave

06/03/2020



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	3.0		4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	0.2	0.2	0.2		0.2	0.2
Recall Mode	C-Max	C-Max	Max		Max	Max
Act Effct Green (s)	43.0	43.0	56.0	59.0	19.0	19.0
Actuated g/C Ratio	0.51	0.51	0.66	0.69	0.22	0.22
v/c Ratio	1.06	0.36	0.37	0.48	0.35	0.39
Control Delay	70.8	10.6	18.3	8.5	31.0	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.8	10.6	18.3	8.5	31.0	7.1
LOS	E	B	B	A	C	A
Approach Delay	57.2			10.2	16.9	
Approach LOS	E			B	B	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 72 (85%), Referenced to phase 2:EBWB, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 1.06
 Intersection Signal Delay: 37.0
 Intersection LOS: D
 Intersection Capacity Utilization 82.9%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 1: N Kilbourn Ave (West) & W Chicago Ave





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	982	288	121	596	131	188
v/c Ratio	1.06	0.36	0.37	0.48	0.35	0.39
Control Delay	70.8	10.6	18.3	8.5	31.0	7.1
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	70.8	10.6	18.3	8.5	31.0	7.1
Queue Length 50th (ft)	~585	62	36	99	59	0
Queue Length 95th (ft)	#814	116	77	211	111	51
Internal Link Dist (ft)	635			266	841	
Turn Bay Length (ft)		50	100			100
Base Capacity (vph)	924	802	323	1232	373	480
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.06	0.36	0.37	0.48	0.35	0.39

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Existing 2020
3: W Chicago Ave & N Kostner Ave

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	138	862	31	4	453	68	44	20	8	116	34	167
Future Volume (vph)	138	862	31	4	453	68	44	20	8	116	34	167
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	100			70			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00		1.00	0.99			0.99	0.99
Frt		0.995			0.980			0.956				0.850
Flt Protected	0.950			0.950			0.950				0.963	
Satd. Flow (prot)	1703	3386	0	1703	3324	0	1327	1326	0	0	1759	1553
Flt Permitted	0.385			0.278			0.615				0.764	
Satd. Flow (perm)	687	3386	0	498	3324	0	859	1326	0	0	1382	1533
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			26			9				182
Link Speed (mph)		30			30			30				30
Link Distance (ft)		660			361			227				577
Travel Time (s)		15.0			8.2			5.2				13.1
Confl. Peds. (#/hr)	10		2	2		10	1		15	15		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	36%	36%	36%	4%	4%	4%
Adj. Flow (vph)	150	937	34	4	492	74	48	22	9	126	37	182
Shared Lane Traffic (%)												
Lane Group Flow (vph)	150	971	0	4	566	0	48	31	0	0	163	182
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		0	0		0	0		1	0	0
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	0		0	0		0	0		20	0	0
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	D.P+P	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2	2 3			3			1				1
Permitted Phases	3			3			1			1		1
Detector Phase	2	2 3		3	3		1	1		1	1	1
Switch Phase												

Existing 2020
3: W Chicago Ave & N Kostner Ave

06/03/2020

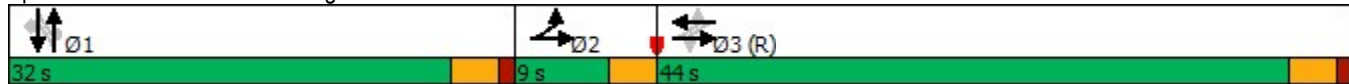


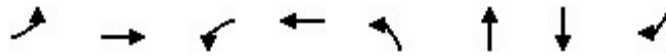
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	6.0			22.0	22.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	9.0			44.0	44.0		32.0	32.0		32.0	32.0	32.0
Total Split (s)	9.0			44.0	44.0		32.0	32.0		32.0	32.0	32.0
Total Split (%)	10.6%			51.8%	51.8%		37.6%	37.6%		37.6%	37.6%	37.6%
Maximum Green (s)	6.0			40.0	40.0		28.0	28.0		28.0	28.0	28.0
Yellow Time (s)	3.0			3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0			1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	3.0			4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lag						Lead	Lead		Lead	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			0.2	0.2		0.2	0.2		0.2	0.2	0.2
Recall Mode	None			C-Max	C-Max		Max	Max		Max	Max	Max
Walk Time (s)				22.0	22.0		10.0	10.0		10.0	10.0	10.0
Flash Dont Walk (s)				18.0	18.0		18.0	18.0		18.0	18.0	18.0
Pedestrian Calls (#/hr)				0	0		0	0		0	0	0
Act Effct Green (s)	47.0	50.0		40.0	40.0		28.0	28.0		28.0	28.0	28.0
Actuated g/C Ratio	0.55	0.59		0.47	0.47		0.33	0.33		0.33	0.33	0.33
v/c Ratio	0.33	0.49		0.02	0.36		0.17	0.07		0.36	0.29	0.29
Control Delay	16.9	20.5		12.5	14.4		22.3	16.0		24.5	4.8	4.8
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	16.9	20.5		12.5	14.4		22.3	16.0		24.5	4.8	4.8
LOS	B	C		B	B		C	B		C	A	A
Approach Delay		20.0			14.4			19.8			14.1	
Approach LOS		C			B			B			B	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 70 (82%), Referenced to phase 3:EBWB, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.49
 Intersection Signal Delay: 17.5 Intersection LOS: B
 Intersection Capacity Utilization 90.0% ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 3: W Chicago Ave & N Kostner Ave





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	150	971	4	566	48	31	163	182
v/c Ratio	0.33	0.49	0.02	0.36	0.17	0.07	0.36	0.29
Control Delay	16.9	20.5	12.5	14.4	22.3	16.0	24.5	4.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.9	20.5	12.5	14.4	22.3	16.0	24.5	4.8
Queue Length 50th (ft)	65	227	1	92	18	8	65	0
Queue Length 95th (ft)	m67	m230	7	130	45	27	119	42
Internal Link Dist (ft)		580		281		147	497	
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	451	1994	234	1578	282	442	455	627
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.33	0.49	0.02	0.36	0.17	0.07	0.36	0.29

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕		↕		↕
Traffic Volume (vph)	52	733	0	0	277	31	51	178	14	176	0	42
Future Volume (vph)	52	733	0	0	277	31	51	178	14	176	0	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	100		0	0		100
Storage Lanes	0		0	0		0	1		0	1		1
Taper Length (ft)	25			25			50			25		
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			1.00		1.00		
Fr _t					0.985			0.989				0.850
Fl _t Protected		0.997					0.950			0.950		
Satd. Flow (prot)	0	3564	0	0	3411	0	1736	1805	0	1612	0	1442
Fl _t Permitted		0.908					0.950			0.562		
Satd. Flow (perm)	0	3245	0	0	3411	0	1736	1805	0	953	0	1442
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					23			8				47
Link Speed (mph)		30			30			30				30
Link Distance (ft)		618			660			642				1899
Travel Time (s)		14.0			15.0			14.6				43.2
Confl. Peds. (#/hr)	3		3	3		3			1	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	4%	4%	4%	12%	12%	12%
Adj. Flow (vph)	58	814	0	0	308	34	57	198	16	196	0	47
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	872	0	0	342	0	57	214	0	196	0	47
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0			0		1	1		1		1
Detector Template	Left	Thru			Thru		Left	Thru		Left		Right
Leading Detector (ft)	20	0			0		20	20		20		20
Trailing Detector (ft)	0	0			0		0	0		0		0
Detector 1 Position(ft)	0	0			0		0	0		0		0
Detector 1 Size(ft)	20	6			6		20	20		20		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Turn Type	Perm	NA			NA		Perm	NA		D.Pm		Perm
Protected Phases		1			1			2				
Permitted Phases	1						2			2		2
Detector Phase	1	1			1		2	2		2		2
Switch Phase												

Existing 2020
6: N Kilbourn Ave & W Lake St

06/03/2020

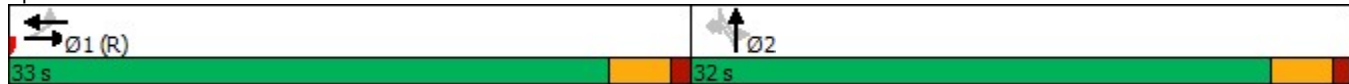


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	20.0	20.0			20.0		16.0	16.0		16.0		16.0
Minimum Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (%)	50.8%	50.8%			50.8%		49.2%	49.2%		49.2%		49.2%
Maximum Green (s)	29.0	29.0			29.0		28.0	28.0		28.0		28.0
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
All-Red Time (s)	1.0	1.0			1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0		0.0
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lead/Lag	Lead	Lead			Lead		Lag	Lag		Lag		Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	0.2	0.2			0.2		4.0	4.0		4.0		4.0
Recall Mode	C-Max	C-Max			C-Max		None	None		None		None
Walk Time (s)	20.0	20.0			20.0		10.0	10.0		10.0		10.0
Flash Dont Walk (s)	9.0	9.0			9.0		18.0	18.0		18.0		18.0
Pedestrian Calls (#/hr)	0	0			0		0	0		0		0
Act Effct Green (s)		36.7			36.7		20.3	20.3		20.3		20.3
Actuated g/C Ratio		0.56			0.56		0.31	0.31		0.31		0.31
v/c Ratio		0.48			0.18		0.11	0.38		0.66		0.10
Control Delay		10.6			7.7		14.4	17.6		29.6		4.7
Queue Delay		0.0			0.0		0.0	0.0		0.0		0.0
Total Delay		10.6			7.7		14.4	17.6		29.6		4.7
LOS		B			A		B	B		C		A
Approach Delay		10.6			7.7			16.9				24.8
Approach LOS		B			A			B				C

Intersection Summary

Area Type:	Other
Cycle Length:	65
Actuated Cycle Length:	65
Offset:	12 (18%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.66
Intersection Signal Delay:	13.0
Intersection LOS:	B
Intersection Capacity Utilization:	85.1%
ICU Level of Service:	E
Analysis Period (min):	15

Splits and Phases: 6: N Kilbourn Ave & W Lake St








Lane Group	EBT	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	872	342	57	214	196	47
v/c Ratio	0.48	0.18	0.11	0.38	0.66	0.10
Control Delay	10.6	7.7	14.4	17.6	29.6	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.6	7.7	14.4	17.6	29.6	4.7
Queue Length 50th (ft)	90	26	16	65	69	0
Queue Length 95th (ft)	185	62	31	92	109	16
Internal Link Dist (ft)	538	580		562		
Turn Bay Length (ft)			100			100
Base Capacity (vph)	1832	1936	747	782	410	647
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.18	0.08	0.27	0.48	0.07
Intersection Summary						

Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↓	
Traffic Vol, veh/h	0	986	512	0	6	13
Future Vol, veh/h	0	986	512	0	6	13
Conflicting Peds, #/hr	3	0	0	3	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	6	6	6	6	0	0
Mvmt Flow	0	1049	545	0	6	14
Major/Minor	Major1	Major2	Minor2			
Conflicting Flow All	-	0	-	0	1070	273
Stage 1	-	-	-	-	545	-
Stage 2	-	-	-	-	525	-
Critical Hdwy	-	-	-	-	6.8	6.9
Critical Hdwy Stg 1	-	-	-	-	5.8	-
Critical Hdwy Stg 2	-	-	-	-	5.8	-
Follow-up Hdwy	-	-	-	-	3.5	3.3
Pot Cap-1 Maneuver	0	-	-	0	219	731
Stage 1	0	-	-	0	551	-
Stage 2	0	-	-	0	564	-
Platoon blocked, %	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	219	731
Mov Cap-2 Maneuver	-	-	-	-	219	-
Stage 1	-	-	-	-	551	-
Stage 2	-	-	-	-	564	-
Approach	EB	WB	SB			
HCM Control Delay, s	0	0	14			
HCM LOS						B
Minor Lane/Major Mvmt	EBT	WBT	SBLn1			
Capacity (veh/h)	-	-	421			
HCM Lane V/C Ratio	-	-	0.048			
HCM Control Delay (s)	-	-	14			
HCM Lane LOS	-	-	B			
HCM 95th %tile Q(veh)	-	-	0.2			

Intersection	
Intersection Delay, s/veh	12.1
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	27	286	10	48	330
Future Vol, veh/h	5	27	286	10	48	330
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles, %	2	2	8	8	5	5
Mvmt Flow	6	32	340	12	57	393
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8.6	11.3	13.1
HCM LOS	A	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	16%	13%
Vol Thru, %	97%	0%	87%
Vol Right, %	3%	84%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	296	32	378
LT Vol	0	5	48
Through Vol	286	0	330
RT Vol	10	27	0
Lane Flow Rate	352	38	450
Geometry Grp	1	1	1
Degree of Util (X)	0.448	0.055	0.56
Departure Headway (Hd)	4.579	5.198	4.479
Convergence, Y/N	Yes	Yes	Yes
Cap	786	686	806
Service Time	2.604	3.249	2.503
HCM Lane V/C Ratio	0.448	0.055	0.558
HCM Control Delay	11.3	8.6	13.1
HCM Lane LOS	B	A	B
HCM 95th-tile Q	2.3	0.2	3.5

Existing 2020 PM
1: N Kilbourn Ave (West) & W Chicago Ave

06/03/2020



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	564	191	157	966	242	265
Future Volume (vph)	564	191	157	966	242	265
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		50	100		0	100
Storage Lanes		1	1		1	1
Taper Length (ft)			50		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98	1.00			
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1776	1509	1736	1827	1770	1583
Flt Permitted			0.181		0.950	
Satd. Flow (perm)	1776	1476	330	1827	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		73				279
Link Speed (mph)	30			30	30	
Link Distance (ft)	715			346	921	
Travel Time (s)	16.3			7.9	20.9	
Confl. Peds. (#/hr)		2	2			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	7%	7%	4%	4%	2%	2%
Adj. Flow (vph)	594	201	165	1017	255	279
Shared Lane Traffic (%)						
Lane Group Flow (vph)	594	201	165	1017	255	279
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	NA	Perm	D.P+P	NA	Prot	Perm
Protected Phases	2		1	1 2	4	
Permitted Phases		2	2			4
Detector Phase	2	2	1	1 2	4	4
Switch Phase						
Minimum Initial (s)	35.0	35.0	20.0		19.0	19.0
Minimum Split (s)	39.0	39.0	23.0		23.0	23.0
Total Split (s)	39.0	39.0	23.0		23.0	23.0
Total Split (%)	45.9%	45.9%	27.1%		27.1%	27.1%
Maximum Green (s)	35.0	35.0	20.0		19.0	19.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	0.0		1.0	1.0

Existing 2020 PM
 1: N Kilbourn Ave (West) & W Chicago Ave

06/03/2020



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	3.0		4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	0.2	0.2	0.2		0.2	0.2
Recall Mode	C-Max	C-Max	Max		Max	Max
Act Effct Green (s)	35.0	35.0	56.0	59.0	19.0	19.0
Actuated g/C Ratio	0.41	0.41	0.66	0.69	0.22	0.22
v/c Ratio	0.81	0.31	0.30	0.80	0.65	0.49
Control Delay	32.9	12.0	12.4	29.9	38.6	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.9	12.0	12.4	29.9	38.6	6.9
LOS	C	B	B	C	D	A
Approach Delay	27.6			27.4	22.1	
Approach LOS	C			C	C	

Intersection Summary

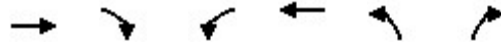
Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 75 (88%), Referenced to phase 2:EBWB, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.81
 Intersection Signal Delay: 26.4
 Intersection LOS: C
 Intersection Capacity Utilization 73.3%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: N Kilbourn Ave (West) & W Chicago Ave



Existing 2020 PM
 1: N Kilbourn Ave (West) & W Chicago Ave

06/03/2020



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	594	201	165	1017	255	279
v/c Ratio	0.81	0.31	0.30	0.80	0.65	0.49
Control Delay	32.9	12.0	12.4	29.9	38.6	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	32.9	12.0	12.4	29.9	38.6	6.9
Queue Length 50th (ft)	273	43	58	539	124	0
Queue Length 95th (ft)	#455	92	101	685	204	61
Internal Link Dist (ft)	635			266	841	
Turn Bay Length (ft)		50	100			100
Base Capacity (vph)	731	650	548	1268	395	570
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.81	0.31	0.30	0.80	0.65	0.49

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Existing 2020 PM
3: W Chicago Ave & N Kostner Ave

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	228	541	18	3	865	138	28	35	18	145	10	219
Future Volume (vph)	228	541	18	3	865	138	28	35	18	145	10	219
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	100			70			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00			0.99			1.00	
Frt		0.995			0.979			0.950				0.850
Flt Protected	0.950			0.950			0.950				0.955	
Satd. Flow (prot)	1703	3386	0	1736	3387	0	1805	1796	0	0	1728	1538
Flt Permitted	0.180			0.425			0.585				0.699	
Satd. Flow (perm)	322	3386	0	775	3387	0	1112	1796	0	0	1261	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			32			19				220
Link Speed (mph)		30			30			30				30
Link Distance (ft)		660			361			227				577
Travel Time (s)		15.0			8.2			5.2				13.1
Confl. Peds. (#/hr)	5		6	6		5			3	3		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	6%	6%	6%	4%	4%	4%	0%	0%	0%	5%	5%	5%
Adj. Flow (vph)	245	582	19	3	930	148	30	38	19	156	11	235
Shared Lane Traffic (%)												
Lane Group Flow (vph)	245	601	0	3	1078	0	30	57	0	0	167	235
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		0	0		0	0		1	0	0
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	0		0	0		0	0		20	0	0
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	D.P+P	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2	2 3			3			1				1
Permitted Phases	3			3			1			1		1
Detector Phase	2	2 3		3	3		1	1		1	1	1
Switch Phase												

Existing 2020 PM
3: W Chicago Ave & N Kostner Ave

06/03/2020

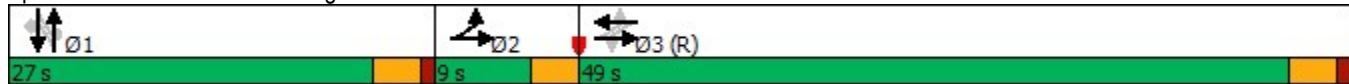


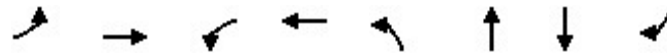
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	6.0			27.0	27.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	9.0			49.0	49.0		27.0	27.0		27.0	27.0	27.0
Total Split (s)	9.0			49.0	49.0		27.0	27.0		27.0	27.0	27.0
Total Split (%)	10.6%			57.6%	57.6%		31.8%	31.8%		31.8%	31.8%	31.8%
Maximum Green (s)	6.0			45.0	45.0		23.0	23.0		23.0	23.0	23.0
Yellow Time (s)	3.0			3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0			1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	3.0			4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lag						Lead	Lead		Lead	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			0.2	0.2		0.2	0.2		0.2	0.2	0.2
Recall Mode	None			C-Max	C-Max		Max	Max		Max	Max	Max
Walk Time (s)				27.0	27.0		5.0	5.0		5.0	5.0	5.0
Flash Dont Walk (s)				18.0	18.0		18.0	18.0		18.0	18.0	18.0
Pedestrian Calls (#/hr)				0	0		0	0		0	0	0
Act Effect Green (s)	52.0	55.0		45.0	45.0		23.0	23.0		23.0	23.0	23.0
Actuated g/C Ratio	0.61	0.65		0.53	0.53		0.27	0.27		0.27	0.27	0.27
v/c Ratio	0.83	0.27		0.01	0.60		0.10	0.11		0.49	0.41	0.41
Control Delay	39.4	8.1		9.7	15.0		24.5	17.9		31.9	6.9	6.9
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	39.4	8.1		9.7	15.0		24.5	17.9		31.9	6.9	6.9
LOS	D	A		A	B		C	B		C	A	A
Approach Delay		17.2			15.0			20.2			17.3	
Approach LOS		B			B			C			B	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 79 (93%), Referenced to phase 3:EBWB, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.83
 Intersection Signal Delay: 16.3 Intersection LOS: B
 Intersection Capacity Utilization 80.2% ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 3: W Chicago Ave & N Kostner Ave





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	245	601	3	1078	30	57	167	235
v/c Ratio	0.83	0.27	0.01	0.60	0.10	0.11	0.49	0.41
Control Delay	39.4	8.1	9.7	15.0	24.5	17.9	31.9	6.9
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	39.4	8.1	9.7	15.0	24.5	17.9	31.9	6.9
Queue Length 50th (ft)	78	58	1	190	12	15	75	6
Queue Length 95th (ft)	m#111	m109	5	250	34	43	137	60
Internal Link Dist (ft)		580		281		147	497	
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	294	2193	410	1808	300	499	341	576
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.83	0.27	0.01	0.60	0.10	0.11	0.49	0.41

Intersection Summary

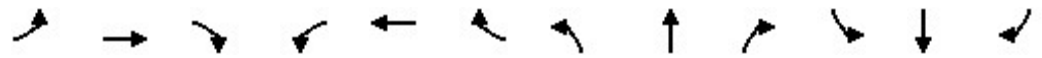
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Existing 2020 PM
6: N Kilbourn Ave & W Lake St

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕		↕		↕
Traffic Volume (vph)	29	296	0	0	633	55	53	215	15	200	0	119
Future Volume (vph)	29	296	0	0	633	55	53	215	15	200	0	119
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	100		0	0		100
Storage Lanes	0		0	0		0	1		0	1		1
Taper Length (ft)	25			25			50			25		
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00							
Frt					0.988			0.990				0.850
Flt Protected		0.996					0.950			0.950		
Satd. Flow (prot)	0	3525	0	0	3490	0	1752	1826	0	1770	0	1583
Flt Permitted		0.874					0.950			0.520		
Satd. Flow (perm)	0	3093	0	0	3490	0	1752	1826	0	969	0	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					18			7				127
Link Speed (mph)		30			30			30				30
Link Distance (ft)		618			660			642				1899
Travel Time (s)		14.0			15.0			14.6				43.2
Confl. Peds. (#/hr)	5						5					
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Adj. Flow (vph)	31	315	0	0	673	59	56	229	16	213	0	127
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	346	0	0	732	0	56	245	0	213	0	127
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0			0		1	1		1		1
Detector Template	Left	Thru			Thru		Left	Thru		Left		Right
Leading Detector (ft)	20	0			0		20	20		20		20
Trailing Detector (ft)	0	0			0		0	0		0		0
Detector 1 Position(ft)	0	0			0		0	0		0		0
Detector 1 Size(ft)	20	6			6		20	20		20		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Turn Type	Perm	NA			NA		Perm	NA		D.Pm		Perm
Protected Phases		1			1			2				
Permitted Phases	1						2			2		2
Detector Phase	1	1			1		2	2		2		2
Switch Phase												

Existing 2020 PM
6: N Kilbourn Ave & W Lake St

06/03/2020

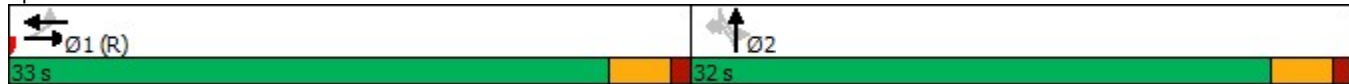


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	20.0	20.0			20.0		16.0	16.0		16.0		16.0
Minimum Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (%)	50.8%	50.8%			50.8%		49.2%	49.2%		49.2%		49.2%
Maximum Green (s)	29.0	29.0			29.0		28.0	28.0		28.0		28.0
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
All-Red Time (s)	1.0	1.0			1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0		0.0
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lead/Lag	Lead	Lead			Lead		Lag	Lag		Lag		Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	0.2	0.2			0.2		4.0	4.0		4.0		4.0
Recall Mode	C-Max	C-Max			C-Max		None	None		None		None
Walk Time (s)	20.0	20.0			20.0		10.0	10.0		10.0		10.0
Flash Dont Walk (s)	9.0	9.0			9.0		18.0	18.0		18.0		18.0
Pedestrian Calls (#/hr)	0	0			0		0	0		0		0
Act Effct Green (s)		36.2			36.2		20.8	20.8		20.8		20.8
Actuated g/C Ratio		0.56			0.56		0.32	0.32		0.32		0.32
v/c Ratio		0.20			0.38		0.10	0.42		0.69		0.21
Control Delay		8.7			9.6		13.9	18.0		30.3		3.7
Queue Delay		0.0			0.0		0.0	0.0		0.0		0.0
Total Delay		8.7			9.6		13.9	18.0		30.3		3.7
LOS		A			A		B	B		C		A
Approach Delay		8.7			9.6			17.2				20.4
Approach LOS		A			A			B				C

Intersection Summary

Area Type:	Other
Cycle Length:	65
Actuated Cycle Length:	65
Offset:	47 (72%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.69
Intersection Signal Delay:	12.9
Intersection LOS:	B
Intersection Capacity Utilization:	65.0%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 6: N Kilbourn Ave & W Lake St





Lane Group	EBT	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	346	732	56	245	213	127
v/c Ratio	0.20	0.38	0.10	0.42	0.69	0.21
Control Delay	8.7	9.6	13.9	18.0	30.3	3.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	9.6	13.9	18.0	30.3	3.7
Queue Length 50th (ft)	31	72	16	74	74	0
Queue Length 95th (ft)	67	141	31	106	120	26
Internal Link Dist (ft)	538	580		562		
Turn Bay Length (ft)			100			100
Base Capacity (vph)	1720	1949	754	790	417	754
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.38	0.07	0.31	0.51	0.17

Intersection Summary




Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑	
Traffic Vol, veh/h	0	702	981	0	7	21
Future Vol, veh/h	0	702	981	0	7	21
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	8	8	4	4	0	0
Mvmt Flow	0	747	1044	0	7	22

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	1418 522
Stage 1	-	-	-	-	1044 -
Stage 2	-	-	-	-	374 -
Critical Hdwy	-	-	-	-	6.8 6.9
Critical Hdwy Stg 1	-	-	-	-	5.8 -
Critical Hdwy Stg 2	-	-	-	-	5.8 -
Follow-up Hdwy	-	-	-	-	3.5 3.3
Pot Cap-1 Maneuver	0	-	-	0	130 505
Stage 1	0	-	-	0	305 -
Stage 2	0	-	-	0	672 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	130 505
Mov Cap-2 Maneuver	-	-	-	-	130 -
Stage 1	-	-	-	-	305 -
Stage 2	-	-	-	-	672 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	18.7
HCM LOS			C

Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	293
HCM Lane V/C Ratio	-	-	0.102
HCM Control Delay (s)	-	-	18.7
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.3

Intersection	
Intersection Delay, s/veh	14.2
Intersection LOS	B

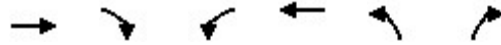
Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	82	401	6	36	343
Future Vol, veh/h	11	82	401	6	36	343
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	6	6	4	4	8	8
Mvmt Flow	13	93	456	7	41	390
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	9.6	15	14.5
HCM LOS	A	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	12%	9%
Vol Thru, %	99%	0%	91%
Vol Right, %	1%	88%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	407	93	379
LT Vol	0	11	36
Through Vol	401	0	343
RT Vol	6	82	0
Lane Flow Rate	462	106	431
Geometry Grp	1	1	1
Degree of Util (X)	0.609	0.161	0.581
Departure Headway (Hd)	4.737	5.471	4.856
Convergence, Y/N	Yes	Yes	Yes
Cap	759	648	736
Service Time	2.801	3.571	2.923
HCM Lane V/C Ratio	0.609	0.164	0.586
HCM Control Delay	15	9.6	14.5
HCM Lane LOS	B	A	B
HCM 95th-tile Q	4.2	0.6	3.8



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	903	265	111	547	120	173
Future Volume (vph)	903	265	111	547	120	173
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		50	100		0	100
Storage Lanes		1	1		1	1
Taper Length (ft)			50		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98	1.00			
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1827	1553	1687	1776	1671	1495
Flt Permitted			0.085		0.950	
Satd. Flow (perm)	1827	1515	151	1776	1671	1495
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		83				190
Link Speed (mph)	30			30	30	
Link Distance (ft)	715			346	921	
Travel Time (s)	16.3			7.9	20.9	
Confl. Peds. (#/hr)		5	5			
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	4%	4%	7%	7%	8%	8%
Adj. Flow (vph)	992	291	122	601	132	190
Shared Lane Traffic (%)						
Lane Group Flow (vph)	992	291	122	601	132	190
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	NA	Perm	D.P+P	NA	Prot	Perm
Protected Phases	2		1	1 2	4	
Permitted Phases		2	2			4
Detector Phase	2	2	1	1 2	4	4
Switch Phase						
Minimum Initial (s)	43.0	43.0	12.0		15.0	15.0
Minimum Split (s)	51.0	51.0	15.0		19.0	19.0
Total Split (s)	51.0	51.0	15.0		19.0	19.0
Total Split (%)	60.0%	60.0%	17.6%		22.4%	22.4%
Maximum Green (s)	47.0	47.0	12.0		15.0	15.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	0.0		1.0	1.0



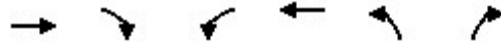
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	3.0		4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	0.2	0.2	0.2		0.2	0.2
Recall Mode	C-Max	C-Max	Max		Max	Max
Act Effct Green (s)	47.0	47.0	60.0	63.0	15.0	15.0
Actuated g/C Ratio	0.55	0.55	0.71	0.74	0.18	0.18
v/c Ratio	0.98	0.33	0.38	0.46	0.45	0.45
Control Delay	44.8	8.4	17.6	6.0	36.9	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	8.4	17.6	6.0	36.9	8.8
LOS	D	A	B	A	D	A
Approach Delay	36.6			8.0	20.3	
Approach LOS	D			A	C	

Intersection Summary

Area Type:	Other
Cycle Length:	85
Actuated Cycle Length:	85
Offset:	72 (85%), Referenced to phase 2:EBWB, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.98
Intersection Signal Delay:	25.4
Intersection LOS:	C
Intersection Capacity Utilization	80.0%
ICU Level of Service	D
Analysis Period (min)	15

Splits and Phases: 1: N Kilbourn Ave (West) & W Chicago Ave

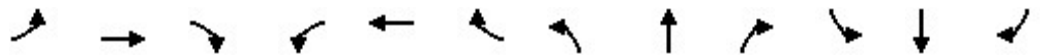




Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	992	291	122	601	132	190
v/c Ratio	0.98	0.33	0.38	0.46	0.45	0.45
Control Delay	44.8	8.4	17.6	6.0	36.9	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	44.8	8.4	17.6	6.0	36.9	8.8
Queue Length 50th (ft)	483	54	33	83	64	0
Queue Length 95th (ft)	#778	102	74	99	119	55
Internal Link Dist (ft)	635			266	841	
Turn Bay Length (ft)		50	100			100
Base Capacity (vph)	1010	874	323	1316	294	420
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.98	0.33	0.38	0.46	0.45	0.45

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	871	31	4	457	69	44	20	8	117	34	169
Future Volume (vph)	139	871	31	4	457	69	44	20	8	117	34	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	100			70			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00		1.00	0.99			0.99	0.99
Fr _t		0.995			0.980			0.956				0.850
Fl _t Protected	0.950			0.950			0.950				0.963	
Satd. Flow (prot)	1703	3386	0	1703	3324	0	1327	1326	0	0	1759	1553
Fl _t Permitted	0.382			0.274			0.613				0.763	
Satd. Flow (perm)	682	3386	0	491	3324	0	856	1326	0	0	1380	1533
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		7			27			9				184
Link Speed (mph)		30			30			30				30
Link Distance (ft)		660			361			227				577
Travel Time (s)		15.0			8.2			5.2				13.1
Confl. Peds. (#/hr)	10		2	2		10	1		15	15		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	36%	36%	36%	4%	4%	4%
Adj. Flow (vph)	151	947	34	4	497	75	48	22	9	127	37	184
Shared Lane Traffic (%)												
Lane Group Flow (vph)	151	981	0	4	572	0	48	31	0	0	164	184
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		0	0		0	0		1	0	0
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	0		0	0		0	0		20	0	0
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	D.P+P	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2	2 3			3			1				1
Permitted Phases	3			3			1			1		1
Detector Phase	2	2 3		3	3		1	1		1	1	1
Switch Phase												

No Build 2022
 3: W Chicago Ave & N Kostner Ave

06/03/2020

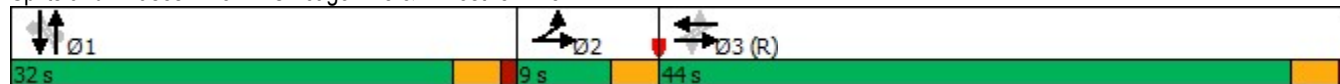


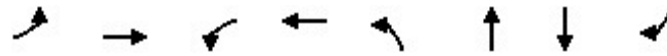
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	6.0			22.0	22.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	9.0			44.0	44.0		32.0	32.0		32.0	32.0	32.0
Total Split (s)	9.0			44.0	44.0		32.0	32.0		32.0	32.0	32.0
Total Split (%)	10.6%			51.8%	51.8%		37.6%	37.6%		37.6%	37.6%	37.6%
Maximum Green (s)	6.0			40.0	40.0		28.0	28.0		28.0	28.0	28.0
Yellow Time (s)	3.0			3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0			1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0		0.0	0.0			0.0	0.0
Total Lost Time (s)	3.0			4.0	4.0		4.0	4.0			4.0	4.0
Lead/Lag	Lag						Lead	Lead		Lead	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			0.2	0.2		0.2	0.2		0.2	0.2	0.2
Recall Mode	None			C-Max	C-Max		Max	Max		Max	Max	Max
Walk Time (s)				22.0	22.0		10.0	10.0		10.0	10.0	10.0
Flash Dont Walk (s)				18.0	18.0		18.0	18.0		18.0	18.0	18.0
Pedestrian Calls (#/hr)				0	0		0	0		0	0	0
Act Effect Green (s)	47.0	50.0		40.0	40.0		28.0	28.0			28.0	28.0
Actuated g/C Ratio	0.55	0.59		0.47	0.47		0.33	0.33			0.33	0.33
v/c Ratio	0.34	0.49		0.02	0.36		0.17	0.07			0.36	0.29
Control Delay	16.3	19.9		12.5	14.4		22.3	16.0			24.6	4.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0			0.0	0.0
Total Delay	16.3	19.9		12.5	14.4		22.3	16.0			24.6	4.7
LOS	B	B		B	B		C	B			C	A
Approach Delay		19.5			14.4			19.8			14.1	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 70 (82%), Referenced to phase 3:EBWB, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.49
 Intersection Signal Delay: 17.2 Intersection LOS: B
 Intersection Capacity Utilization 90.0% ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 3: W Chicago Ave & N Kostner Ave

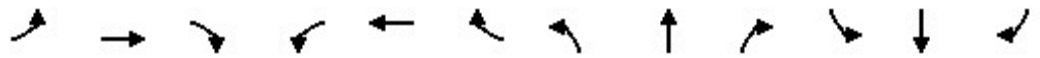




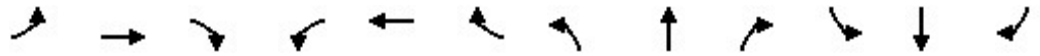
Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	151	981	4	572	48	31	164	184
v/c Ratio	0.34	0.49	0.02	0.36	0.17	0.07	0.36	0.29
Control Delay	16.3	19.9	12.5	14.4	22.3	16.0	24.6	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.3	19.9	12.5	14.4	22.3	16.0	24.6	4.7
Queue Length 50th (ft)	61	234	1	93	18	8	66	0
Queue Length 95th (ft)	m67	m254	7	131	45	27	120	43
Internal Link Dist (ft)		580		281		147	497	
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	449	1994	231	1578	281	442	454	628
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.34	0.49	0.02	0.36	0.17	0.07	0.36	0.29

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↔↔			↔↔		↔	↔		↔		↔
Traffic Volume (vph)	53	740	0	0	280	31	52	180	14	178	0	42
Future Volume (vph)	53	740	0	0	280	31	52	180	14	178	0	42
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	100		0	0		100
Storage Lanes	0		0	0		0	1		0	1		1
Taper Length (ft)	25			25			50			25		
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			1.00		1.00		
Fr _t					0.985			0.989				0.850
Fl _t Protected		0.997					0.950			0.950		
Satd. Flow (prot)	0	3564	0	0	3411	0	1736	1805	0	1612	0	1442
Fl _t Permitted		0.907					0.950			0.559		
Satd. Flow (perm)	0	3241	0	0	3411	0	1736	1805	0	948	0	1442
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					23			8				47
Link Speed (mph)		30			30			30				30
Link Distance (ft)		618			660			642				1899
Travel Time (s)		14.0			15.0			14.6				43.2
Confl. Peds. (#/hr)	3		3	3		3			1	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	4%	4%	4%	12%	12%	12%
Adj. Flow (vph)	59	822	0	0	311	34	58	200	16	198	0	47
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	881	0	0	345	0	58	216	0	198	0	47
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0			0		1	1		1		1
Detector Template	Left	Thru			Thru		Left	Thru		Left		Right
Leading Detector (ft)	20	0			0		20	20		20		20
Trailing Detector (ft)	0	0			0		0	0		0		0
Detector 1 Position(ft)	0	0			0		0	0		0		0
Detector 1 Size(ft)	20	6			6		20	20		20		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Turn Type	Perm	NA			NA		Perm	NA		D.Pm		Perm
Protected Phases		1			1			2				
Permitted Phases	1						2			2		2
Detector Phase	1	1			1		2	2		2		2
Switch Phase												

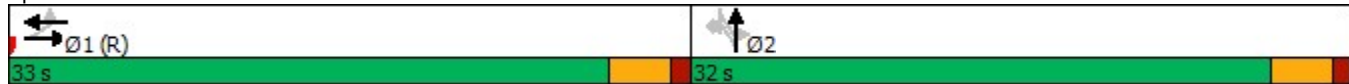


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	20.0	20.0			20.0		16.0	16.0		16.0		16.0
Minimum Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (%)	50.8%	50.8%			50.8%		49.2%	49.2%		49.2%		49.2%
Maximum Green (s)	29.0	29.0			29.0		28.0	28.0		28.0		28.0
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
All-Red Time (s)	1.0	1.0			1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0		0.0
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lead/Lag	Lead	Lead			Lead		Lag	Lag		Lag		Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	0.2	0.2			0.2		4.0	4.0		4.0		4.0
Recall Mode	C-Max	C-Max			C-Max		None	None		None		None
Walk Time (s)	20.0	20.0			20.0		10.0	10.0		10.0		10.0
Flash Dont Walk (s)	9.0	9.0			9.0		18.0	18.0		18.0		18.0
Pedestrian Calls (#/hr)	0	0			0		0	0		0		0
Act Effct Green (s)		36.6			36.6		20.4	20.4		20.4		20.4
Actuated g/C Ratio		0.56			0.56		0.31	0.31		0.31		0.31
v/c Ratio		0.48			0.18		0.11	0.38		0.67		0.10
Control Delay		10.7			7.7		14.3	17.6		30.0		4.7
Queue Delay		0.0			0.0		0.0	0.0		0.0		0.0
Total Delay		10.7			7.7		14.3	17.6		30.0		4.7
LOS		B			A		B	B		C		A
Approach Delay		10.7			7.7			16.9				25.1
Approach LOS		B			A			B				C

Intersection Summary

Area Type:	Other
Cycle Length:	65
Actuated Cycle Length:	65
Offset:	12 (18%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.67
Intersection Signal Delay:	13.1
Intersection LOS:	B
Intersection Capacity Utilization:	85.2%
ICU Level of Service:	E
Analysis Period (min):	15

Splits and Phases: 6: N Kilbourn Ave & W Lake St





Lane Group	EBT	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	881	345	58	216	198	47
v/c Ratio	0.48	0.18	0.11	0.38	0.67	0.10
Control Delay	10.7	7.7	14.3	17.6	30.0	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.7	7.7	14.3	17.6	30.0	4.7
Queue Length 50th (ft)	92	27	17	66	70	0
Queue Length 95th (ft)	187	63	32	93	111	16
Internal Link Dist (ft)	538	580		562		
Turn Bay Length (ft)			100			100
Base Capacity (vph)	1825	1931	747	782	408	647
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.48	0.18	0.08	0.28	0.49	0.07

Intersection Summary




Intersection						
Int Delay, s/veh	0.2					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		⚡	
Traffic Vol, veh/h	0	996	517	0	6	13
Future Vol, veh/h	0	996	517	0	6	13
Conflicting Peds, #/hr	3	0	0	3	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	6	6	6	6	0	0
Mvmt Flow	0	1060	550	0	6	14

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	1080 275
Stage 1	-	-	-	-	550 -
Stage 2	-	-	-	-	530 -
Critical Hdwy	-	-	-	-	6.8 6.9
Critical Hdwy Stg 1	-	-	-	-	5.8 -
Critical Hdwy Stg 2	-	-	-	-	5.8 -
Follow-up Hdwy	-	-	-	-	3.5 3.3
Pot Cap-1 Maneuver	0	-	-	0	216 729
Stage 1	0	-	-	0	547 -
Stage 2	0	-	-	0	560 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	216 729
Mov Cap-2 Maneuver	-	-	-	-	216 -
Stage 1	-	-	-	-	547 -
Stage 2	-	-	-	-	560 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	14.1
HCM LOS			B

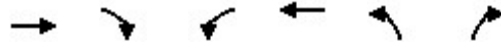
Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	417
HCM Lane V/C Ratio	-	-	0.048
HCM Control Delay (s)	-	-	14.1
HCM Lane LOS	-	-	B
HCM 95th %tile Q(veh)	-	-	0.2

Intersection	
Intersection Delay, s/veh	12.2
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	27	289	10	48	333
Future Vol, veh/h	5	27	289	10	48	333
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles, %	2	2	8	8	5	5
Mvmt Flow	6	32	344	12	57	396
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8.6	11.4	13.2
HCM LOS	A	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	16%	13%
Vol Thru, %	97%	0%	87%
Vol Right, %	3%	84%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	299	32	381
LT Vol	0	5	48
Through Vol	289	0	333
RT Vol	10	27	0
Lane Flow Rate	356	38	454
Geometry Grp	1	1	1
Degree of Util (X)	0.453	0.055	0.565
Departure Headway (Hd)	4.582	5.212	4.483
Convergence, Y/N	Yes	Yes	Yes
Cap	787	684	807
Service Time	2.609	3.265	2.507
HCM Lane V/C Ratio	0.452	0.056	0.563
HCM Control Delay	11.4	8.6	13.2
HCM Lane LOS	B	A	B
HCM 95th-tile Q	2.4	0.2	3.6



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	570	193	159	976	244	268
Future Volume (vph)	570	193	159	976	244	268
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		50	100		0	100
Storage Lanes		1	1		1	1
Taper Length (ft)			50		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98	1.00			
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1776	1509	1736	1827	1770	1583
Flt Permitted			0.175		0.950	
Satd. Flow (perm)	1776	1476	320	1827	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		73				282
Link Speed (mph)	30			30	30	
Link Distance (ft)	715			346	921	
Travel Time (s)	16.3			7.9	20.9	
Confl. Peds. (#/hr)		2	2			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	7%	7%	4%	4%	2%	2%
Adj. Flow (vph)	600	203	167	1027	257	282
Shared Lane Traffic (%)						
Lane Group Flow (vph)	600	203	167	1027	257	282
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	NA	Perm	D.P+P	NA	Prot	Perm
Protected Phases	2		1	1 2	4	
Permitted Phases		2	2			4
Detector Phase	2	2	1	1 2	4	4
Switch Phase						
Minimum Initial (s)	35.0	35.0	20.0		19.0	19.0
Minimum Split (s)	39.0	39.0	23.0		23.0	23.0
Total Split (s)	39.0	39.0	23.0		23.0	23.0
Total Split (%)	45.9%	45.9%	27.1%		27.1%	27.1%
Maximum Green (s)	35.0	35.0	20.0		19.0	19.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	0.0		1.0	1.0

No Build 2022 PM
 1: N Kilbourn Ave (West) & W Chicago Ave

06/03/2020



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	3.0		4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	0.2	0.2	0.2		0.2	0.2
Recall Mode	C-Max	C-Max	Max		Max	Max
Act Effect Green (s)	35.0	35.0	56.0	59.0	19.0	19.0
Actuated g/C Ratio	0.41	0.41	0.66	0.69	0.22	0.22
v/c Ratio	0.82	0.31	0.31	0.81	0.65	0.49
Control Delay	33.5	12.1	12.4	30.2	38.8	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	12.1	12.4	30.2	38.8	7.0
LOS	C	B	B	C	D	A
Approach Delay	28.1			27.7	22.1	
Approach LOS	C			C	C	

Intersection Summary

Area Type:	Other
Cycle Length:	85
Actuated Cycle Length:	85
Offset:	75 (88%), Referenced to phase 2:EBWB, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.82
Intersection Signal Delay:	26.7
Intersection LOS:	C
Intersection Capacity Utilization	73.9%
ICU Level of Service	D
Analysis Period (min)	15

Splits and Phases: 1: N Kilbourn Ave (West) & W Chicago Ave





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	600	203	167	1027	257	282
v/c Ratio	0.82	0.31	0.31	0.81	0.65	0.49
Control Delay	33.5	12.1	12.4	30.2	38.8	7.0
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	33.5	12.1	12.4	30.2	38.8	7.0
Queue Length 50th (ft)	277	44	58	546	125	0
Queue Length 95th (ft)	#462	93	103	693	206	61
Internal Link Dist (ft)	635			266	841	
Turn Bay Length (ft)		50	100			100
Base Capacity (vph)	731	650	544	1268	395	572
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.82	0.31	0.31	0.81	0.65	0.49

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

No Build 2022 PM
3: W Chicago Ave & N Kostner Ave

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	546	18	3	874	139	28	35	18	146	10	221
Future Volume (vph)	230	546	18	3	874	139	28	35	18	146	10	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	100			70			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00			0.99			1.00	
Frt		0.995			0.979			0.950				0.850
Flt Protected	0.950			0.950			0.950				0.955	
Satd. Flow (prot)	1703	3386	0	1736	3387	0	1805	1796	0	0	1728	1538
Flt Permitted	0.177			0.423			0.583				0.699	
Satd. Flow (perm)	317	3386	0	771	3387	0	1108	1796	0	0	1261	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			32			19				218
Link Speed (mph)		30			30			30				30
Link Distance (ft)		660			361			227				577
Travel Time (s)		15.0			8.2			5.2				13.1
Confl. Peds. (#/hr)	5		6	6		5			3	3		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	6%	6%	6%	4%	4%	4%	0%	0%	0%	5%	5%	5%
Adj. Flow (vph)	247	587	19	3	940	149	30	38	19	157	11	238
Shared Lane Traffic (%)												
Lane Group Flow (vph)	247	606	0	3	1089	0	30	57	0	0	168	238
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		0	0		0	0		1	0	0
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	0		0	0		0	0		20	0	0
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Turn Type	D.P+P	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2	2 3			3			1				1
Permitted Phases	3			3			1			1		1
Detector Phase	2	2 3		3	3		1	1		1	1	1
Switch Phase												

Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	6.0			27.0	27.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	9.0			49.0	49.0		27.0	27.0		27.0	27.0	27.0
Total Split (s)	9.0			49.0	49.0		27.0	27.0		27.0	27.0	27.0
Total Split (%)	10.6%			57.6%	57.6%		31.8%	31.8%		31.8%	31.8%	31.8%
Maximum Green (s)	6.0			45.0	45.0		23.0	23.0		23.0	23.0	23.0
Yellow Time (s)	3.0			3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0			1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	3.0			4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lag						Lead	Lead		Lead	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			0.2	0.2		0.2	0.2		0.2	0.2	0.2
Recall Mode	None			C-Max	C-Max		Max	Max		Max	Max	Max
Walk Time (s)				27.0	27.0		5.0	5.0		5.0	5.0	5.0
Flash Dont Walk (s)				18.0	18.0		18.0	18.0		18.0	18.0	18.0
Pedestrian Calls (#/hr)				0	0		0	0		0	0	0
Act Effct Green (s)	52.0	55.0		45.0	45.0		23.0	23.0		23.0	23.0	23.0
Actuated g/C Ratio	0.61	0.65		0.53	0.53		0.27	0.27		0.27	0.27	0.27
v/c Ratio	0.85	0.28		0.01	0.60		0.10	0.11		0.49	0.41	0.41
Control Delay	41.4	8.2		9.7	15.1		24.5	17.9		32.0	7.2	7.2
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	41.4	8.2		9.7	15.1		24.5	17.9		32.0	7.2	7.2
LOS	D	A		A	B		C	B		C	A	A
Approach Delay		17.8			15.1			20.2			17.5	
Approach LOS		B			B			C			B	

Intersection Summary

Area Type: Other

Cycle Length: 85

Actuated Cycle Length: 85

Offset: 79 (93%), Referenced to phase 3:EBWB, Start of Green

Natural Cycle: 85

Control Type: Actuated-Coordinated

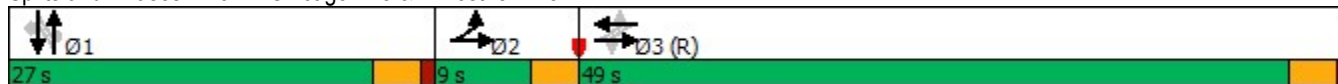
Maximum v/c Ratio: 0.85

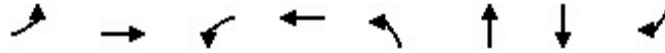
Intersection Signal Delay: 16.6 Intersection LOS: B

Intersection Capacity Utilization 80.4% ICU Level of Service D

Analysis Period (min) 15

Splits and Phases: 3: W Chicago Ave & N Kostner Ave





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	247	606	3	1089	30	57	168	238
v/c Ratio	0.85	0.28	0.01	0.60	0.10	0.11	0.49	0.41
Control Delay	41.4	8.2	9.7	15.1	24.5	17.9	32.0	7.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	41.4	8.2	9.7	15.1	24.5	17.9	32.0	7.2
Queue Length 50th (ft)	81	60	1	192	12	15	75	8
Queue Length 95th (ft)	m#113	m109	5	254	34	43	137	62
Internal Link Dist (ft)		580		281		147	497	
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	291	2193	408	1808	299	499	341	575
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.85	0.28	0.01	0.60	0.10	0.11	0.49	0.41

Intersection Summary

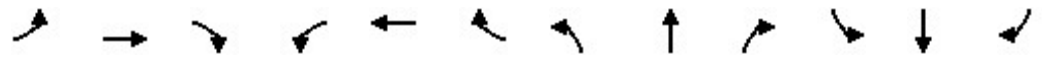
95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

No Build 2022 PM
6: N Kilbourn Ave & W Lake St

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕		↕		↕
Traffic Volume (vph)	29	299	0	0	639	56	54	217	15	202	0	120
Future Volume (vph)	29	299	0	0	639	56	54	217	15	202	0	120
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	100		0	0		100
Storage Lanes	0		0	0		0	1		0	1		1
Taper Length (ft)	25			25			50			25		
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00							
Fr _t					0.988			0.990				0.850
Fl _t Protected		0.996					0.950			0.950		
Satd. Flow (prot)	0	3525	0	0	3490	0	1752	1826	0	1770	0	1583
Fl _t Permitted		0.874					0.950			0.518		
Satd. Flow (perm)	0	3093	0	0	3490	0	1752	1826	0	965	0	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					18			7				128
Link Speed (mph)		30			30			30				30
Link Distance (ft)		618			660			642				1899
Travel Time (s)		14.0			15.0			14.6				43.2
Confl. Peds. (#/hr)	5						5					
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Adj. Flow (vph)	31	318	0	0	680	60	57	231	16	215	0	128
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	349	0	0	740	0	57	247	0	215	0	128
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0			0		1	1		1		1
Detector Template	Left	Thru			Thru		Left	Thru		Left		Right
Leading Detector (ft)	20	0			0		20	20		20		20
Trailing Detector (ft)	0	0			0		0	0		0		0
Detector 1 Position(ft)	0	0			0		0	0		0		0
Detector 1 Size(ft)	20	6			6		20	20		20		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Turn Type	Perm	NA			NA		Perm	NA		D.Pm		Perm
Protected Phases		1			1			2				
Permitted Phases	1						2			2		2
Detector Phase	1	1			1		2	2		2		2
Switch Phase												

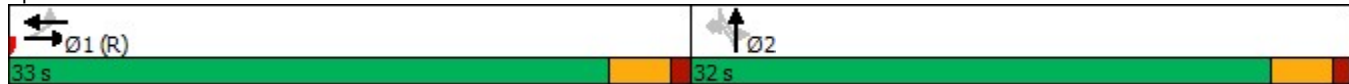


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	20.0	20.0			20.0		16.0	16.0		16.0		16.0
Minimum Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (%)	50.8%	50.8%			50.8%		49.2%	49.2%		49.2%		49.2%
Maximum Green (s)	29.0	29.0			29.0		28.0	28.0		28.0		28.0
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
All-Red Time (s)	1.0	1.0			1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0		0.0
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lead/Lag	Lead	Lead			Lead		Lag	Lag		Lag		Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	0.2	0.2			0.2		4.0	4.0		4.0		4.0
Recall Mode	C-Max	C-Max			C-Max		None	None		None		None
Walk Time (s)	20.0	20.0			20.0		10.0	10.0		10.0		10.0
Flash Dont Walk (s)	9.0	9.0			9.0		18.0	18.0		18.0		18.0
Pedestrian Calls (#/hr)	0	0			0		0	0		0		0
Act Effct Green (s)		36.1			36.1		20.9	20.9		20.9		20.9
Actuated g/C Ratio		0.56			0.56		0.32	0.32		0.32		0.32
v/c Ratio		0.20			0.38		0.10	0.42		0.69		0.22
Control Delay		8.7			9.6		13.9	17.9		30.7		3.6
Queue Delay		0.0			0.0		0.0	0.0		0.0		0.0
Total Delay		8.7			9.6		13.9	17.9		30.7		3.6
LOS		A			A		B	B		C		A
Approach Delay		8.7			9.6			17.2				20.6
Approach LOS		A			A			B				C

Intersection Summary

Area Type:	Other
Cycle Length:	65
Actuated Cycle Length:	65
Offset:	47 (72%), Referenced to phase 1:EBWB, Start of Green
Natural Cycle:	65
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.69
Intersection Signal Delay:	12.9
Intersection LOS:	B
Intersection Capacity Utilization:	65.2%
ICU Level of Service:	C
Analysis Period (min):	15

Splits and Phases: 6: N Kilbourn Ave & W Lake St





Lane Group	EBT	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	349	740	57	247	215	128
v/c Ratio	0.20	0.38	0.10	0.42	0.69	0.22
Control Delay	8.7	9.6	13.9	17.9	30.7	3.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	8.7	9.6	13.9	17.9	30.7	3.6
Queue Length 50th (ft)	32	74	16	74	74	0
Queue Length 95th (ft)	68	143	31	106	122	26
Internal Link Dist (ft)	538	580		562		
Turn Bay Length (ft)			100			100
Base Capacity (vph)	1717	1946	754	790	415	754
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.20	0.38	0.08	0.31	0.52	0.17
Intersection Summary						




Intersection						
Int Delay, s/veh	0.3					
Movement	EBL	EBT	WBT	WBR	SBL	SBR
Lane Configurations		↑↑	↑↑		↑	
Traffic Vol, veh/h	0	709	991	0	7	21
Future Vol, veh/h	0	709	991	0	7	21
Conflicting Peds, #/hr	6	0	0	6	0	0
Sign Control	Free	Free	Free	Free	Stop	Stop
RT Channelized	-	None	-	None	-	None
Storage Length	-	-	-	-	0	-
Veh in Median Storage, #	-	0	0	-	0	-
Grade, %	-	0	0	-	0	-
Peak Hour Factor	94	94	94	94	94	94
Heavy Vehicles, %	8	8	4	4	0	0
Mvmt Flow	0	754	1054	0	7	22

Major/Minor	Major1	Major2	Minor2		
Conflicting Flow All	-	0	-	0	1431 527
Stage 1	-	-	-	-	1054 -
Stage 2	-	-	-	-	377 -
Critical Hdwy	-	-	-	-	6.8 6.9
Critical Hdwy Stg 1	-	-	-	-	5.8 -
Critical Hdwy Stg 2	-	-	-	-	5.8 -
Follow-up Hdwy	-	-	-	-	3.5 3.3
Pot Cap-1 Maneuver	0	-	-	0	128 501
Stage 1	0	-	-	0	301 -
Stage 2	0	-	-	0	669 -
Platoon blocked, %	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	-	128 501
Mov Cap-2 Maneuver	-	-	-	-	128 -
Stage 1	-	-	-	-	301 -
Stage 2	-	-	-	-	669 -

Approach	EB	WB	SB
HCM Control Delay, s	0	0	18.8
HCM LOS			C

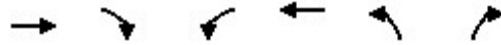
Minor Lane/Major Mvmt	EBT	WBT	SBLn1
Capacity (veh/h)	-	-	290
HCM Lane V/C Ratio	-	-	0.103
HCM Control Delay (s)	-	-	18.8
HCM Lane LOS	-	-	C
HCM 95th %tile Q(veh)	-	-	0.3

Intersection	
Intersection Delay, s/veh	14.4
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	83	405	6	36	346
Future Vol, veh/h	11	83	405	6	36	346
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	6	6	4	4	8	8
Mvmt Flow	13	94	460	7	41	393
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	9.7	15.2	14.7
HCM LOS	A	C	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	12%	9%
Vol Thru, %	99%	0%	91%
Vol Right, %	1%	88%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	411	94	382
LT Vol	0	11	36
Through Vol	405	0	346
RT Vol	6	83	0
Lane Flow Rate	467	107	434
Geometry Grp	1	1	1
Degree of Util (X)	0.616	0.166	0.587
Departure Headway (Hd)	4.746	5.59	4.867
Convergence, Y/N	Yes	Yes	Yes
Cap	757	645	734
Service Time	2.817	3.59	2.94
HCM Lane V/C Ratio	0.617	0.166	0.591
HCM Control Delay	15.2	9.7	14.7
HCM Lane LOS	C	A	B
HCM 95th-tile Q	4.3	0.6	3.9



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	931	265	118	560	120	180
Future Volume (vph)	931	265	118	560	120	180
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		50	100		0	100
Storage Lanes		1	1		1	1
Taper Length (ft)			50		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98	1.00			
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1827	1553	1687	1776	1671	1495
Flt Permitted			0.085		0.950	
Satd. Flow (perm)	1827	1515	151	1776	1671	1495
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		81				198
Link Speed (mph)	30			30	30	
Link Distance (ft)	715			346	786	
Travel Time (s)	16.3			7.9	17.9	
Confl. Peds. (#/hr)		5	5			
Peak Hour Factor	0.91	0.91	0.91	0.91	0.91	0.91
Heavy Vehicles (%)	4%	4%	7%	7%	8%	8%
Adj. Flow (vph)	1023	291	130	615	132	198
Shared Lane Traffic (%)						
Lane Group Flow (vph)	1023	291	130	615	132	198
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	NA	Perm	D.P+P	NA	Prot	Perm
Protected Phases	2		1	1 2	4	
Permitted Phases		2	2			4
Detector Phase	2	2	1	1 2	4	4
Switch Phase						
Minimum Initial (s)	43.0	43.0	12.0		15.0	15.0
Minimum Split (s)	51.0	51.0	15.0		19.0	19.0
Total Split (s)	51.0	51.0	15.0		19.0	19.0
Total Split (%)	60.0%	60.0%	17.6%		22.4%	22.4%
Maximum Green (s)	47.0	47.0	12.0		15.0	15.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	0.0		1.0	1.0



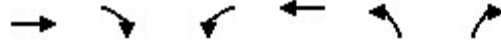
Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	3.0		4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	0.2	0.2	0.2		0.2	0.2
Recall Mode	C-Max	C-Max	Max		Max	Max
Act Effect Green (s)	47.0	47.0	60.0	63.0	15.0	15.0
Actuated g/C Ratio	0.55	0.55	0.71	0.74	0.18	0.18
v/c Ratio	1.01	0.33	0.40	0.47	0.45	0.46
Control Delay	52.6	8.5	19.4	6.6	36.9	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.6	8.5	19.4	6.6	36.9	8.8
LOS	D	A	B	A	D	A
Approach Delay	42.8			8.8	20.0	
Approach LOS	D			A	C	

Intersection Summary

Area Type:	Other
Cycle Length:	85
Actuated Cycle Length:	85
Offset:	72 (85%), Referenced to phase 2:EBWB, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	1.01
Intersection Signal Delay:	29.1
Intersection LOS:	C
Intersection Capacity Utilization:	81.5%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 1: N Kilbourn Ave (West) & W Chicago Ave





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	1023	291	130	615	132	198
v/c Ratio	1.01	0.33	0.40	0.47	0.45	0.46
Control Delay	52.6	8.5	19.4	6.6	36.9	8.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	52.6	8.5	19.4	6.6	36.9	8.8
Queue Length 50th (ft)	~532	54	40	88	64	0
Queue Length 95th (ft)	#815	102	85	171	119	56
Internal Link Dist (ft)	635			266	706	
Turn Bay Length (ft)		50	100			100
Base Capacity (vph)	1010	873	323	1316	294	426
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	1.01	0.33	0.40	0.47	0.45	0.46

Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.
 Queue shown is maximum after two cycles.

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.

Build 2022 AM
3: W Chicago Ave & N Kostner Ave

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	139	902	35	15	501	89	21	4	20	151	8	169
Future Volume (vph)	139	902	35	15	501	89	21	4	20	151	8	169
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	100			70			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00		1.00	0.98			0.99	0.99
Frt		0.994			0.977			0.873				0.850
Flt Protected	0.950			0.950			0.950				0.955	
Satd. Flow (prot)	1703	3382	0	1703	3312	0	1327	1193	0	0	1745	1553
Flt Permitted	0.343			0.259			0.600				0.718	
Satd. Flow (perm)	612	3382	0	464	3312	0	838	1193	0	0	1295	1533
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			32			22				184
Link Speed (mph)		30			30			30				30
Link Distance (ft)		660			361			221				577
Travel Time (s)		15.0			8.2			5.0				13.1
Confl. Peds. (#/hr)	10		2	2		10	1		15	15		1
Peak Hour Factor	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92	0.92
Heavy Vehicles (%)	6%	6%	6%	6%	6%	6%	36%	36%	36%	4%	4%	4%
Adj. Flow (vph)	151	980	38	16	545	97	23	4	22	164	9	184
Shared Lane Traffic (%)												
Lane Group Flow (vph)	151	1018	0	16	642	0	23	26	0	0	173	184
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		0	0		0	2		1	2	0
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	0		0	0		0	100		20	100	0
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)								94				94
Detector 2 Size(ft)								6				6
Detector 2 Type								Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)								0.0				0.0

Build 2022 AM
3: W Chicago Ave & N Kostner Ave

06/03/2020

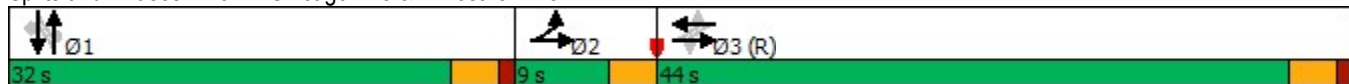


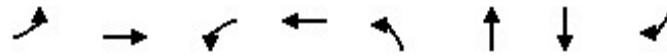
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	D.P+P	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2	2 3			3			1			1	
Permitted Phases	3			3			1			1		1
Detector Phase	2	2 3		3	3		1	1		1	1	1
Switch Phase												
Minimum Initial (s)	6.0			22.0	22.0		10.0	10.0		10.0	10.0	10.0
Minimum Split (s)	9.0			44.0	44.0		32.0	32.0		32.0	32.0	32.0
Total Split (s)	9.0			44.0	44.0		32.0	32.0		32.0	32.0	32.0
Total Split (%)	10.6%			51.8%	51.8%		37.6%	37.6%		37.6%	37.6%	37.6%
Maximum Green (s)	6.0			40.0	40.0		28.0	28.0		28.0	28.0	28.0
Yellow Time (s)	3.0			3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0			1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	3.0			4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lag						Lead	Lead		Lead	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			0.2	0.2		0.2	0.2		0.2	0.2	0.2
Recall Mode	None			C-Max	C-Max		Max	Max		Max	Max	Max
Walk Time (s)				22.0	22.0		10.0	10.0		10.0	10.0	10.0
Flash Dont Walk (s)				18.0	18.0		18.0	18.0		18.0	18.0	18.0
Pedestrian Calls (#/hr)				0	0		0	0		0	0	0
Act Effect Green (s)	47.0	50.0		40.0	40.0		28.0	28.0		28.0	28.0	28.0
Actuated g/C Ratio	0.55	0.59		0.47	0.47		0.33	0.33		0.33	0.33	0.33
v/c Ratio	0.36	0.51		0.07	0.41		0.08	0.06		0.41	0.29	0.29
Control Delay	16.4	20.1		13.6	14.9		20.8	10.0		25.6	4.7	4.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	16.4	20.1		13.6	14.9		20.8	10.0		25.6	4.7	4.7
LOS	B	C		B	B		C	A		C	A	A
Approach Delay		19.7			14.9			15.1			14.9	
Approach LOS		B			B			B			B	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 70 (82%), Referenced to phase 3:EBWB, Start of Green
 Natural Cycle: 85
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.51
 Intersection Signal Delay: 17.4 Intersection LOS: B
 Intersection Capacity Utilization 90.0% ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 3: W Chicago Ave & N Kostner Ave





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	151	1018	16	642	23	26	173	184
v/c Ratio	0.36	0.51	0.07	0.41	0.08	0.06	0.41	0.29
Control Delay	16.4	20.1	13.6	14.9	20.8	10.0	25.6	4.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	16.4	20.1	13.6	14.9	20.8	10.0	25.6	4.7
Queue Length 50th (ft)	60	244	5	106	8	1	71	0
Queue Length 95th (ft)	m65	m256	16	148	26	19	128	43
Internal Link Dist (ft)		580		281		141	497	
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	415	1992	218	1575	276	407	426	628
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.36	0.51	0.07	0.41	0.08	0.06	0.41	0.29

Intersection Summary

m Volume for 95th percentile queue is metered by upstream signal.

Build 2022 AM
6: N Kilbourn Ave & W Lake St

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕		↕		↕
Traffic Volume (vph)	54	740	0	0	280	32	52	185	14	184	0	43
Future Volume (vph)	54	740	0	0	280	32	52	185	14	184	0	43
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	100		0	0		100
Storage Lanes	0		0	0		0	1		0	1		1
Taper Length (ft)	25			25			50			25		
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00			1.00		1.00		
Fr _t					0.984			0.989				0.850
Fl _t Protected		0.997					0.950			0.950		
Satd. Flow (prot)	0	3564	0	0	3407	0	1736	1805	0	1612	0	1442
Fl _t Permitted		0.906					0.950			0.552		
Satd. Flow (perm)	0	3238	0	0	3407	0	1736	1805	0	936	0	1442
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					24			8				48
Link Speed (mph)		30			30			30				30
Link Distance (ft)		618			660			642				1899
Travel Time (s)		14.0			15.0			14.6				43.2
Confl. Peds. (#/hr)	3		3	3		3			1	1		
Peak Hour Factor	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Heavy Vehicles (%)	1%	1%	1%	4%	4%	4%	4%	4%	4%	12%	12%	12%
Adj. Flow (vph)	60	822	0	0	311	36	58	206	16	204	0	48
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	882	0	0	347	0	58	222	0	204	0	48
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0			0		1	1		1		1
Detector Template	Left	Thru			Thru		Left	Thru		Left		Right
Leading Detector (ft)	20	0			0		20	20		20		20
Trailing Detector (ft)	0	0			0		0	0		0		0
Detector 1 Position(ft)	0	0			0		0	0		0		0
Detector 1 Size(ft)	20	6			6		20	20		20		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Turn Type	Perm	NA			NA		Perm	NA		D.Pm		Perm
Protected Phases		1			1			2				
Permitted Phases	1						2			2		2
Detector Phase	1	1			1		2	2		2		2
Switch Phase												

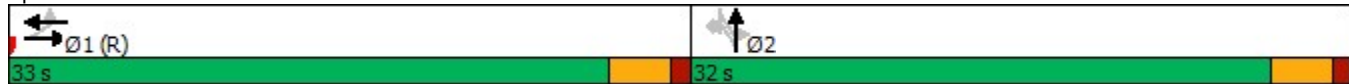


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	20.0	20.0			20.0		16.0	16.0		16.0		16.0
Minimum Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (%)	50.8%	50.8%			50.8%		49.2%	49.2%		49.2%		49.2%
Maximum Green (s)	29.0	29.0			29.0		28.0	28.0		28.0		28.0
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
All-Red Time (s)	1.0	1.0			1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0		0.0
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lead/Lag	Lead	Lead			Lead		Lag	Lag		Lag		Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	0.2	0.2			0.2		4.0	4.0		4.0		4.0
Recall Mode	C-Max	C-Max			C-Max		None	None		None		None
Walk Time (s)	20.0	20.0			20.0		10.0	10.0		10.0		10.0
Flash Dont Walk (s)	9.0	9.0			9.0		18.0	18.0		18.0		18.0
Pedestrian Calls (#/hr)	0	0			0		0	0		0		0
Act Effct Green (s)		36.4			36.4		20.6	20.6		20.6		20.6
Actuated g/C Ratio		0.56			0.56		0.32	0.32		0.32		0.32
v/c Ratio		0.49			0.18		0.11	0.38		0.69		0.10
Control Delay		10.9			7.8		14.2	17.5		31.1		4.6
Queue Delay		0.0			0.0		0.0	0.0		0.0		0.0
Total Delay		10.9			7.8		14.2	17.5		31.1		4.6
LOS		B			A		B	B		C		A
Approach Delay		10.9			7.8			16.8				26.1
Approach LOS		B			A			B				C

Intersection Summary

Area Type: Other
 Cycle Length: 65
 Actuated Cycle Length: 65
 Offset: 12 (18%), Referenced to phase 1:EBWB, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.69
 Intersection Signal Delay: 13.4
 Intersection LOS: B
 Intersection Capacity Utilization 85.5%
 ICU Level of Service E
 Analysis Period (min) 15

Splits and Phases: 6: N Kilbourn Ave & W Lake St





Lane Group	EBT	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	882	347	58	222	204	48
v/c Ratio	0.49	0.18	0.11	0.38	0.69	0.10
Control Delay	10.9	7.8	14.2	17.5	31.1	4.6
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	10.9	7.8	14.2	17.5	31.1	4.6
Queue Length 50th (ft)	94	27	17	67	72	0
Queue Length 95th (ft)	188	63	32	96	116	16
Internal Link Dist (ft)	538	580		562		
Turn Bay Length (ft)			100			100
Base Capacity (vph)	1813	1918	747	782	403	648
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.49	0.18	0.08	0.28	0.51	0.07

Intersection Summary




Intersection												
Int Delay, s/veh	4.4											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑	↑↑		↑		↑		↔	
Traffic Vol, veh/h	0	1007	66	4	526	0	66	0	8	6	0	13
Future Vol, veh/h	0	1007	66	4	526	0	66	0	8	6	0	13
Conflicting Peds, #/hr	3	0	0	0	0	3	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	0	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	92	92	94	94	92	92	92	94	92	94
Heavy Vehicles, %	6	6	2	2	6	6	2	2	2	0	2	0
Mvmt Flow	0	1071	72	4	560	0	72	0	9	6	0	14

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	1143	0	0	1395	-	572	1104	1711	280
Stage 1	-	-	-	-	-	-	1107	-	-	568	568	-
Stage 2	-	-	-	-	-	-	288	-	-	536	1143	-
Critical Hdwy	-	-	-	4.14	-	-	7.54	-	6.94	7.5	6.54	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	-	-	6.5	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	-	-	6.5	5.54	-
Follow-up Hdwy	-	-	-	2.22	-	-	3.52	-	3.32	3.5	4.02	3.3
Pot Cap-1 Maneuver	0	-	-	607	-	0	101	0	463	168	90	723
Stage 1	0	-	-	-	-	0	224	0	-	480	505	-
Stage 2	0	-	-	-	-	0	695	0	-	501	273	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	607	-	-	99	-	463	164	89	723
Mov Cap-2 Maneuver	-	-	-	-	-	-	99	-	-	164	89	-
Stage 1	-	-	-	-	-	-	224	-	-	480	501	-
Stage 2	-	-	-	-	-	-	677	-	-	492	273	-

Approach	EB			WB			NB			SB		
HCM Control Delay, s	0			0.1			94.8			16		
HCM LOS							F			C		

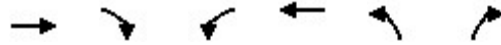
Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	99	463	-	-	607	-	348
HCM Lane V/C Ratio	0.725	0.019	-	-	0.007	-	0.058
HCM Control Delay (s)	104.7	12.9	-	-	11	-	16
HCM Lane LOS	F	B	-	-	B	-	C
HCM 95th %tile Q(veh)	3.8	0.1	-	-	0	-	0.2

Intersection	
Intersection Delay, s/veh	12.5
Intersection LOS	B

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	27	296	10	48	340
Future Vol, veh/h	5	27	296	10	48	340
Peak Hour Factor	0.84	0.84	0.84	0.84	0.84	0.84
Heavy Vehicles, %	2	2	8	8	5	5
Mvmt Flow	6	32	352	12	57	405
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	8.6	11.6	13.5
HCM LOS	A	B	B

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	16%	12%
Vol Thru, %	97%	0%	88%
Vol Right, %	3%	84%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	306	32	388
LT Vol	0	5	48
Through Vol	296	0	340
RT Vol	10	27	0
Lane Flow Rate	364	38	462
Geometry Grp	1	1	1
Degree of Util (X)	0.465	0.056	0.576
Departure Headway (Hd)	4.594	5.246	4.493
Convergence, Y/N	Yes	Yes	Yes
Cap	783	680	804
Service Time	2.621	3.302	2.519
HCM Lane V/C Ratio	0.465	0.056	0.575
HCM Control Delay	11.6	8.6	13.5
HCM Lane LOS	B	A	B
HCM 95th-tile Q	2.5	0.2	3.7



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Configurations	↑	↑	↑	↑	↑	↑
Traffic Volume (vph)	583	193	164	997	379	412
Future Volume (vph)	583	193	164	997	379	412
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900
Storage Length (ft)		50	100		0	100
Storage Lanes		1	1		1	1
Taper Length (ft)			50		25	
Lane Util. Factor	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		0.98	1.00			
Frt		0.850				0.850
Flt Protected			0.950		0.950	
Satd. Flow (prot)	1776	1509	1736	1827	1770	1583
Flt Permitted			0.132		0.950	
Satd. Flow (perm)	1776	1475	241	1827	1770	1583
Right Turn on Red		Yes				Yes
Satd. Flow (RTOR)		69				321
Link Speed (mph)	30			30	30	
Link Distance (ft)	715			346	742	
Travel Time (s)	16.3			7.9	16.9	
Confl. Peds. (#/hr)		2	2			
Peak Hour Factor	0.95	0.95	0.95	0.95	0.95	0.95
Heavy Vehicles (%)	7%	7%	4%	4%	2%	2%
Adj. Flow (vph)	614	203	173	1049	399	434
Shared Lane Traffic (%)						
Lane Group Flow (vph)	614	203	173	1049	399	434
Enter Blocked Intersection	No	No	No	No	No	No
Lane Alignment	Left	Right	Left	Left	Left	Right
Median Width(ft)	12			12	12	
Link Offset(ft)	0			0	0	
Crosswalk Width(ft)	16			16	16	
Two way Left Turn Lane						
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)		9	15		15	9
Number of Detectors	0	0	0	0	0	0
Detector Template	Thru	Right	Left	Thru	Left	Right
Leading Detector (ft)	0	0	0	0	0	0
Trailing Detector (ft)	0	0	0	0	0	0
Turn Type	NA	Perm	D.P+P	NA	Prot	Perm
Protected Phases	2		1	1 2	4	
Permitted Phases		2	2			4
Detector Phase	2	2	1	1 2	4	4
Switch Phase						
Minimum Initial (s)	10.0	10.0	7.0		7.0	7.0
Minimum Split (s)	14.0	14.0	10.0		11.0	11.0
Total Split (s)	37.0	37.0	20.0		28.0	28.0
Total Split (%)	43.5%	43.5%	23.5%		32.9%	32.9%
Maximum Green (s)	33.0	33.0	17.0		24.0	24.0
Yellow Time (s)	3.0	3.0	3.0		3.0	3.0
All-Red Time (s)	1.0	1.0	0.0		1.0	1.0

Build 2022 PM
 1: N Kilbourn Ave (West) & W Chicago Ave

06/03/2020



Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lost Time Adjust (s)	0.0	0.0	0.0		0.0	0.0
Total Lost Time (s)	4.0	4.0	3.0		4.0	4.0
Lead/Lag	Lag	Lag	Lead			
Lead-Lag Optimize?						
Vehicle Extension (s)	0.2	0.2	0.2		0.2	0.2
Recall Mode	C-Max	C-Max	Max		Max	Max
Act Effect Green (s)	33.0	33.0	51.0	54.0	24.0	24.0
Actuated g/C Ratio	0.39	0.39	0.60	0.64	0.28	0.28
v/c Ratio	0.89	0.33	0.39	0.90	0.80	0.64
Control Delay	42.0	13.5	16.6	41.0	42.3	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.0	13.5	16.6	41.0	42.3	12.2
LOS	D	B	B	D	D	B
Approach Delay	34.9			37.6	26.6	
Approach LOS	C			D	C	

Intersection Summary

Area Type: Other
 Cycle Length: 85
 Actuated Cycle Length: 85
 Offset: 75 (88%), Referenced to phase 2:EBWB, Start of Green
 Natural Cycle: 75
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.90
 Intersection Signal Delay: 33.6
 Intersection LOS: C
 Intersection Capacity Utilization 80.1%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 1: N Kilbourn Ave (West) & W Chicago Ave





Lane Group	EBT	EBR	WBL	WBT	NBL	NBR
Lane Group Flow (vph)	614	203	173	1049	399	434
v/c Ratio	0.89	0.33	0.39	0.90	0.80	0.64
Control Delay	42.0	13.5	16.6	41.0	42.3	12.2
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	42.0	13.5	16.6	41.0	42.3	12.2
Queue Length 50th (ft)	300	47	69	596	197	47
Queue Length 95th (ft)	#502	99	m113	#793	#340	144
Internal Link Dist (ft)	635			266	662	
Turn Bay Length (ft)		50	100			100
Base Capacity (vph)	689	614	443	1160	499	677
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.89	0.33	0.39	0.90	0.80	0.64

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Build 2022 PM
3: W Chicago Ave & N Kostner Ave

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations												
Traffic Volume (vph)	230	699	22	23	902	174	28	6	11	156	8	221
Future Volume (vph)	230	699	22	23	902	174	28	6	11	156	8	221
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	100		0	100		0	0		0	0		0
Storage Lanes	1		0	1		0	1		0	0		1
Taper Length (ft)	100			70			25			25		
Lane Util. Factor	1.00	0.95	0.95	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor	1.00	1.00		1.00	1.00			0.99			1.00	
Frt		0.995			0.976			0.900				0.850
Flt Protected	0.950			0.950			0.950				0.955	
Satd. Flow (prot)	1703	3386	0	1736	3374	0	1805	1693	0	0	1728	1538
Flt Permitted	0.155			0.358			0.568				0.724	
Satd. Flow (perm)	278	3386	0	653	3374	0	1079	1693	0	0	1306	1538
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)		8			40			12				211
Link Speed (mph)		30			30			30				30
Link Distance (ft)		660			361			239				577
Travel Time (s)		15.0			8.2			5.4				13.1
Confl. Peds. (#/hr)	5		6	6		5			3	3		
Peak Hour Factor	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Heavy Vehicles (%)	6%	6%	6%	4%	4%	4%	0%	0%	0%	5%	5%	5%
Adj. Flow (vph)	247	752	24	25	970	187	30	6	12	168	9	238
Shared Lane Traffic (%)												
Lane Group Flow (vph)	247	776	0	25	1157	0	30	18	0	0	177	238
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		12			12			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0		0	0		0	2		1	2	0
Detector Template	Left	Thru		Left	Thru		Left	Thru		Left	Thru	Right
Leading Detector (ft)	20	0		0	0		0	100		20	100	0
Trailing Detector (ft)	0	0		0	0		0	0		0	0	0
Detector 1 Position(ft)	0	0		0	0		0	0		0	0	0
Detector 1 Size(ft)	20	6		20	6		20	6		20	6	20
Detector 1 Type	Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex	Cl+Ex	Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Queue (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 1 Delay (s)	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Detector 2 Position(ft)								94				94
Detector 2 Size(ft)								6				6
Detector 2 Type								Cl+Ex				Cl+Ex
Detector 2 Channel												
Detector 2 Extend (s)								0.0				0.0

Build 2022 PM
3: W Chicago Ave & N Kostner Ave

06/03/2020

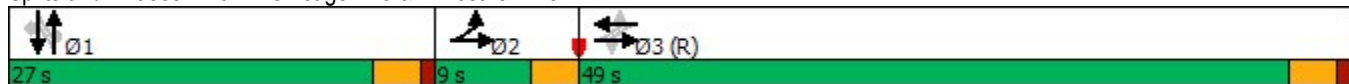


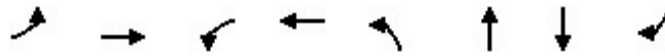
Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Turn Type	D.P+P	NA		Perm	NA		Perm	NA		Perm	NA	Perm
Protected Phases	2	2 3			3			1			1	
Permitted Phases	3			3			1			1		1
Detector Phase	2	2 3		3	3		1	1		1	1	1
Switch Phase												
Minimum Initial (s)	6.0			27.0	27.0		5.0	5.0		5.0	5.0	5.0
Minimum Split (s)	9.0			49.0	49.0		27.0	27.0		27.0	27.0	27.0
Total Split (s)	9.0			49.0	49.0		27.0	27.0		27.0	27.0	27.0
Total Split (%)	10.6%			57.6%	57.6%		31.8%	31.8%		31.8%	31.8%	31.8%
Maximum Green (s)	6.0			45.0	45.0		23.0	23.0		23.0	23.0	23.0
Yellow Time (s)	3.0			3.0	3.0		3.0	3.0		3.0	3.0	3.0
All-Red Time (s)	0.0			1.0	1.0		1.0	1.0		1.0	1.0	1.0
Lost Time Adjust (s)	0.0			0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Lost Time (s)	3.0			4.0	4.0		4.0	4.0		4.0	4.0	4.0
Lead/Lag	Lag						Lead	Lead		Lead	Lead	Lead
Lead-Lag Optimize?												
Vehicle Extension (s)	3.0			0.2	0.2		0.2	0.2		0.2	0.2	0.2
Recall Mode	None			C-Max	C-Max		Max	Max		Max	Max	Max
Walk Time (s)				27.0	27.0		5.0	5.0		5.0	5.0	5.0
Flash Dont Walk (s)				18.0	18.0		18.0	18.0		18.0	18.0	18.0
Pedestrian Calls (#/hr)				0	0		0	0		0	0	0
Act Effct Green (s)	52.0	55.0		45.0	45.0		23.0	23.0		23.0	23.0	23.0
Actuated g/C Ratio	0.61	0.65		0.53	0.53		0.27	0.27		0.27	0.27	0.27
v/c Ratio	0.91	0.35		0.07	0.64		0.10	0.04		0.50	0.42	0.42
Control Delay	49.5	8.8		10.6	15.7		24.5	14.6		32.0	7.7	7.7
Queue Delay	0.0	0.0		0.0	0.0		0.0	0.0		0.0	0.0	0.0
Total Delay	49.5	8.8		10.6	15.7		24.5	14.6		32.0	7.7	7.7
LOS	D	A		B	B		C	B		C	A	A
Approach Delay		18.6			15.6			20.8			18.1	
Approach LOS		B			B			C			B	

Intersection Summary

Area Type:	Other
Cycle Length:	85
Actuated Cycle Length:	85
Offset:	79 (93%), Referenced to phase 3:EBWB, Start of Green
Natural Cycle:	85
Control Type:	Actuated-Coordinated
Maximum v/c Ratio:	0.91
Intersection Signal Delay:	17.3
Intersection LOS:	B
Intersection Capacity Utilization:	80.4%
ICU Level of Service:	D
Analysis Period (min):	15

Splits and Phases: 3: W Chicago Ave & N Kostner Ave





Lane Group	EBL	EBT	WBL	WBT	NBL	NBT	SBT	SBR
Lane Group Flow (vph)	247	776	25	1157	30	18	177	238
v/c Ratio	0.91	0.35	0.07	0.64	0.10	0.04	0.50	0.42
Control Delay	49.5	8.8	10.6	15.7	24.5	14.6	32.0	7.7
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	49.5	8.8	10.6	15.7	24.5	14.6	32.0	7.7
Queue Length 50th (ft)	85	95	6	210	12	2	80	11
Queue Length 95th (ft)	m#124	m142	19	277	34	18	143	66
Internal Link Dist (ft)		580		281		159	497	
Turn Bay Length (ft)	100		100					
Base Capacity (vph)	270	2193	345	1805	291	466	353	570
Starvation Cap Reductn	0	0	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0	0	0
Reduced v/c Ratio	0.91	0.35	0.07	0.64	0.10	0.04	0.50	0.42

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

Build 2022 PM
6: N Kilbourn Ave & W Lake St

06/03/2020



Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↕↕			↕↕		↕	↕		↕		↕
Traffic Volume (vph)	30	299	0	0	639	57	54	224	15	340	0	257
Future Volume (vph)	30	299	0	0	639	57	54	224	15	340	0	257
Ideal Flow (vphpl)	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900	1900
Storage Length (ft)	0		0	0		0	100		0	0		100
Storage Lanes	0		0	0		0	1		0	1		1
Taper Length (ft)	25			25			50			25		
Lane Util. Factor	0.95	0.95	1.00	1.00	0.95	0.95	1.00	1.00	1.00	1.00	1.00	1.00
Ped Bike Factor		1.00			1.00							
Fr _t					0.988			0.991				0.850
Fl _t Protected		0.995					0.950			0.950		
Satd. Flow (prot)	0	3522	0	0	3489	0	1752	1828	0	1770	0	1583
Fl _t Permitted		0.868					0.950			0.545		
Satd. Flow (perm)	0	3072	0	0	3489	0	1752	1828	0	1015	0	1583
Right Turn on Red			Yes			Yes			Yes			Yes
Satd. Flow (RTOR)					19			7				142
Link Speed (mph)		30			30			30				30
Link Distance (ft)		618			660			642				1899
Travel Time (s)		14.0			15.0			14.6				43.2
Confl. Peds. (#/hr)	5						5					
Peak Hour Factor	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94	0.94
Heavy Vehicles (%)	2%	2%	2%	2%	2%	2%	3%	3%	3%	2%	2%	2%
Adj. Flow (vph)	32	318	0	0	680	61	57	238	16	362	0	273
Shared Lane Traffic (%)												
Lane Group Flow (vph)	0	350	0	0	741	0	57	254	0	362	0	273
Enter Blocked Intersection	No	No	No	No	No	No	No	No	No	No	No	No
Lane Alignment	Left	Left	Right	Left	Left	Right	Left	Left	Right	Left	Left	Right
Median Width(ft)		0			0			12				12
Link Offset(ft)		0			0			0				0
Crosswalk Width(ft)		16			16			16				16
Two way Left Turn Lane												
Headway Factor	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Turning Speed (mph)	15		9	15		9	15		9	15		9
Number of Detectors	1	0			0		1	1		1		1
Detector Template	Left	Thru			Thru		Left	Thru		Left		Right
Leading Detector (ft)	20	0			0		20	20		20		20
Trailing Detector (ft)	0	0			0		0	0		0		0
Detector 1 Position(ft)	0	0			0		0	0		0		0
Detector 1 Size(ft)	20	6			6		20	20		20		20
Detector 1 Type	Cl+Ex	Cl+Ex			Cl+Ex		Cl+Ex	Cl+Ex		Cl+Ex		Cl+Ex
Detector 1 Channel												
Detector 1 Extend (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Queue (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Detector 1 Delay (s)	0.0	0.0			0.0		0.0	0.0		0.0		0.0
Turn Type	Perm	NA			NA		Perm	NA		D.Pm		Perm
Protected Phases		1			1			2				
Permitted Phases	1						2			2		2
Detector Phase	1	1			1		2	2		2		2
Switch Phase												

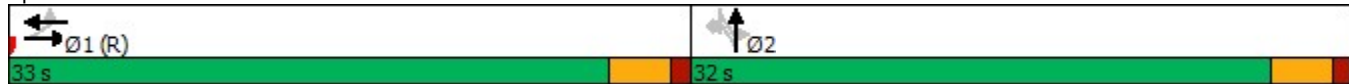


Lane Group	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Minimum Initial (s)	20.0	20.0			20.0		16.0	16.0		16.0		16.0
Minimum Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (s)	33.0	33.0			33.0		32.0	32.0		32.0		32.0
Total Split (%)	50.8%	50.8%			50.8%		49.2%	49.2%		49.2%		49.2%
Maximum Green (s)	29.0	29.0			29.0		28.0	28.0		28.0		28.0
Yellow Time (s)	3.0	3.0			3.0		3.0	3.0		3.0		3.0
All-Red Time (s)	1.0	1.0			1.0		1.0	1.0		1.0		1.0
Lost Time Adjust (s)		0.0			0.0		0.0	0.0		0.0		0.0
Total Lost Time (s)		4.0			4.0		4.0	4.0		4.0		4.0
Lead/Lag	Lead	Lead			Lead		Lag	Lag		Lag		Lag
Lead-Lag Optimize?												
Vehicle Extension (s)	0.2	0.2			0.2		4.0	4.0		4.0		4.0
Recall Mode	C-Max	C-Max			C-Max		None	None		None		None
Walk Time (s)	20.0	20.0			20.0		10.0	10.0		10.0		10.0
Flash Dont Walk (s)	9.0	9.0			9.0		18.0	18.0		18.0		18.0
Pedestrian Calls (#/hr)	0	0			0		0	0		0		0
Act Effct Green (s)		31.1			31.1		25.9	25.9		25.9		25.9
Actuated g/C Ratio		0.48			0.48		0.40	0.40		0.40		0.40
v/c Ratio		0.24			0.44		0.08	0.35		0.90		0.38
Control Delay		11.2			12.5		11.4	14.1		45.3		7.8
Queue Delay		0.0			0.0		0.0	0.0		0.0		0.0
Total Delay		11.2			12.5		11.4	14.1		45.3		7.8
LOS		B			B		B	B		D		A
Approach Delay		11.2			12.5			13.6				29.2
Approach LOS		B			B			B				C

Intersection Summary

Area Type: Other
 Cycle Length: 65
 Actuated Cycle Length: 65
 Offset: 47 (72%), Referenced to phase 1:EBWB, Start of Green
 Natural Cycle: 65
 Control Type: Actuated-Coordinated
 Maximum v/c Ratio: 0.90
 Intersection Signal Delay: 17.7
 Intersection LOS: B
 Intersection Capacity Utilization 73.7%
 ICU Level of Service D
 Analysis Period (min) 15

Splits and Phases: 6: N Kilbourn Ave & W Lake St





Lane Group	EBT	WBT	NBL	NBT	SBL	SBR
Lane Group Flow (vph)	350	741	57	254	362	273
v/c Ratio	0.24	0.44	0.08	0.35	0.90	0.38
Control Delay	11.2	12.5	11.4	14.1	45.3	7.8
Queue Delay	0.0	0.0	0.0	0.0	0.0	0.0
Total Delay	11.2	12.5	11.4	14.1	45.3	7.8
Queue Length 50th (ft)	43	100	13	62	121	31
Queue Length 95th (ft)	68	143	31	109	#269	76
Internal Link Dist (ft)	538	580		562		
Turn Bay Length (ft)			100			100
Base Capacity (vph)	1470	1680	754	791	437	762
Starvation Cap Reductn	0	0	0	0	0	0
Spillback Cap Reductn	0	0	0	0	0	0
Storage Cap Reductn	0	0	0	0	0	0
Reduced v/c Ratio	0.24	0.44	0.08	0.32	0.83	0.36

Intersection Summary

95th percentile volume exceeds capacity, queue may be longer.
 Queue shown is maximum after two cycles.




Intersection												
Int Delay, s/veh	4.8											
Movement	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Lane Configurations		↑↑		↑	↑↑		↑		↑		↑↓	
Traffic Vol, veh/h	0	836	29	3	1009	0	64	0	18	7	0	22
Future Vol, veh/h	0	836	29	3	1009	0	64	0	18	7	0	22
Conflicting Peds, #/hr	6	0	0	0	0	6	0	0	0	0	0	0
Sign Control	Free	Free	Free	Free	Free	Free	Stop	Stop	Stop	Stop	Stop	Stop
RT Channelized	-	-	None	-	-	None	-	-	None	-	-	None
Storage Length	-	-	-	100	-	-	0	-	0	-	-	-
Veh in Median Storage, #	-	0	-	-	0	-	-	0	-	-	0	-
Grade, %	-	0	-	-	0	-	-	0	-	-	0	-
Peak Hour Factor	94	94	92	92	94	94	92	92	92	94	92	94
Heavy Vehicles, %	8	8	2	2	4	4	2	2	2	0	2	0
Mvmt Flow	0	889	32	3	1073	0	70	0	20	7	0	23

Major/Minor	Major1			Major2			Minor1			Minor2		
Conflicting Flow All	-	0	0	921	0	0	1448	-	461	1524	2000	537
Stage 1	-	-	-	-	-	-	905	-	-	1079	1079	-
Stage 2	-	-	-	-	-	-	543	-	-	445	921	-
Critical Hdwy	-	-	-	4.14	-	-	7.54	-	6.94	7.5	6.54	6.9
Critical Hdwy Stg 1	-	-	-	-	-	-	6.54	-	-	6.5	5.54	-
Critical Hdwy Stg 2	-	-	-	-	-	-	6.54	-	-	6.5	5.54	-
Follow-up Hdwy	-	-	-	2.22	-	-	3.52	-	3.32	3.5	4.02	3.3
Pot Cap-1 Maneuver	0	-	-	737	-	0	92	0	547	82	59	494
Stage 1	0	-	-	-	-	0	298	0	-	237	293	-
Stage 2	0	-	-	-	-	0	492	0	-	567	347	-
Platoon blocked, %	-	-	-	-	-	-	-	-	-	-	-	-
Mov Cap-1 Maneuver	-	-	-	737	-	-	87	-	547	79	59	494
Mov Cap-2 Maneuver	-	-	-	-	-	-	87	-	-	79	59	-
Stage 1	-	-	-	-	-	-	298	-	-	237	292	-
Stage 2	-	-	-	-	-	-	467	-	-	547	347	-

Approach	EB	WB	NB	SB
HCM Control Delay, s	0	0	105.1	24.2
HCM LOS			F	C

Minor Lane/Major Mvmt	NBLn1	NBLn2	EBT	EBR	WBL	WBT	SBLn1
Capacity (veh/h)	87	547	-	-	737	-	218
HCM Lane V/C Ratio	0.8	0.036	-	-	0.004	-	0.142
HCM Control Delay (s)	131.4	11.8	-	-	9.9	-	24.2
HCM Lane LOS	F	B	-	-	A	-	C
HCM 95th %tile Q(veh)	4.1	0.1	-	-	0	-	0.5

Intersection	
Intersection Delay, s/veh	42.1
Intersection LOS	E

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	11	83	414	6	36	621
Future Vol, veh/h	11	83	414	6	36	621
Peak Hour Factor	0.88	0.88	0.88	0.88	0.88	0.88
Heavy Vehicles, %	6	6	4	4	8	8
Mvmt Flow	13	94	470	7	41	706
Number of Lanes	1	0	1	0	0	1

Approach	WB	NB	SB
Opposing Approach		SB	NB
Opposing Lanes	0	1	1
Conflicting Approach Left	NB		WB
Conflicting Lanes Left	1	0	1
Conflicting Approach Right	SB	WB	
Conflicting Lanes Right	1	1	0
HCM Control Delay	10.8	18.7	61.6
HCM LOS	B	C	F

Lane	NBLn1	WBLn1	SBLn1
Vol Left, %	0%	12%	5%
Vol Thru, %	99%	0%	95%
Vol Right, %	1%	88%	0%
Sign Control	Stop	Stop	Stop
Traffic Vol by Lane	420	94	657
LT Vol	0	11	36
Through Vol	414	0	621
RT Vol	6	83	0
Lane Flow Rate	477	107	747
Geometry Grp	1	1	1
Degree of Util (X)	0.681	0.183	1.023
Departure Headway (Hd)	5.253	6.337	4.931
Convergence, Y/N	Yes	Yes	Yes
Cap	692	569	724
Service Time	3.253	4.337	3.029
HCM Lane V/C Ratio	0.689	0.188	1.032
HCM Control Delay	18.7	10.8	61.6
HCM Lane LOS	C	B	F
HCM 95th-tile Q	5.4	0.7	17.6













Appendix E

Signal Warrant Analysis

YEAR: 2022
 INTERSECTION: Chicago Ave & Kolin Ave
 MUNICIPALITY: CDOT
 COUNTY: Cook

SUMMARY OF TRAFFIC SURVEY

2020-2022 Growth Factor **1.01**

ROUTE	TRAFFIC FROM EAST (WB) <u>Chicago Ave</u> <input type="checkbox"/> SRA				TRAFFIC FROM WEST (EB) <u>Chicago Ave</u> <input type="checkbox"/> SRA				TOTAL NORTH AND SOUTH	TRAFFIC FROM SOUTH (NB) <u>Kolin Ave</u> <input type="checkbox"/> SRA				TRAFFIC FROM NORTH (SB) <u>Kolin Ave</u> <input type="checkbox"/> SRA				TOTAL EAST AND WEST	GRAND TOTAL		
	E. OF: <u>Kolin Ave</u> <i>GOING</i>	<i>SOUTH</i> 	<i>WEST</i> 	<i>NORTH</i> 	TOTAL	<i>NORTH</i> 	<i>EAST</i> 	<i>SOUTH</i> 		TOTAL	S. OF: <u>Chicago Ave</u> <i>GOING</i>	<i>WEST</i> 	<i>NORTH</i> 	<i>EAST</i> 	TOTAL	N. OF: <u>Chicago Ave</u> <i>GOING</i>	<i>EAST</i> 			<i>SOUTH</i> 	<i>WEST</i> 
1	7:00	3	510	0	513	0	985	59	1043	1556	72	0	7	79	7	0	10	17	96	1652	
2	8:00	1	518	0	519	0	893	38	931	1450	34	0	4	38	9	0	11	20	59	1509	
3	16:00	2	1035	0	1037	0	853	31	885	1922	62	0	15	77	13	0	20	33	110	2032	
4	17:00	1	1078	0	1079	0	632	37	670	1748	58	0	2	60	3	0	9	12	72	1820	

Major

Major

Minor

Minor

Grade Crossing Approach

Grade Crossing Approach

REVIEW INFORMATION

COUNTS USED:
 COUNT DATE(S): 3/3/2020
 DATE REVIEWED:
 REVIEWED BY

WARRANT 2 ANALYSIS, MUTCD, Section 4C.2, 2009

2022

Data Source: 2020 Projected Volumes

Chicago Ave & Kolin Ave

User Input:

Major Road VPH: 1556 1450 1922 1748
 Minor road VPH: 79 38 77 60

Number of lanes, major approach: Chicago Ave 2 lane(s)

Number of lanes, minor approach: Kolin Ave 2 lane(s)

Plotted Values

Major Road VPH: 1556 1450 1922 1748
 Minor road VPH: 79 38 77 60

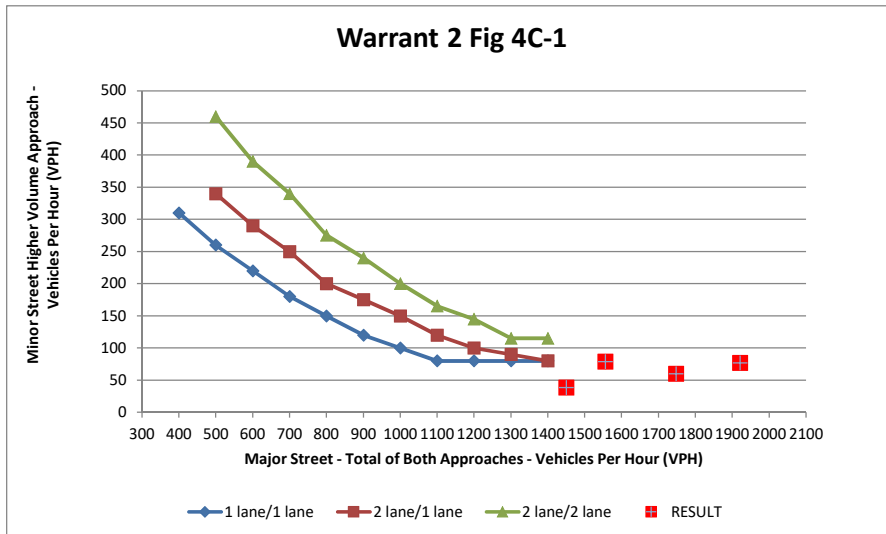
These values are plotted below and shown as the "Result" plotted points
 If plotted point is above the controlling lane configuration line, 2 lane(s) major street/2 lane(s) minor street,
 for four or more hours during the day, then Traffic Signal Warrant is satisfied.
 Engineering Judgement is still a key part in this decision, see MUTCD Section 4C.03, 2009.

Warrant Satisfied?

N (Y or N)

N/A

SRA



Data for Figure 4C-1

DO NOT DELETE OR ALTER			
Major	No. of Lane (Major/Minor)		
	1 lane/1 lane	2 ln/1 ln	2 ln/2 ln
1400	80	80	115
1300	80	90	115
1200	80	100	145
1100	80	120	165
1000	100	150	200
900	120	175	240
800	150	200	275
700	180	250	340
600	220	290	390
500	260	340	460
400	310	390	N/A

WARRANT 3 ANALYSIS, MUTCD, Section 4C.3, 2009

2022

Data Source: [2022 Projected Volum](#)

Chicago Ave & Kolin Ave

User Input:

Major Road ADT: (Road w/out the RR Crossing, Average Daily Traffic, total of each direction)
 Minor Road ADT: (Road with the RR crossing, approach to short storage ONLY)
 Major Road VPH: (If know, override existing #, else ADT x K factor (say .095, Highway Cap. Manual Exhibit 9-2, 2000) is used for Vehicles Per Hour)
 Minor road VPH: (If know, override existing #, else ADT x K factor (say .095) is used for Vehicles Per Hour)
 Number of lanes, major approach: 2 lane(s)
 Number of lanes, minor approach: 2 lane(s)

Plotted Values

Major Road VPH: 1556 1450 1922 1748
 Minor road VPH: 79 38 77 60

These values are plotted below and shown as the "Result" plotted point

If plotted point is above the controlling lane configuration line, **2 lane(s) major street/2 lane(s) minor street**, then Traffic Signal Warrant is satisfied.

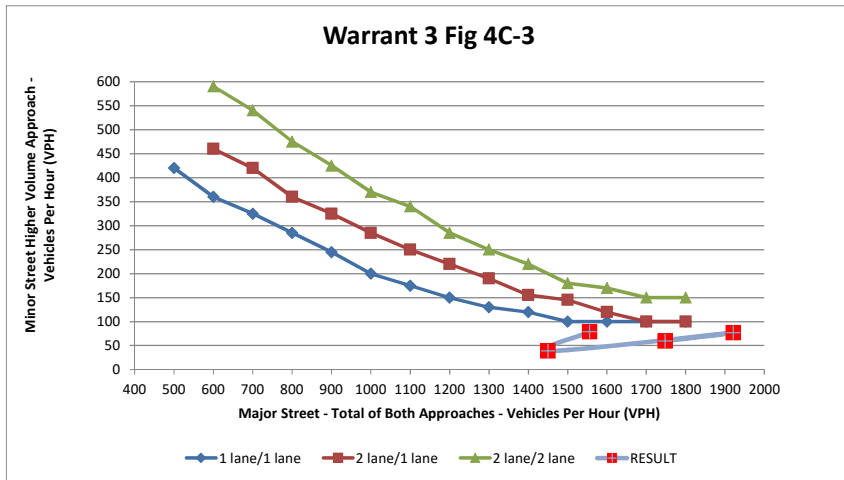
Engineering Judgement is still a key part in this decision, see MUTCD Section 4C.04, 2009.

Warrant Satisfied?

N (Y or N)

N/A

SRA



Data for Figure 4C-3

DO NOT DELETE OR ALTER			
Major	No. of Lane (Major/Minor)		
	1 lane/1 lane	2 ln/1 ln	2 ln/2 ln
1800	100	100	150
1700	100	100	150
1600	100	120	170
1500	100	145	180
1400	120	155	220
1300	130	190	250
1200	150	220	285
1100	175	250	340
1000	200	285	370
900	245	325	425
800	285	360	475
700	325	420	540
600	360	460	590
500	420	N/A	N/A

2022 **SIGNAL WARRANT REVIEW SHEET**

Chicago & Kolin

SRA: _____ YES NO

INTERSECTION: Chicago Ave and Kolin Ave
MUNICIPALITY: CDOT, IL

COUNTY: Cook

Speed Limit on Major Route 30 MPH
Number of Lanes on Major Approach 2

Speed Limit on Minor Route 30 MPH
Number of Lanes on Minor Approach 2

HOUR BEGIN	MAJOR STREET VOLUME (Both Approaches)	ADJ. MINOR STREET VOLUME (Higher Vol Approach)	CHECK ANY HOURS WHICH MEET THE FOLLOWING WARRANTS					
			WARRANT 1		WARRANT 7: 8 hrs of one of the following			
			A	B	WARRANT 1 A/B:		8 hrs of BOTH:	
				100% of A	100% of B	80% of A	80% of B	80% of Warr #4
6:00	1556	80	NO	YES	NO	NO		
7:00	1450	39	NO	NO	NO	NO		
16:00	1922	78	NO	YES	NO	NO		
17:00	1748	60	NO	NO	NO	NO		

*Note: Volume Requirements Reduced Due to Speed

Hours Met:		0	2	0	0
Volume Requirements	MAJOR:	600	900	480	720
	MINOR:	150	75	120	60

REVIEW INFORMATION

COUNTS USED: _____
COUNT DATE(S): _____
DATE REVIEWED: _____
REVIEWED BY: _____

Traffic Signal Approved: _____

COMMENTS

*MINOR STREET VOLUME REQUIREMENTS FOR CONDITION B INCREASED ALONG SRA ROUTE FROM 75 TO 100 FOR SINGLE LANE APPROACH AND FROM 100 TO 150 FOR A TWO OR MORE LANE APPROACH. CORRESPONDING 80% VOLUMES FOR WARRANT 7 ARE ALSO INCREASED ACCORDINGLY, FROM 80 TO 80 FOR SINGLE LANE MINOR APPROACH AND FROM 80 TO 120 FOR A TWO OR MORE LANE MINOR APPROACH ALONG AN SRA ROUTE.

WARRANT 1 Yes No

Warrant 1 is met if any of the following conditions are met:

* Condition A 0 Yes No
MINIMUM VEHICULAR VOLUME

* Condition B 2 Yes No
INTERRUPTION OF CONTINUOUS TRAFFIC

* Condition A/B 0 Yes No
COMBINATION OF WARRANTS

WARRANT 2 Yes No

4-HOUR VEHICULAR VOLUME

WARRANT 3 Yes No

PEAK HOUR VOLUME

WARRANT 4 Yes No

PEDESTRIAN VOLUME

WARRANT 5 Yes No

SCHOOL CROSSING

WARRANT 6 Yes No

COORDINATED SIGNAL SYSTEM

WARRANT 7 Yes No

ACCIDENT EXPERIENCE

	08	09	10	11
TOTAL NO. CRASHES				
NO. CORRECTABLE CRASHES				
TRIED LESS RESTRICTIVE METHODS?				
ARE VOLUME REQUIREMENTS MET?				

WARRANT 8 Yes No

ROADWAY NETWORK

WARRANT 9 Yes No

Intersection Near a Grade Crossing

STOP OR YIELD CONTROLLED LEG WITH GRADE CROSSING

D (Clear Storage Distance) =

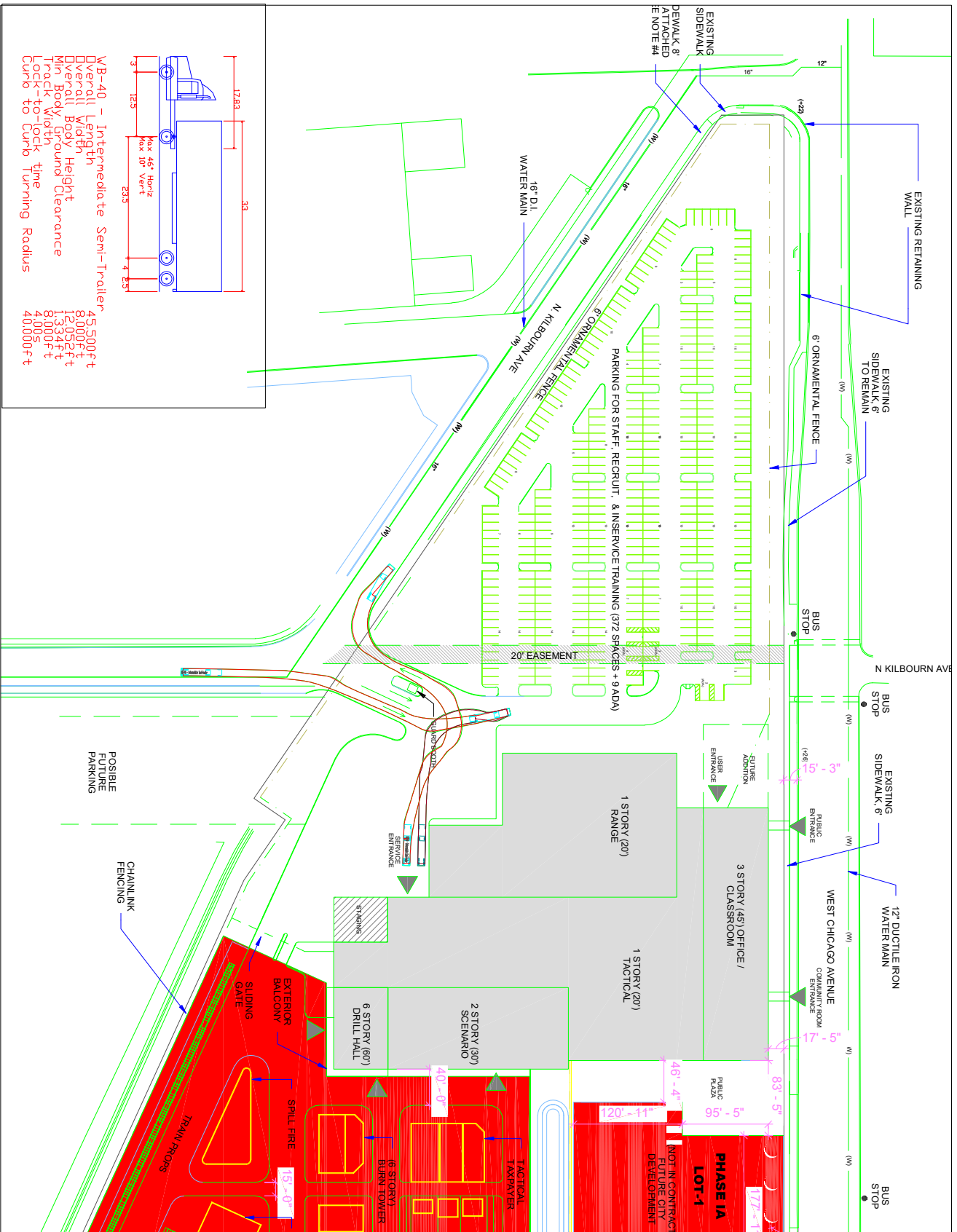
#	%	Factor

RAIL TRAFFIC PER DAY = _____
HIGH OCCUPANCY BUSES PER HOUR = _____
TRUCKS PER HOUR = _____
OVERALL ADJUSTMENT FACTOR = _____

Appendix F

Turning Movement Diagrams (AutoTurn)

Appendix F Auto Turn (Turning Movement Diagrams)



Appendix G
**Growth Factor from Chicago Metropolitan Agency for
Planning (CMAP)**

TRAFFIC FORECAST RECORD

Record Number: ck-24-20

Type of Report: Projection

Year Sought: 2050

Analyst: JAR

Organization requesting forecast: AECOM

Contact: Jenna Brose, P.E., PTOE

Phone number: (312) 373-6781

Sponsor: CDOT

Date request was received: March 4, 2020

Date that response was mailed or faxed: March 5, 2020

Facility Location: Joint Public Safety Training Campus - Chicago Avenue

Municipality: City of Chicago



Chicago Metropolitan Agency for Planning

233 South Wacker Drive
Suite 800
Chicago, Illinois 60606

312 454 0400
www.cmap.illinois.gov

March 5, 2020

Jenna Brose, P.E., PTOE
Project Manager, Transportation
AECOM
303 E. Wacker Drive
Suite 1400
Chicago, IL 60601

***Subject: Joint Public Safety Training Campus - Chicago Avenue
CDOT***

Dear Ms. Brose:

In response to a request made on your behalf and dated March 4, 2020, we have developed year 2050 average daily traffic (ADT) projections for the subject location. These are in a table on the following page.

Traffic projections are developed using existing ADT data provided in the request letter and the results from the October 2019 CMAP Travel Demand Analysis. The regional travel model uses CMAP 2050 socioeconomic projections and assumes the implementation of the ON TO 2050 Comprehensive Regional Plan for the Northeastern Illinois area.

If you have any questions, please call me at (312) 386-8806.

Sincerely,

A handwritten signature in black ink, appearing to read "Jose Rodriguez".

Jose Rodriguez, PTP, AICP
Senior Planner, Research & Analysis

cc: Neuert (City of Chicago Department of Assets, Information & Services)
2020_TrafficForecast\Chicago\ck-24-20\ck-24-20.docx

Table:
Existing and Year 2050 projected ADT, Streets near Joint Public Safety Training Campus
– Chicago Avenue

Intersection	Street	Leg	Existing ADT		Traffic Projections	
			Year	VPD	Year	VPD
Chicago & Kolin	Chicago	West	2018	17800	2050	20,600
Chicago & Kolin	Chicago	East	2018	17800	2050	20,600
Chicago & Kolin	Kolin	North	N/A		2050	1.157
Chicago & Kostner	Chicago	West	2018	17800	2050	20,600
Chicago & Kostner	Chicago	East	2018	17800	2050	20,600
Chicago & Kostner	Kostner	North	2018	7250	2050	8,400
Chicago & Kostner	Kostner	South	N/A		2050	1.157
Chicago & Kilbourn	Chicago	West	2018	17800	2050	20,600
Chicago & Kilbourn	Chicago	East	2018	17800	2050	20,600
Chicago & Kilbourn	Kilbourn	North	N/A		2050	1.157
Chicago & Kilbourn	Chicago	West	2018	17800	2050	21,800
Chicago & Kilbourn	Chicago	East	2018	17800	2050	21,100
Chicago & Kilbourn	Kilbourn	South	2018	6350	2050	7,800
Kilbourn & Ohio	Kilbourn	North	2018	6350	2050	7,800
Kilbourn & Ohio	Kilbourn	South	2018	6350	2050	7,800
Kilbourn & Ohio	Ohio	East	N/A		2050	1.228
Kilbourn & Lake	Kilbourn	North	2018	5400	2050	6,600
Kilbourn & Lake	Kilbourn	South	N/A		2050	1.122
Kilbourn & Lake	Lake	East	2018	13100	2050	14,700
Kilbourn & Lake	Lake	West	2018	13100	2050	14,700

Note: where no existing ADT has been listed, a growth factor to Year 2050 has been provided

Prepared and Finalized by CMAP March 5, 2020

2018	2050	2018-2050	Annual Growth Rate	2020-2022
17800	20600	1.157	0.46%	1.01
7250	8400	1.159	0.46%	1.01
17800	21800	1.225	0.64%	1.01
17800	21100	1.185	0.53%	1.01
6350	7800	1.228	0.64%	1.01
5400	6600	1.222	0.63%	1.01
13100	14700	1.122	0.36%	1.01

Intersection	Street	Leg	Existing ADT		Traffic Projections	
			Year	VPD	Year	VPD
Chicago & Kolin	Chicago	West	2018	17800	2050	20,600
Chicago & Kolin	Chicago	East	2018	17800	2050	20,600
Chicago & Kolin	Kolin	North	N/A		2050	1,157
Chicago & Kostner	Chicago	West	2018	17800	2050	20,600
Chicago & Kostner	Chicago	East	2018	17800	2050	20,600
Chicago & Kostner	Kostner	North	2018	7250	2050	8,400
Chicago & Kostner	Kostner	South	N/A		2050	1,157
Chicago & Kilbourn	Chicago	West	2018	17800	2050	20,600
Chicago & Kilbourn	Chicago	East	2018	17800	2050	20,600
Chicago & Kilbourn	Kilbourn	North	N/A		2050	1,157
Chicago & Kilbourn	Chicago	West	2018	17800	2050	21,800
Chicago & Kilbourn	Chicago	East	2018	17800	2050	21,100
Chicago & Kilbourn	Kilbourn	South	2018	6350	2050	7,800
Kilbourn & Ohio	Kilbourn	North	2018	6350	2050	7,800
Kilbourn & Ohio	Kilbourn	South	2018	6350	2050	7,800
Kilbourn & Ohio	Ohio	East	N/A		2050	1,228
Kilbourn & Lake	Kilbourn	North	2018	5400	2050	6,600
Kilbourn & Lake	Kilbourn	South	N/A		2050	1,122
Kilbourn & Lake	Lake	East	2018	13100	2050	14,700
Kilbourn & Lake	Lake	West	2018	13100	2050	14,700

Note: where no existing ADT has been listed, a growth factor to Year 2050 has been provided

SECTION 01 10 00 - SUMMARY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Phased construction.
4. Work by Client.
5. Work under separate contracts.
6. Future work.
7. Purchase contracts.
8. Client-furnished products.
9. Contractor-furnished, Client-installed products.
10. Access to site.
11. Coordination with occupants.
12. Work restrictions.
13. Specification and Drawing conventions.
14. Miscellaneous provisions.

- B. Related Requirements:

1. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS for limitations and procedures governing temporary use of Client's facilities.

1.3 PROJECT INFORMATION

- A. Project Identification: EMS ADDITION

1. Project Location:
701 NORTH KILBOURN AVENUE
CHICAGO IL 60651

- B. Client: PUBLIC BUILDING COMMISSION OF CHICAGO
1. Client's Representative: CURTIS JONES JR.
50 W WASHINGTON STREET, SUITE 200
CHICAGO, IL 60602
312-744-3090
- C. Architect: AECOM SERVICES OF ILLINOIS, INC., could also refer to the respective engineers of record.
1. Project Manager: JENNA JOO
303 E WACKER DR. SUITE 1400
CHICAGO, IL 60601
312-373-6725
- D. Architect's Consultants: Architect has retained the following design professionals who have prepared designated portions of the Contract Documents:
1. Professional Land Surveying
ERIK TONNESEN
PROFESSIONALS ASSOCIATED
7100 N TRIPP AVENUE
LINCOLNWOOD, IL 60712
847-675-3000
 2. Geotechnical Engineering
WALT FLOOD IV
FLOOD TESTING LABORATORIES, INC
1945 EAST 87TH STREET
CHICAGO, IL 60617
773-721-2200
 3. Civil Engineering
HARISH GOYAL
INFRASTRUCTURE ENGINEERING
1 SOUTH WACKER DRIVE, SUITE 2650
CHICAGO, IL 60606
312-425-9560
 4. Landscape Architecture
TERRY RYAN
JACOBS/RYAN ASSOCIATED
1527 N SANDBURG TERRACE
CHICAGO, IL 60610
312-664-3217
 5. Architecture, Structural, Mechanical, Plumbing, Fire Protection, Fire Alarm
GEORGE GELDIS (ARCHITECT)
DOMENIC CAPORALE (STRUCTURAL)
CASEY STEIN (MECHANICAL)
KEVIN MESSERLY (PLUMBING)

DANIEL KASCAK (FIRE PROTECTION, FIRE ALARM)
AECOM SERVICES OF ILLINOIS, INC
303 E WACKER DR. SUITE 1400
CHICAGO, IL 60601
312-373-6725

6. Architecture
TODD SVOBODA
ARCHITRAVE
211 W WACKER DR. UNIT 1650
CHICAGO, IL 60606
312-373-6725
7. Electrical Engineer
MICHAEL SCHIRO
MILHOUSE
333 S. WABASH AVE #2901
CHICAGO, IL 60604
312-987-0061
8. Telecommunications/Low Voltage
BRIAN SCOTT
LEVEL-1 GLOBAL SOLUTIONS
318 W ADAMS, SUITE 1600
CHICAGO, IL 60606
9. LEED Consulting
MICHELLE HALLE STERN
THE GREEN FACILITATOR
3903 N. KEELER AVENUE
CHICAGO, IL 60641
773-914-3036
10. Public Safety Consultant
TOMMY ABERCROMBIE
ABERCROMBIE PLANNING + DESIGN
3508 OVERTON PARK DR W
FORT WORTH, TX 76109
11. Commissioning
ALEX STAPLES
DBHMS
303 W. ERIE STREET, SUITE 510
CHICAGO, IL 60654
12. Permit Expeditor
JASON COHEN
THOMAS RAINES ATTORNEY & LAW
20 N. WACKER DRIVE, SUITE 556
CHICAGO, IL 60606

13. Roof Consultant
JIM GRUEBNAU
IRCA
4302-G CRYSTAL LAKE ROAD
MCHENRY, ILLINOIS 60050
14. Cost Estimator
RIDER LEVETT BUCKNALL
141 W JACKSON BLVD
CHICAGO, IL 60604

- E. Contractor: <CONTRACTOR> has been engaged as Contractor for this Project
- F. Sub-contractor: Is the sub-contractor to the referenced contractor.
- G. Web-Based Project Software: Project software administered by Contractor will be used for purposes of managing communication and documents during the construction stage. Software will be BIM360.
 1. See Section 01 31 00 PROJECT MANAGEMENT AND COORDINATION for requirements for using the web-based Project software.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

- A. The Work of Project is defined by the Contract Documents and consists of the following:
 1. Approximately 53,000 SF, 3-story building addition at the south end of the Joint Public Safety Training Campus Phase I building.
 2. Visual Screen between Phase IA and Phase II sites.
 3. Rolling Gate at Chicago Ave. entrance.
- B. Type of Contract:
 1. Project will be constructed under a single prime contract.
 - a. EMS Addition

1.5 PHASED CONSTRUCTION

- A. The site will be occupied during construction. The Work shall be conducted per the phasing plan in the contract documents to be substantially complete as indicated:
 1. A portion of the Phase I building 2nd floor corridor, Classroom 254 and 294 shall be protected and maintained for the duration of construction in order to allow for user access. Construction will consist of demolition and restoration of existing exterior wall, roof, and roof accessories.

2. Before commencing Work of each phase, submit an updated copy of Contractor's construction schedule showing the sequence, commencement, and completion dates, and move-out and -in dates of Client's personnel for all phases of the Work.

1.6 WORK BY CLIENT

- A. General: Cooperate fully with Client so work may be carried out smoothly, without interfering with or delaying work under this Contract or work by Client. Coordinate the Work of this Contract with work performed by Client.
- B. Concurrent Work: Client will perform the following construction operations at Project site. Those operations will be conducted simultaneously with Work under this Contract.
 1. Wireless network active devices
 2. Communications network active devices
 3. Security system active devices
- C. Subsequent Work: Client will perform the following additional work at site after Substantial Completion. Completion of that work will depend on successful completion of preparatory Work under this Contract.
 1. Installation of electric vehicle charging stations

1.7 WORK UNDER SEPARATE CONTRACTS

- A. General: Cooperate fully with separate contractors so work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with work performed under separate contracts.

1.8 ACCESS TO SITE

- A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.
- B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.
 1. Limits: Confine construction operations to those within the EMS Addition and selected site areas for screen and rolling gate installation. Avoid work within Phase IA, IB, and II.
 2. Limits: Limit site disturbance, including earthwork and clearing of vegetation, to 40 feet (12.2 m) beyond building perimeter; 10 feet (3 m) beyond surface walkways, patios, surface parking, and utilities less than 12 inches (300 mm) in diameter; 15 feet (4.5 m) beyond primary roadway curbs and main utility branch trenches; and

25 feet (7.6 m) beyond constructed areas with permeable surfaces (such as pervious paving areas, stormwater detention facilities, and playing fields) that require additional staging areas in order to limit compaction in the constructed area.

3. Driveways, Walkways and Entrances: Keep driveways and entrances serving premises clear and available to Client, Client's employees, emergency vehicles and other Contractors at all times. Do not use these areas for parking or for storage of materials. See contract drawings for staging area location. Refer to phasing as described in this section.
 - a. Schedule deliveries during non-peak neighborhood traffic times and to minimize use of driveways and entrances by construction operations.
 - b. Schedule deliveries during non-peak neighborhood traffic times and to minimize space and time requirements for storage of materials and equipment on-site.
- C. Condition of Existing Grounds: Maintain portions of existing grounds, landscaping, and hardscaping affected by construction operations throughout construction period. Repair damage caused by construction operations.

1.9 COORDINATION WITH OCCUPANTS

- A. Partial Client Occupancy: Client will occupy the premises during the entire construction period, with the exception of areas under construction. Cooperate with Client during construction operations to minimize conflicts and facilitate Client usage. Perform the Work so as not to interfere with Client's operations. Maintain existing exits unless otherwise indicated. Coordinate access with Phasing as described in this section.
 1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Client and authorities having jurisdiction.
 2. Provide not less than 72 hours' notice to Client of activities that will affect Client's operations.
- B. Client Limited Occupancy of Completed Areas of Construction: Client reserves the right to occupy and to place and install equipment in completed portions of the Work, prior to Substantial Completion of the Work, provided such occupancy does not interfere with completion of the Work. Such placement of equipment and limited occupancy shall not constitute acceptance of the total Work.
 1. Architect will prepare a Certificate of Substantial Completion for each specific portion of the Work to be occupied prior to Client acceptance of the completed Work.
 2. Obtain a Certificate of Occupancy from authorities having jurisdiction before limited Client occupancy.
 3. Before limited Client occupancy, mechanical and electrical systems shall be fully operational, and required tests and inspections shall be successfully completed. On occupancy, Client will operate and maintain mechanical and electrical systems serving occupied portions of Work.

C. Campus Coordination

JPSTC CAMPUS HOURS OF OPERATION	24 hours a day, 7 days a week
Calendar Year Operating Hours	
Staff regular hours	6:00am-4:00pm, Monday-Friday
Student regular hours	24 hours a day, 7 days a week
Building Engineer regular hours	6AM-2:30PM, Monday-Friday
Custodian regular hours	24 hours a day, Monday-Friday
Weekend activities	Training Sessions
Last day of training for students	N/A
Breaks	N/A
Construction Black Out Dates	
Student Testing Dates:	As Needed
Other Black Out Dates	City Designated Holidays
Other Important Dates	
Night Training Dates	24 hours a day, 7 days a week
Misc Events Dates	TBD

D. SPECIAL REQUIREMENTS:

CRITICAL COORDINATION ITEMS	
Long Lead Items	
ComEd Coordination	
People's Gas Coordination	
CDOT Coordination	
OEMC Coordination	
AV/IT Coordination	AV/IT to be copied on all relevant submittals. AV/IT is critical to getting internet and communications set up at the facility once complete. Adequate time must be given in order to set up server necessary or completion of GC scope items.
Safety and Security Coordination	Camera and Intrusion Detection System scope included in project. Note that coordination with 2FM Safety and Security will need to take place for camera programming upon completion of install.
New Keying System	Include details if scope requires or N/A if not applicable
Moving	If moves are required to perform the work, Staff will be required to label and pack the material to be moved. <USER AGENCY> Operations will provide boxes and provide moving services to make moves out of and back into designated spaces. ITS will be responsible for moving computers. Client is responsible for coordinating with ITS for reconnecting any computers that are required to be disconnected and relocated due to construction.

Cleaning	2FM approved post-construction clean of new building and any impacted areas of existing building is required prior to SC and turnover of responsibilities to <USER AGENCY>. Contractor responsible for Final Clean in all areas impacted by construction, including corridors used for access. Cleaning includes stripping and waxing of VCT flooring.
OTHER COORDINATION INFORMATION	
Assigned <USER AGENCY> cleaning vendor and contact information:	
Does end users have anyone with ADA needs?	
Any ongoing or other upcoming projects at the site:	
Any leases impacting Work:	
Does project scope require any material to be salvaged?	Relocated gate arm and AI phone/card access at Kilbourn Ave.
Staging area(s)	Refer to the Phasing Plan in the project documents for reference.

1.10 WORK RESTRICTIONS

- A. Work Restrictions, General: Comply with restrictions on construction operations.
 - 1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.
- B. On-Site Work Hours
 - 1. The Joint Public Safety Training Campus normal business hours are 6:00AM - 4:00PM Mon - Fri and Closed Sat – Sun (Administrative Personnel).
 - a. Weekend Hours: N/A
 - b. Early Morning Hours: N/A
 - c. Hours for Utility Shutdowns: Client to be notified 7 to 10 days prior to shut down, Client will provide shutdown hours upon notice of which utilities are to be affected and length of time to be shut down.
 - d. Hours for Core Drilling, noisy activity or vibrations: Client requires 7 to 10 days prior notice of type and length of time for loud work.
- C. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Client or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
 - 1. Notify Client not less than 1 week in advance of proposed utility interruptions.
 - 2. Obtain Client’s written permission before proceeding with utility interruptions.

- D. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Client occupancy with Client.
 - 1. Notify Client not less than two days in advance of proposed disruptive operations.
 - 2. Obtain Client's written permission before proceeding with disruptive operations.
- E. Restricted Substances: Use of tobacco products and other controlled substances Project site is not permitted.
- F. Employee Identification: Client will provide identification tags for Contractor personnel working **within existing building**. **General Contractor will provide identification tags for Contractor personnel working on Project Site but not within the existing building**. Require personnel to use identification tags at all times.
- G. Employee Screening: Comply with Client requirements for drug and background screening of Contractor personnel working on Project site.
 - 1. Maintain list of approved screened personnel with Client's representative.

1.11 SPECIFICATION AND DRAWING CONVENTIONS

- A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:
 - 1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
 - 2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.
- B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.
- C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:
 - 1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
 - 2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard, defined within the specifications or as scheduled on Drawings.
 - 3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.12 GENERAL REQUIREMENTS

- A. General Contractor shall review and be familiar with the site conditions.
- B. General Contractor shall provide all temporary and permanent driveway apron and alley permits for the duration of the construction if required. The General Contractor is to pay all fees required for processing permits and is to contact and comply with all authorities and jurisdiction required for permitting.
- C. General Contractor shall provide snow removal and generally maintain ingress and egress ensuring the site is clear and free of debris further maintaining accessibility that conforms with OSHA, Chicago Building Code, and emergency egress standards.
- D. General Contractor shall provide all required permits for street access for truck delivery from the local and state jurisdiction.
- E. General Contractor shall, at all times, provide access to the work for the Architect/Engineer of Record, Client's Representative, and Client, their employees or representatives and the representative of any other authority having jurisdiction. The General Contractor shall provide safe and proper facilities for access and inspection, including standby personnel as required.
- F. General Contractor shall be required to coordinate and complete the work within the contractual completion date(s) for the work as described within Section 00 73 00 - Supplemental Conditions and this section. The General Contractor shall be also held responsible for meeting all related provisions as described within this section.
- G. General Contractor shall coordinate access to the building at a mutually agreed upon location. Contractor may be required to remove <USER AGENCY> core from construction entry door and replace it with a construction core provided by the General Contractor for the duration of the project. At project conclusion, General Contractor shall reinstall original <USER AGENCY> core removed for construction.
- H. General Contractor shall survey the site and photograph the area of construction operations. Upon completion of the work the Contractor is to restore the area to the documented condition prior to the start of work or as otherwise indicated in the Contract Documents. The GC shall provide evidence of compliance.
- I. General Contractor is to replace all removed trees, bushes, ground covers and grass on the Chicago City Colleges' property disrupted, or otherwise damaged as a result of construction activities. Hard surfaces including but not limited to concrete pavement walks and asphalt surfaces shall be restored to condition prior to construction. Restoration of hard surfaces may require cleaning, repair or replacement.
- J. General Contractor shall coordinate and maintain all exit egress during construction as required by the City of Chicago code, other entities with jurisdiction, and as directed by the Commission's Representatives. The General Contractor shall provide and maintain all materials and labor including barricades, construction fence, doors, partitions, and fire rated walls as required for safe egress. All costs for this work shall be included in the Contract Base Bid regardless of whether it is indicated in the Contract Documents or not.

- K. No deliveries will be permitted to either the existing facility or the new addition between the hours of 3:00PM to 7:00AM Sun-Sat, weekends or City designated holidays.
- L. During the calendar year, no work may be performed as declared by City Ordinance.
- M. The Contractor is to set up and stage the entire project within the boundaries of the construction fence. The General Contractor is responsible for maintaining and modifying the fence as necessary and as approved in the Site Utilization Plan for the life of the project. Removal and disposal of the fence and project signage at the conclusion of the project is the responsibility of the General Contractor.
- ~~N. Building Engineer or other <USER AGENCY> staff (including contract employees) will not be paid overtime by the Commission, in order to be present at times when work is in progress in the existing Building. The General Contractor shall be responsible for all overtime costs for the <USER AGENCY> staff member for work outside of normal working hours, if need is due to construction work. Overtime arrangements for <USER AGENCY> staff includes weekends, holidays, and generally hours beyond that listed in Site Restrictions above. Recognized Holidays are as follows with Saturday holidays observed on Friday, and Sunday holidays observed on Monday (contract employees may follow a different schedule):~~
 - ~~1. New Year's Day~~
 - ~~2. Dr. Martin Luther King Jr.'s Birthday~~
 - ~~3. Lincoln's Birthday~~
 - ~~4. Washington's Birthday~~
 - ~~5. Pulaski Day~~
 - ~~6. Memorial Day~~
 - ~~7. Juneteenth Day~~
 - ~~8. Independence Day~~
 - ~~9. Labor Day~~
 - ~~10. Columbus Day~~
 - ~~11. Veterans Day~~
 - ~~12. Thanksgiving Day~~
 - ~~13. Christmas Day~~

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

3.1 SITE UTILIZATION PLAN

- A. Prior to Notice to Proceed, the Contractor shall prepare and submit to the Commission's Representative, the Building Engineer, and the Architect/Engineer of Record for approval a Site Utilization Plan based on the Construction Operations Parameters outlined in this section. Mobilization on-site is not to occur until approval of the Site Utilization Plan is obtained. A preliminary meeting to review site elements and Construction Operations with the Commission's Representative, Architect/Engineer of Record, and School staff prior to submission of the Site Utilization Plan shall be held.

- B. The Site Utilization Plan shall be provided in a full-size graphic drawing electronic format (same size as the Construction Document drawings), printable in 11x17 inch format. Provide a separate plan for the site and for each floor of the existing building where work is being performed. Modifications to the format and sheet size shall be permitted if pre-approved by the Commission's Representative and if proposed modifications shall facilitate preparation, presentation and review of the Site Utilization Plan. Electronic copies of the Contract Document drawings as appropriate shall be provided for this purpose upon request. The Site Utilization Plan shall at a minimum include the following elements:
1. Title block information including Facility Name, Contract Number, General Contractor, Building floor/level information, and current plan date.
 2. Building footprint of both new (if applicable) and existing buildings, trees, landscaping, paving, drainage structures, existing and ornamental fencing and other important site features.
 3. Areas of staging for students and staff, student drop-off points, existing school entrances and exits, staff parking areas, and traffic patterns for both construction and non-construction vehicles.
 4. Limits of construction and required construction fencing including any existing fencing to remain.
 5. Required covered construction barricade walkways.
 6. Areas allowed for staging purposes: construction personnel parking, material storage, and construction trailer(s). Such activities are to only take place in areas designated.
 7. Any specific site conditions required to be observed such as keeping alleys clear next to adjacent properties, and any other issues listed on the Construction Operations Site Plan.
 8. Areas allowed for site access gates.
 9. Areas of work within the existing building for the period of time covered by the Site Utilization Plan, coordinated with the Project Schedule. Each area should indicate planned beginning and end dates for work in that area. Areas where all work is completed are to be noted.
 10. Construction worker ingress/egress, material staging areas in the existing building.
 11. Proposed locations of temporary protection, barricades, and temporary walls within the existing building.
 12. Location of all temporary exits and path of travel.
 13. Indication of specific areas and their required contractual completion dates. If overtime work is required to meet the project dates it shall be at no additional cost to the Chicago Public Schools.
 14. Locations of construction signage.
 15. Indicate truck routes to nearest highway. Deliveries shall not deviate from this route.
 16. Limits of phasing with associated sequencing and dates (if applicable).

3.2 SITE UTILIZATION PLAN UPDATES

- A. The General Contractor is required to submit for approval updated Site Utilization Plans whenever conditions in the current approved plan have changed. Approval is required

prior to proceeding on any changed conditions not previously approved. Requirements for updating include the following:

1. In coordination with the project schedule provide detailed information regarding work in the existing building including phasing, vacation of existing in-use areas, and any other information requested by the Commission's Representative.
2. Revision to the site plan to reflect changing conditions regarding construction fencing, ingress and egress, student and staff staging, construction deliveries, areas of stored materials, parking, and any other construction facility revisions.

END OF SECTION 01 10 00

SECTION 01 22 00 – UNIT PRICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for unit prices.
- B. Related Requirements:
 - 1. Section 012600 "Contract Modification Procedures" for procedures for submitting and handling Change Orders.
 - 2. Section 014000 "Quality Requirements" for field testing by an independent testing agency.

1.3 DEFINITIONS

- A. Unit price is an amount incorporated into the Agreement, applicable during the duration of the Work as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, added to or deducted from the Contract Sum by appropriate modification, if the scope of Work or estimated quantities of Work required by the Contract Documents are increased or decreased.

1.4 PROCEDURES

- A. Unit prices include all necessary material, plus cost for delivery, installation, insurance, applicable taxes, overhead, and profit.
- B. Measurement and Payment: See individual Specification Sections for work that requires establishment of unit prices. Methods of measurement and payment for unit prices are specified in those Sections.
- C. Owner reserves the right to reject Contractor's measurement of work-in-place that involves use of established unit prices and to have this work measured, at Owner's expense, by an independent surveyor acceptable to Contractor.
- D. List of Unit Prices: A schedule of unit prices is included in Part 3. Specification Sections referenced in the Part 3 "Schedule of Unit Prices" Article contain requirements for materials described under each unit price.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF UNIT PRICES

A. Unit Price No. 1: Drilled shaft length adjustment.

1. Description: Drilled shaft length adjustment including labor, drilling, soil removal, concrete, and reinforcing steel as specified in Section 316329 "Drilled Concrete Shafts"
2. Unit of Measurement: linear foot of drilled shaft length.
3. Quantity Allowance: As shown on Drawings. Contract value will be adjusted up or down based upon unit prices and actual length of shaft installed.

END OF SECTION 01 22 00

SECTION 01 23 00 - ALTERNATES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for alternates.

1.2 DEFINITIONS

- A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.
 - 1. Alternates described in this Section are part of the Work only if enumerated in the Contract.
 - 2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.
 - 3. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

1.3 PROCEDURES

- A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Client's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.
- B. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.
 - 1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.
- C. Execute accepted alternates under the same conditions as other work of the Contract.

1.4 SCHEDULE OF ALTERNATES

- A. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

- A. Alternate No. 1: Chicago Ave. Gate. See G107 for additional information.
1. Base Bid: Add loop detector at south side of existing sliding gate, double-height mounted AI phone/card reader, and photo beams to existing rolling gate. Connect proposed AI phone to (2) front desks at Phase I building and guard shack at EMS Addition.
 2. Alternate: Add 24' wide automated, ornamental Chicago Building Code compliant rolling gate with screen to match adjacent ornamental fence at Chicago Ave. entrance to Phase II. Provide required grading, retaining walls, utilities, operator, and accessories as required for installation of new gate. Modify existing fence at east of drive to accommodate pedestrian gate. Provide photo beams, double-height mounted card reader, security camera connected to both front desks and loop detectors. Connect proposed AI phone to (2) front desks at Phase I building. Provide two (2) single panel, LED traffic light. Provide buried power, control, and fiber conduits to existing building. Route the conduits in the grass area. Conduit entry into the building shall be concealed. Connect to the existing power panel, next available circuit.
- B. Alternate No. 2: Visual Screen
1. Base Bid: No changes to existing conditions.
 2. Alternate: Add approximately 350' linear feet of 6' height aluminum, powder-coated in manufacturer's black color. Provide .125" minimum thickness of perforated metal infill panels to be installed on existing ornamental fence. Metal screen to be perforated with maximum 3/16" round holes with minimum 50% openings.
- C. Alternate No. 3: Exterior Cladding - Metal Panel Material
1. Base Bid: Aluminum panels, coping, and associated accessories.
 2. Alternate: In place of aluminum panels, provide galvanized steel metal panels, coping, and associated accessories. Provide stainless steel fasteners.

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Procedural requirements for proposed substitutions.

1.02 DEFINITIONS

- A. Substitutions: Changes from Contract Document requirements proposed by Contractor to materials, products, assemblies, and equipment.
 - 1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
 - a. Unavailability: The specified product or method of construction is no longer available.
 - b. Regulatory changes.
 - c. There is no condition under which the specified product or method of construction can be installed as shown on the Contract Documents.
 - d. There is no condition under which the specified product or method of construction can be provided within the time limits of the Contract.
 - 2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project and to the Client.
 - a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 - PRODUCTS - NOT USED**PART 3 - EXECUTION**

3.01 GENERAL REQUIREMENTS

- A. All Substitution Requests are to utilize the form 01 25 00.01 – Substitution Request Form.
- B. Refer to 01 60 00 - Product Requirements for additional requirements for product selection and substitution limitations.
- C. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
 - 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
 - 2. Agrees to provide the same warranty for the substitution as for the specified product.
 - 3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Client.
 - 4. Waives claims for additional costs or time extension that may subsequently become apparent.

- D. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
 - 1. Note explicitly any non-compliant characteristics.
- E. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
 - 1. Forms included in Section 00 25 00.01 – Substitution Request Form are adequate for this purpose, and must be used.
 - 2. Attach applicable supporting documentation. Provide point-by-point side-by-side comparison addressing essential attributes specified, as appropriate and relevant for the item.
- F. Limit each request to a single proposed substitution item.
 - 1. Submit an electronic document, combining the request form with supporting data into single document.
- G. There shall be no time extensions granted due to time required for completion of the Substitution process either successfully or unsuccessfully.

3.02 SUBSTITUTION PROCEDURES

- A. Submittal Form: Submit substitution requests by completing the form in Section 01 25 00.01 – Substitution Request Form. Use only this form; other forms of submission are unacceptable.
- B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect/Engineer of Record, in order to stay on approved project schedule.
- C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect/Engineer of Record, in order to comply with approved project schedule.
 - 1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Client through cost savings, time savings, greater energy conservation, or in other specific ways.
 - 2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.
- D. The Architect/Engineer of Record shall consider requests for substitutions which are received within thirty (30) days after the Notice to Proceed. Any such requests which are received by the Architect/Engineer of Record more than thirty (30) days after the date of the Notice to Proceed may be considered or rejected in the sole and absolute discretion of the Architect/Engineer of Record.

3.03 RESOLUTION

- A. Architect/Engineer of Record may request additional information and documentation prior to rendering a decision. Contractor shall provide this data in an expeditious manner. Architect/Engineer of Record will request additional information or documentation for evaluation within one week of receipt of a request for substitution.

- B. Architect/Engineer of Record will notify Contractor in writing of decision to accept or reject request within 14 days of receipt of the request, or 7 days of receipt of additional information or documentation, whichever is later.
1. Architect/Engineer of Record's decision following review of proposed substitution will be noted on the submitted form.
 2. Contractor shall use the product specified if the Architect/Engineer of Record cannot make a decision on the use of a proposed substitute within the time allocated.

END OF SECTION 01 25 00

SECTION 01 25 00.01 - SUBSTITUTION REQUEST FORM**FACILITY/PROJECT:** _____

TO: ARCHITECT OF RECORD: _____
 CC: CLIENT'S _____
 REPRESENTATIVE: _____
 DATE SUBMITTED: _____

GENERAL CONTRACTOR: _____

SUBMITTING
 CONTRACTOR:
(if different from GC)

Address: _____

Contact Name: _____

Phone Number: _____

Email Address: _____

Referenced Specification Section: _____ Paragraph: _____

REQUESTED SUBSTITUTION:		In Lieu of Specified Manufacturer/Product:
Manufacturer Name		
Product/Model		
Manufacturer Address		
Contact Name		
Phone Number		

Reason For Substitution (select one of the following):

- The specified product or method of construction is no longer available.
- There is no condition under which the specified product or method of construction can be installed as shown on the Contract Documents.
- There is no condition under which the specified product or method of construction can be provided within the time limits of the Contract.
- Additional benefits (in cost, time, or performance) are available to the Board with the requested substitute product.

Additional Explanation: _____

Attach applicable supporting documentation including, but not limited to, the following (select all that are included with this request):

- Itemized Comparison of the requested substitution with product specified. **REQUIRED**
- Performance and Test Data, including performance against specified reference standards. **REQUIRED**
- Manufacturer's Qualifications: Evidence of manufacturer qualifications and reputation for prompt delivery and efficiency in servicing products. **REQUIRED**
- Previous Installations: Attach list of not less than 5 similar projects on which proposed substitution was used. List projects in the Chicago area. List name and

address of project, date of installation, and name, address, and phone number of Architect. REQUIRED

- Color Chart, illustrating Manufacturer's full range. IF APPLICABLE**
- Installation Instructions. IF APPLICABLE**
- Maintenance Instructions. IF APPLICABLE**
- Changes in Work: Attach data relating to changes required in other work to permit use of proposed substitution and changes required in construction schedule. IF APPLICABLE**
- Cost Data: Attach accurate cost data on proposed substitution in comparison with product specified. IF APPLICABLE**

In making this request for substitution, the Submitting Contractor and General Contractor represents that:

- a. Contractor has examined the Contract Documents and investigated the proposed product/system and has determined that the proposed substitution is appropriate for the use intended for this Project, and shall meet or exceed the quality level of the specified product/system.
- b. Contractor shall provide the same warranties for the substituted product/system as required for the product/system specified.
- c. Contractor shall coordinate installation of accepted substitution into Work, and make changes to other Work that may be required for the Work to be complete with no additional cost to the Board.
- d. Contractor waives all claims for additional costs related to accepted substitutions that may subsequently become apparent.
- e. Cost data is complete and includes any and all related costs for this Project.

Submitting Company Name:

Authorized Signature:

Printed Name: _____

Date: _____

REVIEWED BY INSTALLER: (company name): _____

Signature: _____

Date: _____

REVIEWED BY MANUFACTURER: (company name): _____

Signature: _____

Date: _____

REVIEWED BY GENERAL CONTRACTOR: (company name): _____

Signature: _____

Date: _____

Requests that are not complete will be returned by the Architect for additional information.

Requests that do not meet Client requirements for acceptable substitutions will be rejected.

AOR/EOR REVIEW: The submitted information has been reviewed by the Architect and found to be complete and meets the Client requirements for acceptable substitution

Agreement By (Name):

Architect Firm Name: _____ **Date:** _____

Client REVIEW:

Substitution Accepted by Client: _____ **Date:** _____ **Submit**
substituted product for review.

Substitution Rejected by Client: _____ **Date:** _____ **Submit**
specified product for review.

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative and procedural requirements for handling and processing Contract modifications.
- B. Related Requirements:
 - 1. Section 01 25 00 - SUBSTITUTION PROCEDURES for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

- A. Architect will issue through Contractor supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710 form.

1.4 PROPOSAL REQUESTS

- A. Contractor Initiated Proposal Requests: Contractor will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.
 - 1. Work Change Proposal Requests issued by Contractor are not instructions either to stop work in progress or to execute the proposed change.
 - 2. Within 5 working days, when not otherwise specified, after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.
 - a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - c. Include costs of labor and supervision directly attributable to the change.

- d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationships. Use available total float before requesting an extension of the Contract Time.
 - e. Quotation Form: Use form type as provided by the Contractor.
- B. Contractor Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to the Client.
- 1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
 - 2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
 - 3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
 - 4. Include costs of labor and supervision directly attributable to the change.
 - 5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
 - 6. Comply with requirements in Section 01 25 00 - SUBSTITUTION PROCEDURES if the proposed change requires substitution of one product or system for product or system specified.
 - 7. Proposal Request Form: Use form type as provided by the Contractor.

1.5 CHANGE ORDER PROCEDURES

- A. On Client's approval of a Work Change Proposal Request, Contractor will issue a Change Order for signatures of Client and Contractor on a format provided by the Contractor.

1.6 CONSTRUCTION CHANGE DIRECTIVE

- A. Construction Change Directive: Contractor may issue a Construction Change Directive on a format provided by the Contractor. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 - 1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

1.7 WORK CHANGE DIRECTIVE

- A. Work Change Directive: Contractor may issue a Work Change Directive on a format provided by the Contractor. Work Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.
 1. Work Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.
- B. Documentation: Maintain detailed records on a time and material basis of work required by the Work Change Directive.
 1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 26 00

SECTION 01 26 13 – REQUESTS FOR INTERPRETATION (RFI)**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies administrative and procedural requirements for handling and processing Requests for Interpretation.
- B. Related Sections include the following:
 - 1. Section 01 26 00 - CONTRACT MODIFICATION PROCEDURES for procedural requirements governing handling and processing of Contract modifications.
 - 2. Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
 - 3. Section 01 33 00 - SUBMITTAL PROCEDURES for submittal requirements for RFI drawings.
 - 4. Section 01 60 00 - PRODUCT REQUIREMENTS for product and substitution requirements.

1.3 DEFINITIONS

- A. Request for Interpretation (RFI): Request from Contractor seeking interpretation or clarification of some requirement of Contract Documents and not involving change in Contract Sum or Contract Time.
 - 1. Improper RFI: An RFI meeting any of the following conditions:
 - a. RFI not prepared in accordance with requirements of this Section
 - b. RFI missing graphic solution proposal from contractor where appropriate
 - c. RFI with subject listed as improper subject matter in “GENERAL” Article of this section.
 - d. RFI requiring a response in 48 hours or less.
 - 2. Frivolous RFI: RFI that requests information that is clearly indicated on or reasonably inferable from Contract Documents.

1.4 GENERAL

- A. Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified, or a form provided by the Contractor.

1. ALL RFIs must be submitted to the Architect. RFIs submitted directly to the Owner may be deemed improper and may delay the Architect's response.
- B. Submit RFI from subcontractor or material supplier through Contractor who shall review and sign each RFI prior to submittal to the Contractor.
1. Contractor will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
 2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractors work or work of other contractors.
- C. Improper subjects for RFIs: Do not submit RFI for following:
1. Requests for approval of submittals. Comply with Section 01 33 00 - SUBMITTAL PROCEDURES.
 2. Requests for approval of substitutions. Comply with Section 01 60 00 - PRODUCT REQUIREMENTS.
 3. Requests for approval of Contractor's means and methods.
 4. Requests for coordination information already indicated in the Contract Documents.
 5. Requests for coordination of various materials and systems indicated on Contract Documents with field conditions and with each other. Comply with Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION.
 6. To provide as-built information required by Record Documents specified in Section 01 78 39 - PROJECT RECORD DOCUMENTS.
 7. To request changes which are known to entail additional cost or credit, or alter Contract Time. Comply with Section 01 26 00 - CONTRACT MODIFICATION PROCEDURES.
 8. Requests for interpretation of Architect's actions on submittals.
 9. Incomplete RFIs or inaccurately prepared RFIs.

1.5 REQUEST FOR INTERPRETATION (RFI)

- A. General:
1. RFI is a request for interpretation only. If Contractor believes response to RFI results in change in Contract Sum, Contract Time, or both, and complies with Division 01 Section "Contract Modification Procedures."
 2. Submit RFI on form attached or as provided by the Contractor, subject to Contractors prior review and approval. Form shall be completely in full and if prepared by hand, shall be fully legible after scanning, photocopying or transmission by facsimile (FAX), e-mail, or other approved electronic means of transmission.
 3. RFI may be submitted by e-mail or via web-based system. Address for e-mail or web address and login information will be distributed by the office of the Architect. Electronic form of attached Request for Interpretation will be provided upon request.
- B. Number RFIs sequentially using only next sequential number. Do not include subcontractors RFI number on form; include date submitted.

1. Each page of attachments to RFI shall bear RFI number and shall be consecutively numbered.
- C. Content of RFIs:
1. Specifically identify time response interpretation is required to avoid impact on Construction Schedule and Cost.
 - a. RFIs requesting responses within 96 hours or less shall be deemed Improper, unless approved verbally by the Architect's designated authorized representative.
 2. Include a detailed, legible description of item needing information or interpretation and the following:
 - a. Project name.
 - b. Project number.
 - c. Date.
 - d. Date shall reflect the Date submitted to the Architect.
 - e. Name of Contractor.
 - f. Name of Architect.
 - g. RFI number, numbered sequentially.
 - h. RFI subject.
 - i. Specification Section number and title and related paragraphs, as appropriate.
 - j. Drawing number and detail references, as appropriate.
 - k. Field dimensions and conditions, as appropriate.
 - l. Contractor's suggested resolution.
 - m. If Contractor's solution(s) impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
 - n. Contractor's signature.
 - o. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.
 - 1) Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.
- D. RFI shall include written and graphic solutions proposed by Contractor. Contractor will determine if proposal is in accord with Contract Documents and design intent of Project.
1. Contractor's failure to make reasonable effort to propose realistic solution may result in Request for Interpretation returned with no action.
 2. Submit separate RFI for each item or, subject to Contractor's approval, group of closely related items requiring interpretation or clarification. RFIs containing more than a single item or group of closely related items not approved by Contractor will be returned unanswered or will be reviewed with the time specified for review allotted to each individual item, at Contractor's discretion.
- E. Improper or Frivolous RFI:
1. Will be returned unanswered and shall be labeled as frivolous in the official RFI log.

2. At Contractor's request, after notification by Contractor that RFI is improper or frivolous, RFI will be processed with processing costs charged to Contractor as follows:
 - a. Contractor shall reimburse Contractor for Architect's account for time spent in processing improper or frivolous RFI at rate of 2.5 times rate of Direct Personnel Expense (DPE). Direct Personnel Expense is defined as direct salaries of Architect's personnel engaged on Project and portion of costs of mandatory, and customary contributions and benefits related thereto, including employment taxes and other statutory employee benefits, insurance, sick leave, holidays, vacations, pensions, and similar contributions and benefits.
- F. For RFIs submitted in form of drawings, follow submittal procedures specified for Shop Drawings in Division 01 Section "Submittal Requirements."

1.6 REVIEW AND SUBMITTAL

- A. Submit Electronic copy of completed RFI form to Architect, including required attachments.
 1. RFIs received on Friday afternoon will not be processed until following Monday, which will be recorded receipt of RFI date.
- B. Allow minimum of seven (7) working days review and response time for each RFI.
 1. Requested response time indicated on RFI shall be consistent with minimum review period specified.
 - a. Circumstances which might require a shorter response time **MUST BE** preceded by a telephone call to the Contractor's designated Project Director. The Project Director must pre-approve any review time of seven (7) working days or less.
 2. Requested response time will be extended where required by concurrent review of excessive number of RFIs, including improper and frivolous RFIs.
- C. Contractor's Action: Contractor will review each RFI, determine action required, and respond.
 1. The following RFIs will be returned without action:
 - a. RFIs that meet improper or frivolous definitions as listed in this section.
 2. Contractor's action may include a request for additional information, in which case Architect's time for response will date from time of receipt of additional information.
 - a. If an RFI is submitted, that either relates to a previously submitted RFI, or continues a dialogue related to the RFI's previous submission date, as a result of the Contractor failing to adequately state the question or to provide required Content in accordance with Paragraph 1.4.C, the RFI (including the previously related RFI), or the latest dialogue, shall be considered the date on which the RFI is received.
 3. Contractor's action on RFIs that may result in a change to the Contract Time or the Contract Sum may be eligible for Contractor to submit Change Proposal according to Division 01 Section "Contract Modification Procedures."

- a. If Contractor believes the RFI response warrants change in the Contract Time or the Contract Sum, notify Architect in writing within 10 days of receipt of the RFI response.
- D. On receipt of Contractor's action, update the RFI log and immediately distribute the RFI response to affected parties. Review response and notify Contractor within seven days if Contractor disagrees with response.
- E. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log bi-weekly and as requested by Architect. Use software log that is part of Project Web site to include not less than the following:
 - 1. Project name.
 - 2. Name and address of Contractor.
 - 3. Name and address of Architect.
 - 4. RFI number including RFIs that were dropped and not submitted.
 - 5. RFI description.
 - 6. Date the RFI was submitted.
 - 7. Date Architect's response was received.
 - 8. Identification of related Minor Change in the Work, Construction Change Directive, and Proposal Request, as appropriate.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 29 00

SECTION 01 29 00 - PAYMENT PROCEDURES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

1.2 SCHEDULE OF VALUES

- A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule.
 - 1. Coordinate line items in the schedule of values with items required to be indicated as separate activities in Contractor's construction schedule.
 - 2. Submit the schedule of values to Contractor at earliest possible date, but no later than 10 working days before the date scheduled for submittal of initial Applications for Payment.
- B. Format and Content: Provide at least one line item for each Specification Section, a draft of proposed line items shall be submitted to the Architect for approval.
 - 1. Arrange schedule of values consistent with format of AIA Document G703.
 - 2. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
 - 3. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.
 - a. Differentiate between items stored on-site and items stored off-site.
 - 4. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
 - 5. Overhead Costs: Show cost of temporary facilities and other major cost items that are not direct cost of actual work-in-place as separate line items.
 - 6. Closeout Costs. Include separate line items under Contractor and principal subcontracts for Project closeout requirements in an amount totaling five percent of the Contract Sum and subcontract amount.
 - 7. Schedule of Values Revisions: Revise the schedule of values when Change Orders or Construction Change Directives result in a change in the Contract Sum. Include at least one separate line item for each Change Order and Construction Change Directive.

1.3 APPLICATIONS FOR PAYMENT

- A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments.
- B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Client and Contractor, occurring monthly. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.
 - 1. Submit draft copy of Application for Payment seven days prior to due date for review by Architect.
- C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.
- D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Architect. Architect will return incomplete applications without action.
 - 1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
 - 2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
 - 3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
- E. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.
 - 1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.
- F. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from subcontractors, sub-subcontractors, and suppliers for construction period covered by the previous application.
 - 1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
 - 2. When an application shows completion of an item, submit conditional final or full waivers.
 - 3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
 - 4. Submit final Application for Payment with or preceded by conditional final waivers from every entity involved with performance of the Work covered by the application who is lawfully entitled to a lien.
 - 5. Waiver Forms: Submit executed waivers of lien on forms acceptable to Architect.

- G. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:
1. List of subcontractors.
 2. Schedule of values.
 3. Contractor's construction schedule (preliminary if not final).
 4. Products list (preliminary if not final).
 5. Sustainable design action plans, including preliminary project materials cost data.
 6. Schedule of unit prices.
 7. Submittal schedule (preliminary if not final).
 8. List of Contractor's staff assignments.
 9. List of Architect's principal consultants.
 10. Copies of building permits.
 11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
 12. Initial progress report.
 13. Report of preconstruction conference.
 14. Certificates of insurance and insurance policies, if still pending.
 15. Performance and payment bonds, if applicable.
 16. Data needed to acquire Owner's insurance, if applicable.
- H. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.
1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
 2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.
- I. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited to, the following:
1. Evidence of completion of Project closeout requirements.
 2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
 3. Updated final statement, accounting for final changes to the Contract Sum.
 4. Consent of Surety for Final Payment, if applicable.
 5. Evidence that claims have been settled.
 6. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
 7. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. RFIs.
4. Digital project management procedures.
5. Project meetings.

- B. Related Requirements:

1. Section 01 26 13 - REQUEST FOR INTERPRETATION (RFI) for procedural requirements for the submission
2. Section 01 73 00 - EXECUTION for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.

1.3 DEFINITIONS

- A. BIM: Building Information Modeling.
- B. RFI: Request for Interpretation. Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

- A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:
 1. Name, address, telephone number, and email address of entity performing subcontract or supplying products.
 2. Number and title of related Specification Section(s) covered by subcontract.
 3. Drawing number and detail references, as appropriate, covered by subcontract.

1.5 GENERAL COORDINATION PROCEDURES

- A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations included in different Sections that depend on each other for proper installation, connection, and operation.
1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
 2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
 3. Make adequate provisions to accommodate items scheduled for later installation.
- B. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:
1. Preparation of Contractor's construction schedule.
 2. Preparation of the schedule of values.
 3. Installation and removal of temporary facilities and controls.
 4. Delivery and processing of submittals.
 5. Progress meetings.
 6. Preinstallation conferences.
 7. Project closeout activities.
 8. Startup and adjustment of systems.

1.6 COORDINATION DRAWINGS

- A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely indicated on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.
1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
 - a. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
 - b. Indicate dimensions shown on Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternative sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.
- B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate sub-framing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within plenums to accommodate layout of light fixtures and other components indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment and ancillary items such as, but not limited to, piping, conduits, and valves.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Review: Architect will review coordination drawings to confirm that in general the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility.

1.7 DIGITAL PROJECT MANAGEMENT PROCEDURES

- A. Use of Architect's Digital Data Files: Digital data files of Architect's BIM model or CAD drawings will be provided by Architect for Contractor's use during construction.
 1. Digital data files may be used by Contractor in preparing coordination drawings, Shop Drawings, and Project record Drawings.
 2. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Contract Drawings. For all dimensions Contractor is to rely on Contract Drawings only.
 3. Digital Drawing Software Program: Contract Drawings are available in Autodesk Revit 2022, and Revit exportable CAD files.
 4. Contractor shall execute a data licensing agreement in a form of Agreement as agreed to by the Architect.
 - a. Subcontractors, and other parties granted access by Contractor to Architect's digital data files shall execute a data licensing agreement in the same format as previously agreed.
- B. Web-Based Project Software: Contractor will use a web-based Project software site for purposes of hosting and managing communication and documentation until Final Completion, but the web-based software shall not relieve the Contractor from the requirements of the Contract Documents, including General Requirements of Division 01 contained herein.
 1. Web-based Project software site may include the following features:

- a. Compilation of Project data, including Contractor, subcontractors, Architect, architect's consultants, Client, and other entities involved in Project. Include names of individuals and contact information.
 - b. Access control for each entity for each workflow process, to determine entity's digital rights to create, modify, view, and print documents.
 - c. Document workflow planning, allowing customization of workflow between project entities.
 - d. Creation, logging, tracking, and notification for Client communications required in other Specification Sections, including, but not limited to, RFIs, submittals, Minor Changes in the Work, Construction Change Directives, and Change Orders.
 - e. Track status of each communication in real time, and log time and date when responses are provided.
 - f. Procedures for handling PDFs or similar file formats, allowing markups by each entity. Provide security features to lock markups against changes once submitted.
 - g. Processing and tracking of payment applications, subject to Client's and Architect's approval.
 - h. Processing and tracking of contract modifications.
 - i. Creating and distributing meeting minutes.
 - j. Document management for Drawings, Specifications, and coordination drawings, including revision control.
 - k. Management of construction progress photographs.
 - l. Mobile device compatibility, including smartphones and tablets.
- C. PDF Document Preparation: Where PDFs are required to be submitted to Architect, prepare as follows:
1. Assemble complete submittal package into a single indexed file (hyperlinks) incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
 2. Name file with submittal number or other unique identifier, including revision identifier.
 3. Certifications: Where digitally submitted certificates and certifications are required, provide a digital signature with digital certificate where indicated.

1.8 PROJECT MEETINGS

- A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.
- B. Preconstruction Conference: Schedule and conduct a preconstruction conference before starting construction, at a time convenient to Client, Contractor, and Architect, but no later than 15 working days after execution of the Agreement.
 1. Attendees: Authorized representatives of Client, Contractor, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the

conference shall be familiar with Project and authorized to conclude matters relating to the Work.

2. Agenda: Discuss items of significance that could affect progress, including the following:

- a. Responsibilities and personnel assignments.
- b. Tentative construction schedule.
- c. Phasing.
- d. Critical work sequencing and long lead items.
- e. Designation of key personnel and their duties.
- f. Lines of communications.
- g. Use of web-based Project software.
- h. Procedures for processing field decisions and Change Orders.
- i. Procedures for RFIs.
- j. Procedures for testing and inspecting.
- k. Procedures for processing Applications for Payment.
- l. Distribution of the Contract Documents.
- m. Submittal procedures.
- n. Preparation of Record Documents.
- o. Use of the premises.
- p. Work restrictions.
- q. Working hours.
- r. Owner's occupancy requirements.
- s. Responsibility for temporary facilities and controls.
- t. Procedures for moisture and mold control.
- u. Procedures for disruptions and shutdowns.
- v. Construction waste management and recycling.
- w. Parking availability.
- x. Office, work, and storage areas.
- y. Equipment deliveries and priorities.
- z. First aid.
- aa. Security.
- bb. Progress cleaning.

3. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

- C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity when required by other sections and when required for coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Owner and Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:
 - a. Contract Documents.
 - b. Options.
 - c. Related RFIs.

- d. Related Change Orders.
 - e. Purchases.
 - f. Deliveries.
 - g. Submittals.
 - h. Review of mockups.
 - i. Possible conflicts.
 - j. Compatibility requirements.
 - k. Time schedules.
 - l. Weather limitations.
 - m. Manufacturer's written instructions.
 - n. Warranty requirements.
 - o. Compatibility of materials.
 - p. Acceptability of substrates.
 - q. Temporary facilities and controls.
 - r. Space and access limitations.
 - s. Regulations of authorities having jurisdiction.
 - t. Testing and inspecting requirements.
 - u. Installation procedures.
 - v. Coordination with other work.
 - w. Required performance results.
 - x. Protection of adjacent work.
 - y. Protection of construction and personnel.
- 3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
 - 4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
 - 5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.
- D. Progress Meetings: Conduct progress meetings at weekly intervals.
- 1. Coordinate dates of meetings with preparation of payment requests.
 - 2. Attendees: In addition to representatives of Contractor and Architect, each Contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.
 - a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

- 1) Review schedule for next period.
- b. Review present and future needs of each entity present, including the following:
 - 1) Interface requirements.
 - 2) Sequence of operations.
 - 3) Status of submittals.
 - 4) Deliveries.
 - 5) Off-site fabrication.
 - 6) Access.
 - 7) Site use.
 - 8) Temporary facilities and controls.
 - 9) Progress cleaning.
 - 10) Quality and work standards.
 - 11) Status of correction of deficient items.
 - 12) Field observations.
 - 13) Status of RFIs.
 - 14) Status of Proposal Requests.
 - 15) Pending changes.
 - 16) Status of Change Orders.
 - 17) Pending claims and disputes.
 - 18) Documentation of information for payment requests.
4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.
 - a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 31 00

SECTION 01 32 00 – CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:
1. Contractor's Construction Schedule.
 2. Construction schedule updating reports.
 3. Daily construction reports.
 4. Site condition reports.

1.2 DEFINITIONS

- A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction Project. Activities included in a construction schedule consume time and resources.
1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
 2. Predecessor Activity: An activity that precedes another activity in the network.
 3. Successor Activity: An activity that follows another activity in the network.
- B. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.
- C. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.
- D. Event: The starting or ending point of an activity.
- E. Float: The measure of leeway in starting and completing an activity.
1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date. The Contractor does not own Float.
 2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
 3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

1.3 INFORMATIONAL SUBMITTALS

- A. Format for Submittals: Submit required submittals in the following format:
 - 1. PDF file.
 - 2. Native format (latest version of Primavera P6)
- B. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.
- C. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.
 - 1. Activity Report: List of activities sorted by activity number and then early start date, or actual start date if known.
 - 2. Logic Report: List of preceding and succeeding activities for each activity, sorted in ascending order by activity number and then by early start date, or actual start date if known.
 - 3. Total Float Report: List of activities sorted in ascending order of total float.
- D. Construction Schedule Updating Reports: Submit with Applications for Payment.
- E. Daily Construction Reports: Submit weekly as agreed with the Client.
- F. Site Condition Reports: Submit at time of discovery of differing conditions.

1.4 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the schedule of values, and list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.
 - 1. Secure time commitments for performing critical elements of the Work from entities involved.
 - 2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

1.5 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

- A. Computer Scheduling Software: Prepare schedules using current version of Primavera P6.

- B. Time Frame: Extend schedule from date established for the Notice of Award to date of final completion.
- C. Activities: Treat each floor or separate area as a separate work breakdown element activity for each main element of the Work. Comply with the following:
 - 1. Activity Duration: Define activities so no activity is longer than 20 working days, unless specifically allowed by Client. Additionally, no activity shall be greater than a value of \$50,000.00.
 - 2. Procurement Activities: Include procurement process activities for major items, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
 - 3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 - SUBMITTAL PROCEDURES in schedule. Coordinate submittal review times in Contractor's Construction Schedule with submittal schedule.
 - 4. Startup and Testing Time: Include not fewer than 15 working days for startup and testing.
 - 5. Testing and Commissioning: Include not more than 30 calendar days for testing and commissioning efforts. If a period greater than 30 calendar days is needed, Client approval is required.
 - 6. Substantial Completion: Indicate completion in advance of date established for Substantial Completion and allow time for Architect's administrative procedures necessary for certification of Substantial Completion.
 - 7. Punch List and Final Completion: Include not more than 30 calendar days for completion of punch list items and final completion.
- D. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule and show how the sequence of the Work is affected.
 - 1. Phasing: Arrange list of activities on schedule by phase.
 - 2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 - SUMMARY. Delivery dates indicated stipulate the earliest possible delivery date.
 - 3. Work Restrictions: Show the effect of the following items on the schedule:
 - a. Seasonal variations.
- E. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Start-up, Testing and Commissioning, Substantial Completion, Punch List and Final Completion, and the following interim milestones:
 - 1. Site Mobilization
 - 2. Completion of piling efforts
 - 3. Completion of steel erection
 - 4. Temporary enclosure and space conditioning
 - 5. Inspector reviews

- F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:
1. Unresolved issues.
 2. Unanswered Requests for Information.
 3. Rejected or unreturned submittals.
 4. Notations on returned submittals.
 5. Pending modifications affecting the Work and the Contract Time.
- G. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule updates at the next regularly scheduled progress meeting.
1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
 2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
 3. As the Work progresses, indicate final completion percentage for each activity.
- H. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, Contractor shall submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, equipment required to achieve compliance, and date by which recovery will be accomplished.
- I. Distribution: Distribute copies of approved schedule to Architect, Client, separate contractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility.
1. Post copies to project management site, project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

1.6 CPM SCHEDULE REQUIREMENTS

- A. General: Prepare network diagrams using AON (activity-on-node) format.
- B. Startup Network Diagram: Submit diagram within 14 calendar days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 calendar days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

- C. CPM Schedule: Prepare Contractor's Construction Schedule using a time-scaled CPM network analysis diagram for the Work.
1. Acceptable CPM schedule to be submitted within 30 calendar days after date established for the Notice to Proceed.
 - a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates.
 2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
 3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
 4. Use "one workday" as the unit of time for individual activities. Indicate non-working days and holidays incorporated into the schedule to coordinate with the Contract Time.
- D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.
1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:
 - a. Preparation and processing of submittals.
 - b. Mobilization and demobilization.
 - c. Purchase of materials.
 - d. Delivery.
 - e. Fabrication.
 - f. Utility interruptions.
 - g. Installation.
 - h. Work by Client that may affect or be affected by Contractor's activities.
 - i. Testing and inspection.
 - j. Commissioning.
 - k. Punch list and final completion.
 - l. Activities occurring following final completion.
 2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.
 3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
 4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

- a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.
- E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall Project schedule.
- F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:
 - 1. Contractor or subcontractor and the Work or activity.
 - 2. Description of activity.
 - 3. Main events of activity.
 - 4. Immediate preceding and succeeding activities.
 - 5. Early and late start dates.
 - 6. Early and late finish dates.
 - 7. Activity duration in workdays.
 - 8. Total float or slack time.
 - 9. Average size of workforce.
 - 10. Dollar value of activity (coordinated with the schedule of values).
- G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:
 - 1. Identification of activities that have changed.
 - 2. Changes in early and late start dates.
 - 3. Changes in early and late finish dates.
 - 4. Changes in activity durations in workdays.
 - 5. Changes in the critical path.
 - 6. Changes in total float or slack time.
 - 7. Changes in the Contract Time.

1.7 REPORTS

- A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:
 - 1. List of subcontractors at Project site.
 - 2. List of separate contractors at Project site.
 - 3. Approximate count of personnel at Project site.
 - 4. Equipment at Project site.
 - 5. Material deliveries.
 - 6. High and low temperatures and general weather conditions, including presence of rain or snow.
 - 7. Testing and inspection.
 - 8. Accidents.
 - 9. Meetings and significant decisions.

10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

- B. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Interpretation. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 32 00

SECTION 01 32 16 - CONSTRUCTION PROJECT SCHEDULE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Administrative and procedural requirements for preparation, submission, updating, and reporting of Contractor's construction schedule.

1.02 DEFINITIONS

- A. Activity: A discrete part (task or event) of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule have a definable start and stop and consume time and resources, such as people, materials, or facilities. Each activity shall be assigned a unique alphanumeric identification code (Activity ID).
 - 1. Controlling Activity: The first incomplete activity on the critical path.
 - 2. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times, and that contains zero or less total float.
 - 3. Predecessor Activity: An activity that precedes another activity in the network and may require completion prior to the start of a successor activity. A predecessor activity may control the start or finish of a successor activity.
 - 4. Successor Activity: An activity that follows another activity in the network. The start or finish of a successor activity may be controlled by the predecessor activity.
- B. Completion Date, Contract: The date specified in the Contract Documents for completion of the Work, or a revised date resulting from approved extensions of the Contract Time.
- C. Completion Date, Scheduled: The date projected or forecasted by the project schedule.
- D. Constraint: A factor or restriction imposed on, and that controls, an activity's start or finish date, regardless of other logic that may be applied to the activity.
- E. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved in writing by the Client.
- F. Critical Path: The path (sequence) of activities that represent the minimum time required to complete the project and contains no float. A delay in any activity in the critical path will cause a delay in the completion of the project.
- G. Critical Path Method (CPM) Scheduling: A method of planning and scheduling a construction project that breaks the project down into activities that are arranged in a logical sequence, based on activity relationships, to determine the overall schedule and time required to successfully complete the project. CPM scheduling focuses attention on the critical path of activities that affect the completion date, or interim milestones, for the project.

- H. Data Date: The date to use as the starting point for schedule calculations. The data date shall be changed to the specified date when recording progress.
- I. Date, Early: The earliest date an activity can start or finish.
- J. Date, Late: The latest date an activity can start or finish without affecting successor activities, interim milestone date(s), and/or the project completion date.
- K. Duration: The estimated time needed to perform an activity or project.
- L. Float: The amount of time that an activity can be delayed without delaying the rest of the project and/or the project completion date. Float (also known as "Total Float") is owned by the project, is not for the exclusive use by or the benefit of the Client or the Contractor, and is therefore a resource available to both the Client and the Contractor on a first needed basis.
 - 1. Extensions of Contract Time shall not be granted unless the accepted delay affects the critical path, all available float has been used, and a time impact analysis has been performed.
- M. Free Float: The amount of time an activity can be delayed without delaying the early start of any successor activities.
- N. Gantt Chart: A graphic representation of a project schedule, with bars arranged in a chronological order, without relationships shown, and project calendar days shown along the horizontal axis.
- O. Logic Relationship: A dependency between two project activities.
- P. Milestone: An activity with zero duration that represents a clearly identifiable and significant point in the project.
- Q. Network Diagram: A graphic diagram of a CPM schedule, showing activities and the relationships among activities.
- R. Open End: The condition that exists when an activity has either no predecessor or no successor, or when an activity's only predecessor relationship is a finish-to-finish relationship or an activity's only successor relationship is a start-to-start relationship.
- S. Recovery Schedule: A revised critical path analysis and CPM schedule that demonstrates how the Contractor will recover the progress of Work that has fallen behind schedule in order to meet the approved milestone dates.
- T. Relationships: The interdependence among activities, linking activities to predecessors and successors.
- U. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled, or the identification of subcontractor performing the Work.
- V. Schedule: A set of activities, organized by relationships, that depict the plan for execution of the Project.

1. **Baseline Schedule:** The approved plan for a project, against which construction progress is compared and deviations are measured. The baseline schedule may include dates related to interim milestones, completion of project phase(s), and other aspects of the Project.
2. **Initial Schedule:** Schedule showing the proposed initial plan for the Project.
3. **Bi-Weekly Updated Schedule:** Schedule incorporating the Project's actual progress every two weeks during summer construction period.
4. **Monthly Updated Schedule:** Schedule incorporating the Project's actual progress every month during non-summer construction period.
5. **Revised Schedule:** Schedule prepared and submitted by the Contractor that includes significant changes to the Contractor's plan and schedule.
6. **Final Schedule:** The last schedule update, containing the actual start and finish dates for every activity in the project schedule. The Contractor must certify the final schedule's accuracy.

1.03 SUBMITTALS

- A. **Schedule Narrative:** Submit a written narrative with the construction schedules, including updates, as indicated.
- B. **Contractor's Construction Schedule:** Using the Client's scheduling software (or other format approved by the Client), submit the following:
 1. **Baseline Schedule:** Submit an electronic copy of the baseline schedule, showing the entire construction period, within the timeframe specified.
 2. **Updated Schedule:** Submit updates to the construction schedule at required intervals.
 3. **Revised Schedule:** Submit revised schedules as required or as requested by the Board's Representative.
- C. **Qualifications:** Submit qualifications for project scheduler not less than seven (7) days prior to Notice of Award. Include resume, years of experience, certifications, licenses, and examples of prepared schedules.
 1. The Client will approve or reject the project scheduler proposed by the Contractor and will notify the Contractor in writing of their approval or rejection within four (4) days of receipt of the required documentation.
 - a. If rejected by the Client, the Contractor shall submit documentation for a replacement project scheduler within three (3) days of receipt of written notice of rejection.
 - b. This procedure shall be followed until a project scheduler is approved by the Client.
 2. The project scheduler must be approved by the Client prior to Notice of Award.

1.04 QUALITY ASSURANCE

- A. **Qualifications - Project Scheduler:** Employ an experienced project scheduler, skilled in the application of network techniques for construction projects, with not less than three (3) years' experience in CPM scheduling and reporting, including experience in the creation and maintenance of CPM construction project schedules utilizing the specified software on not less than three (3) projects of comparable scale and complexity to this Project. If skilled personnel are not employed, engage the services of a consultant with

the same experience and capabilities to provide planning, evaluation, and reporting of the CPM schedule for the duration of the Project.

1. The project scheduler shall be responsible for development of the project schedule, implementing required updates and requested changes to the schedule, and maintenance of the project schedule.
2. The project scheduler shall cooperate with the Client, be on the project site periodically, and attend all meetings related to Project progress, alleged delays, and time impacts as required to accurately modify and update the construction project schedule.
3. Upon approval by the Client, the project scheduler shall be maintained throughout the Project and shall not be replaced without written approval from the Client.
 - a. Should the project scheduler voluntarily leave the Contractor's staff, the Contractor shall submit to the Client a resume and qualifications for a replacement project scheduler within five (5) days.
4. The Client reserves the right to reject project scheduling staff or consultant(s) proposed by the Contractor.
5. The Client reserves the right to request replacement of the project scheduler at any point during the Project should the project schedule, in the opinion of the Client, not meet the degree of detail described in the Contract Documents.

B. Project Scheduling Conference: Prior to submission of a baseline schedule, coordinate a project scheduling conference with the Client and Architect to review methods and procedures related to the construction schedule including, but not limited to, the following:

1. Verification of availability of qualified personnel needed to develop and update schedule.
2. Phasing, work stages, school requirements, milestones, and partial Client occupancy.
3. Delivery dates for the Client-furnished products, if any.
4. Schedule for work of the Client's separate contracts, if any.
5. Time required for review of submittals and resubmittals.
6. Time required for fabrication and delivery of key and long lead items.
7. Requirements for tests and inspections by independent testing and inspecting agencies.
8. Time required for completion and startup procedures, including commissioning activities.
9. Closeout procedures and documentation, including project record documents and warranties.
10. Review and finalize list of construction activities to be included in schedule.
11. Procedures for updating schedule.
12. Facilities programmatic schedule (which should be reflected by assigning a calendar).

1.05 PAYMENT

A. Contractor's Application for Payment - Initial: Approval of the first Application for Payment submitted by the Contractor shall be withheld until the Contractor has an approved baseline construction schedule.

- B. Contractor's Application for Payment - Subsequent: Approval of subsequent Applications for Payments shall be withheld until the Contractor provides required updates of the construction schedule.

PART 2 - PRODUCTS

2.01 BASELINE CONSTRUCTION SCHEDULE

- A. Delivery: Within seven (7) days of receipt of Notice of Award, submit a preliminary baseline construction schedule to the Board's Representative for review and approval or rejection.
 - 1. The preliminary baseline construction schedule shall be created in the Client's scheduling software, and shall be sorted by early start and total float.
- B. Preparation: The preliminary baseline construction schedule shall include all work by subcontractors, sub-subcontractors, suppliers, and other entities contracted to provide services or manpower required to complete the Work.
 - 1. Narrative: With the preliminary baseline construction schedule, a written narrative shall be provided to the Client. The narrative shall describe the Project sequencing, calendars used, critical path, Client constraints, phasing showing existing operational conditions, resource utilizations, major equipment used, weather days accounted for, risks analysis, proposed building engineer's overtime request, and any other Client applied or required resources.
- C. Review: The preliminary baseline construction schedule shall be reviewed by the Client and approved or rejected. The Client shall notify the Contractor in writing of their approval or rejection of the preliminary baseline construction schedule within four (4) days of receipt of initial construction schedule from the Contractor.
 - 1. If rejected by the Client, the Contractor shall submit a revised initial construction schedule within three (3) days of receipt of written notice of rejection.
 - 2. This procedure shall be followed until the preliminary baseline construction schedule is acceptable to the Client.
 - a. When directed by the Board's Representative, the Contractor shall add cost- and resource-loading to the baseline construction schedule.
- D. Upon review and approval of the preliminary baseline construction schedule by the Client the preliminary baseline construction schedule, as approved, shall become the Project's baseline construction schedule, including cost- and resource-loading.

2.02 CONTRACTOR'S CONSTRUCTION SCHEDULE

- A. Schedule, General: The Client requires a schedule using the CPM. The schedule shall be created using the Client's latest Primavera format (or other format acceptable to the Client), and shall be used to monitor construction progress.
 - 1. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of the Client's or Architect's approval of the schedule.
 - 2. Lack of an approved schedule, or qualified scheduling personnel, shall prevent the Client from properly evaluating progress of the Work and reviewing progress payments.

3. Failure to provide the information specified shall result in rejection of the baseline construction schedule, bi-weekly schedule updates, and revised schedules.
 4. When revisions requested by the Client are not addressed in subsequent updates to the schedule, the Client may withhold approval of Contractor's Application for Payment each pay period until the required revisions are incorporated into the schedule.
 5. The Contractor shall monitor and update the CPM schedule, and report progress to the Client.
- B. Delivery: Within seven (7) days of approval of Project baseline construction schedule, submit a cost- and resource-loaded construction schedule to the Client for review and approval or rejection.
1. Review: Within four (4) days of receipt of the Contractor's construction schedule, the Client shall review and approve or reject the Contractor's construction schedule, and notify the Contractor in writing of their approval or rejection.
 - a. If rejected by the Client, the Contractor shall submit a revised construction schedule within three (3) days of receipt of written notice of rejection.
 - b. This procedure shall be followed until the Contractor's construction schedule is approved by the Client.
- C. Narrative: With the Contractor's construction schedule, including each update to the schedule, a written narrative shall be provided to the Client. The narrative shall describe the Project sequencing, calendars used, critical path, Client constraints, phasing showing existing operational conditions, resource utilizations, major equipment used, weather days accounted for, risks analysis, proposed building engineer's overtime request, and any other Board applied or required resources.
- D. Time Frame: Extend schedule from the date established for the Notice of Award to the date identified for Final Acceptance.
1. Use "one workday" as the unit of time for individual activities. Include nonworking days and holidays incorporated into the schedule in order to coordinate with the established Contract Time.
- E. Activities: Include work to be performed by the Contractor and its subcontractors or suppliers, the Client, other contractors, and/or other entities as required for successful completion of the Project. Indicate the estimated time duration, sequence requirements, and relationship for each activity in relation to other activities.
1. Duration: Define activities so no activity is longer than 14 days, unless the Board's Representative has agreed to a greater time period in writing. Exceptions include long lead items and deliveries.
 2. Relationships: All activities are to be linked to each other with predecessors/successors relationships so that the only activity without predecessors is the first activity (Notice of Award) on the schedule, and the only activity without successors is the last activity on the schedule (Final Completion).
 - a. Include as many predecessor/successor relationships as required to produce a chain of logic that automatically and accurately adjusts as status of the Work changes.
 - b. The following relationship types shall not be used:
 - 1) Lags.
 - 2) Open ended relationships.
 - 3) Constraints.

3. Attributes: For each activity in the schedule, include the following:
 - a. Unique activity description, using attributes such as type of work and location as required to distinguish activities.
 - b. Contractor shall create each activity to reside within the WBS template defined by the Client.
 - c. Resource values for cost, major equipment, and manpower. The sum of costs assigned to activities shall equal the total Contract Sum.
 - d. Logically assign each activity to a calendar.
 - 1) The number of school days may change during the Project's duration. Any changes in the number of school days shall be reflected in the schedule update immediately following receipt of a written notification of the change from the Board's Representative.
 - e. Weather dependent activity durations are calculated using the NOAA 10 year average. In order to properly compute any anticipated weather delays, add the appropriate number of working days to each weather dependent activity based on the NOAA 10 year average.
4. Milestones: Milestones are activities of zero day's duration that represent a key point in the Project. Include in the Project schedule as indicated in the Contract Documents and as otherwise required.
 - a. Include the following, at a minimum:
 - 1) Notice of Award.
 - 2) Notice to Proceed.
 - 3) Preliminary Acceptance.
 - 4) Final Acceptance.
 - b. Include the following as applicable to the Project and as directed by the Client's Representative:
 - 1) Start of heating season.
 - 2) End of heating season.
 - 3) Start/end of Project phases.
 - 4) Building enclosure complete (dry-in).
 - 5) HVAC system complete and operational.
5. Facility Activities, Breaks, and Holidays: Include observed holidays, and facility activities that affect construction-related activities. These activities include:
 - a. Observed national holidays.
 - b. Local/Facility holidays.
6. Procurement Activities: Include procurement process activities for long-lead items and major items as separate activities in the schedule. Procurement activities shall include submittals, approvals, purchasing, fabrication, delivery, installation, and start-up activities (if required).
7. Submittal Review Time: Include review and resubmittal times indicated in Section 01 30 00 - Administrative Requirements in the schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
8. Board-Furnished Products: Include a separate activity for each product, with delivery date indicating the earliest possible delivery date.
9. Preliminary Acceptance: Indicate completion in advance of date established for Preliminary Acceptance, and allow time for inspections, receipt of Certificate of Occupancy, and other administrative procedures necessary for Architect/Engineer of Record's and Board's Representative review and certification of Preliminary Acceptance.

10. Punch List and Final Acceptance: Include not more than 60 days following Preliminary Acceptance for completion of minor (punch list) work and Final Acceptance.
 11. Miscellaneous Activities: Include and indicate the following as separate activities (as applicable):
 - a. Mobilization and demobilization.
 - b. Receipt of required permits, temporary closure of public way (if required), and inspections by authorities having jurisdiction.
 - c. Installation and removal of temporary facilities and utilities.
 - d. Utility notification(s), interruption(s), and relocation(s).
 - e. HVAC system start-up and commissioning.
 - f. Project record document preparation and submission.
 - g. Demonstration and training, as required.
- F. Recovery Schedule: When a periodic update indicates the Work is seven (7) or more days behind the approved schedule, submit, no later than the next schedule update, a separate recovery schedule indicating a workable plan to come into compliance with the approved schedule and complete the Project, including achieving interim milestone dates, by the previously approved date. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance with the approved schedule and narrative, and date by which recovery shall be accomplished. The Client may withhold a portion of progress payments until an acceptable recovery schedule is submitted.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor has the duty to deliver to the Client an approved construction schedule. The Contractor shall not assert any claim whatsoever for any delay or additional cost incurred in connection with the development, maintenance, and updating of the schedule. No payment shall be awarded to the Contractor until a baseline schedule has been submitted and approved.

3.02 COORDINATION

- A. Coordinate Contractor's Construction Schedule with the Schedule of Values, Submittal Schedule, progress reports, payment requests, and other required schedules and reports.

3.03 ELECTRONIC SCHEDULING

- A. Scheduling Software: Contractor shall use the Client's scheduling software (or other format approved by the Board's Representative) for creating the baseline schedule, preparing all bi-weekly schedule updates (summer construction), monthly schedule updates (construction during the school year), revised schedules, and preparing recovery schedules as required.

3.04 REVIEWS

- A. General: Review and acceptance of the Contractor's construction schedule, including any revisions and/or updates, by the Board's Representative and Architect/Engineer of Record is advisory only and does not relieve the Contractor of the responsibility for accomplishing each portion of the Work within the time provided by the Contract Documents. Omissions and errors in the accepted schedule, including any revisions and/or updates, shall not excuse performance that is not in compliance with the Contract Documents.
- B. Baseline Construction Schedule: Immediately following submission of the preliminary baseline construction schedule, the Board's Representative shall coordinate a meeting with the Contractor and Architect/Engineer of Record to review the submitted schedule.
 - 1. All issues regarding the schedule shall be reviewed and resolved at this meeting.
 - 2. If issues remain unresolved at the end of the meeting, the Board's Representative shall establish the date and time for a second meeting
- C. The Board's Representative shall review each submitted schedule and return the reviewed schedule, including any comments and required revisions, to the Contractor within the following time frames:
 - 1. Baseline Schedule: Four (4) days of receipt by the Board's Representative.
 - 2. Updated Schedule: Four (4) days of receipt by the Board's Representative.
 - 3. Revised Schedule: Four (4) days of receipt by the Board's Representative.
- D. A schedule found to be impractical for any reason shall be revised and resubmitted by the Contractor within three (3) days.

3.05 UPDATES

- A. The Contractor's construction schedule shall be updated on a bi-weekly basis (summer construction - from end of school to the start of school) or monthly basis (during the school year) to indicate the status of the Project and progress of the Work, as well as the plan for completion of the Project. The updated schedule shall include a new data date. Indicate the projected days remaining for each activity in the schedule as the Work progresses.
 - 1. The updated schedule and update narrative shall be submitted within two (2) days following the data date.
 - 2. Coordinate a meeting two days following the data date to review, and to resolve any issues with, the updated schedule. Attendees shall include the Contractor, Board's Representative, and Architect/Engineer of Record.
- B. Update Narrative: With each schedule update, submit a written narrative listing all activities that have been revised since the last schedule update. Also include a list of itemized explanations of all changes to the construction schedule, including all activities that have been added to or deleted from the schedule, and logic changes. This narrative shall be created with a word processing program and shall be submitted as portable document format (PDF).

3.06 REVISIONS

- A. Board Requested Revisions: The Board retains the right to request a revised schedule for reasons that include, but are not limited to, the following:
 - 1. A projected or forecasted delay to critical activities.
 - 2. Delay of a non-critical activity that changes the course of the critical path.
 - 3. A Change Order or RFI that affects the completion date or sequence of activities.
- B. Contractor Requested Revisions: The Contractor shall notify the Client in writing of any requested changes to the schedule, including changes to the logic or duration of activities. The written request shall clearly outline the reason(s), in detail, for each change requested.
 - 1. All Contractor requested revisions to the schedule including, but not limited to, any change to the schedule logic, order or sequence of activities, or duration of activities, shall be approved by the Client in writing before the revisions are implemented and the schedule revised.

3.07 CONTRACT MODIFICATIONS

- A. Extensions of the Contract Time shall not be allowed unless approved in writing by the Client.
- B. Scheduling of approved changes in the Work is the responsibility of the Contractor.
- C. With each proposed contract modification, prior to initiation of related work, submit a separate schedule analysis to the Client for review. Each schedule analysis shall include all activities required to complete the proposed change and indicate the effect of the proposed change on the overall project schedule.
 - 1. The schedule analysis shall indicate all affected and revised activities, the duration of the change, the cost(s) of the change, any constraints that result from the change, and whether the change is concurrent or sequential.
 - 2. This analysis shall be attached to any Contractor proposal if time extensions are requested.
- D. If the Client accepts the proposed revision, including the schedule analysis, the revised schedule, including all activities required to incorporate the change and complete the Project, shall become the basis for the next bi-weekly update to the schedule.

3.08 DELAYS AND EXTENSIONS OF TIME

- A. The Contractor shall execute its work as required to maintain progress of the Work in accordance with the accepted construction schedule. Should the Contractor fail to maintain progress according to the approved schedule, the Contractor shall take measures necessary to bring progress of the Work into line with the schedule at no additional cost to the Client.
- B. The Contractor shall be responsible for requesting an extension of the Contract Time due to a delay or occurrence that negatively impacts, in the opinion of the Contractor, the critical path of the Project. All requests shall be submitted to the Client in writing within seven (7) days of the delay.

1. Failure to submit a written request to the Client within the specified time period shall result in rejection of the request for extension of the Contract Time and any related request(s) for a change to the Contract Sum.
 2. Delays to non-critical activities (those with float) shall not be considered a basis for either a change in the Contract Time or a change in the Contract Sum.
 3. Extensions of the Contract Time shall not be considered accepted and shall not be incorporated into the schedule unless accepted in writing by the Client.
 - a. When the Client finds the Contractor is entitled to an extension in Contract Time, the total number of days extension shall be based upon the current analysis of the schedule and upon the data relevant to the extension.
 - b. When agreement to an acceptable extension in time cannot be reached, the Contractor shall incorporate schedule changes in accordance with the Client's direction.
- C. With each request for an extension of the Contract Time, a separate schedule analysis and written narrative shall be submitted to the Client.
1. The schedule analysis shall be in the form of a bi-weekly schedule update, with adjusted activity durations and appropriate resource-loading, and logic relationships for the added scope. The schedule analysis shall clearly indicate how all of the schedule's activities are affected, including float related to the affected activities, and how the Project's completion date is impacted, by the requested time extension.
 2. The written narrative shall list all activities that are to be added to or deleted from the schedule, as well as all activities that are to be changed in any way. The narrative shall include a list of itemized explanations of all changes to the schedule.

3.09 DISTRIBUTION

- A. Distribution: Distribute copies of approved schedule to Architect, Client, subcontractors, testing and inspecting agencies, and other parties identified by Contractor with a need-to-know schedule responsibility and as otherwise directed by the Client.
1. Post large scale copy of the baseline schedule in Project meeting rooms and temporary field offices.
 2. When revisions are made, distribute updated schedules to the same parties and post in the same locations. Delete parties from distribution when they have completed their assigned portion of the Work and are no longer involved in performance of construction activities.

3.10 REPORTS

- A. General: Reports shall be created and prepared, and electronically submitted within the Board's contract management software (Primavera CM).
- B. Daily Construction Reports: Prepare daily construction reports recording the following information concerning events at Project site:
1. List of subcontractors at Project site.
 2. Approximate count of personnel and equipment at Project site.
 3. All visitors the job site. Include each person's name and name of company.

4. Material delivery information.
 5. High and low temperatures and general weather conditions.
 6. Accidents.
 7. Meetings and significant decisions.
 8. Unusual events (refer to special reports).
 9. Stoppages, delays, shortages, and losses.
 10. Meter readings and similar recordings.
 11. Emergency procedures.
 12. Orders and requests of authorities having jurisdiction.
 13. Change Orders received and implemented.
 14. Bulletins received.
 15. Services connected and disconnected.
 16. Equipment or system tests and startups.
 17. All work performed that day on a time and materials basis. Include hours expended for labor and equipment and any material(s).
 18. Any proposed change order work not yet approved, completed that day.
- C. Special Reports: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise the Client in advance when these events are known or predictable.

END OF SECTION 01 32 16

SECTION 01 32 33 – PHOTOGRAPHIC DOCUMENTATION**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes administrative and procedural requirements for the following:
 - 1. Preconstruction photographs.
 - 2. Construction photographs.
 - 3. Preconstruction videos.
- B. Related Sections include the following:
 - 1. Section 01 33 00 – SUBMITTAL PROCEDURES for submitting photographic documentation.
 - 2. Section 01 77 00 - CLOSEOUT PROCEDURES for submitting digital media as Project Record Documents at Project closeout.

1.2 SUBMITTALS

- A. Qualification Data: For photographer.
- B. Key Plan: Submit key plan of Project site and building with notation of vantage points marked for location and direction of each photograph or video. Indicate elevation or story of construction. Include same label information as corresponding set of photographs or video.
- C. Construction Photographs: Submit one (1) set of digital photographic views.
 - 1. Digital Images: Submit a complete set of digital image electronic files in Adobe Acrobat PDF format with each submittal of prints on CD-ROM. Identify electronic media with date photographs were taken. Submit images that have same aspect ratio as the sensor, uncropped.
- D. Sustainable Design Documentation: Submit documentation to comply with sustainable design credits. This shall include digital files and written descriptions to provide justification of compliance.

1.3 COORDINATION

- A. Auxiliary Services: Cooperate with photographer and provide auxiliary services requested, including access to Project site and use of temporary facilities, including temporary lighting required to produce clear, well-lit photographs without obscuring shadows.

PART 2 - PRODUCTS

2.1 PHOTOGRAPHIC MEDIA

- A. Digital Images: Provide images in uncompressed TIFF format, produced by a digital camera with minimum sensor size of 4.0 megapixels, and at an image resolution of not less than 1600 by 1200 pixels.

PART 3 - EXECUTION

3.1 CONSTRUCTION PHOTOGRAPHS

- A. General: Take photographs using the maximum range of depth of field, and that are in focus, to clearly show the Work. Photographs with blurry or out-of-focus areas will not be accepted.
 - 1. Maintain key plan with each set of construction photographs that identifies each photographic location.
- B. Digital Images: Submit digital images exactly as originally recorded in the digital camera, without alteration, manipulation, editing, or modifications using image-editing software.
 - 1. Date and Time: Include date and time in filename for each image.
 - 2. Field Office Images: Maintain one set of images on an external drive in the field office at Project site, available at all times for reference. Identify images same as for those submitted to Architect.
- C. Preconstruction Photographs: Before commencement of excavation, take color, digital photographs of Project site and surrounding properties, including existing items to remain during construction, from different vantage points, as necessary to show the condition of the existing facilities prior to the start of work.
 - 1. Flag construction limits before taking construction photographs.
 - 2. Take photographs to show existing conditions adjacent to property before starting the Work.
 - 3. Take photographs of existing buildings either on or adjoining property to accurately record physical conditions at start of construction. This includes any fences, gates, bus stops, traffic signals, crosswalks, light poles, and the like.
 - 4. Take additional photographs as required to record settlement or cracking of adjacent structures, pavements, and improvements.

- D. Additional Photographs: Client may issue requests for additional photographs, in addition to photographs specified, one such example being the need to comply with LEED or sustainable design requirements.
1. Three days' notice will be given, where feasible.
 2. In emergency situations, take additional photographs within 24 hours of request.
 3. Circumstances that could require additional photographs include, but are not limited to, the following:
 - a. Special events planned at Project site.
 - b. Immediate follow-up when on-site events result in construction damage or losses.
 - c. Photographs to be taken at fabrication locations away from Project site. These photographs are not subject to unit prices or unit-cost allowances.
 - d. Substantial Completion of a major phase or component of the Work.
 - e. Extra record photographs at time of final acceptance.
 - f. Owner's request for special publicity photographs.

END OF SECTION 01 32 33

SECTION 01 33 00 – SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Submittal schedule requirements.
 - 2. Administrative and procedural requirements for submittals.

1.2 DEFINITIONS

- A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."
- B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

1.3 SUBMITTAL SCHEDULE

- A. Submittal Schedule: Submit, as an action submittal, a list of submittals, arranged in chronological order by dates required by construction schedule. Include time required for Contractor approval, Architect review, Architect's consultant's review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and/or the Architect's consultants; and additional time for handling and reviewing submittals after required corrections have been completed. A long lead submittal schedule shall be submitted to the Client within 14 calendar days of receipt of Notice to Proceed, this schedule shall also cover any action submittals requiring processing within the first 60 calendar days. A complete action submittal schedule shall be submitted within 30 calendar days of the Notice to Proceed.
 - 1. Failure of Contractor to properly Schedule and provide Schedules and Scheduling information to Client and Architect, of required Submittals, shall indicate that Contractor waives any claims for delays and additional costs associated with untimely or delayed Submittals.

1.4 SUBMITTAL FORMATS

- A. Submittal Information: Include the following information in each submittal:
 - 1. Project name.

2. Date.
 3. Name of Client.
 4. Name of Architect.
 5. Name of Contractor.
 6. Name of firm or entity that prepared submittal.
 7. Names of subcontractor, manufacturer, and supplier.
 8. Unique submittal number, including revision identifier. Include Specification Section number with sequential alphanumeric identifier; and alphanumeric suffix for resubmittals.
 9. Category and type of submittal.
 10. Submittal purpose and description.
 11. Number and title of Specification Section, with paragraph number and generic name for each of multiple items.
 12. Drawing number and detail references, as appropriate.
 13. Indication of full or partial submittal.
 14. Location(s) where product is to be installed, as appropriate.
 15. Other necessary identification.
 16. Remarks.
 17. Signature of transmitter.
- B. Options: Identify options requiring selection by Architect.
- C. Deviations and Additional Information: On each submittal, clearly indicate deviations from requirements in the Contract Documents, including minor variations and limitations; include relevant additional information and revisions, other than those requested by Architect on previous submittals. Indicate by highlighting on each submittal or noting on attached separate sheet.
- D. Physical Submittals:
1. Place a permanent label on, or secured to, each submittal item for identification; include name of firm or entity that prepared submittal.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Architect's review and action taken (6 by 4-inches).
 3. Action Submittals: Submit two of each submittal item unless otherwise indicated. Architect will return one item.
 4. Informational Submittals: Submit one copy of each submittal unless otherwise indicated. Architect will not return the item.
 5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form acceptable to the Architect.
- E. PDF Submittals: Prepare submittals as PDF package, incorporating complete information into each PDF file. Name PDF file with submittal package number.
1. Label each submittal item for identification; include name of firm or entity that prepared submittal.
 2. Provide a space approximately 6 by 8 inches on label or beside title block to record Architect's review and action taken (6 by 4-inches),
 3. Submittals: Submit two of each submittal item unless otherwise indicated. Architect will return one item.

4. Informational Submittals: Submit one copy of each submittal unless otherwise indicated. Architect will not return copies.
5. Transmittal for Submittals: Assemble each submittal individually and appropriately for transmittal and handling. Transmit each submittal using transmittal form acceptable to the Architect.

1.5 SUBMITTAL PROCEDURES

- A. Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections. Submittal packages shall be inclusive of all related submittal items.
 1. Email: Shall be the default method of submission, except for physical samples which shall be delivered to the office of the Architect, unless noted otherwise.
 - a. Prepare submittals as PDF package and transmit to Architect by sending via email. Include PDF transmittal form. Include information in email subject line as requested by Architect.
 2. Web-Based Project Software: Utilize the web-based project management software provided by the Contractor.
 3. E-mail and Web-Based Project Software use shall not relieve the Contractor of complying with the requirements of the Contract Documents and the General Requirements of Division 01. Where the requirements of these General Conditions are in conflict with the capabilities of Web-Based Project Software, the requirements of the General Conditions take precedence.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
 2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
- C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals. Any Submittals received after 5:00 pm Central Standard Time, shall be deemed received the following working day, or if on a Friday afternoon shall be deemed received the following Monday, and shall be noted as such. Physical Samples shall be deemed received upon physical delivery to the office of the Architect, except when received after 5:00 pm Central Standard Time, shall be deemed received the following working day, or if on a Friday afternoon shall be deemed received the following Monday, and shall be noted as such.

1. Initial Review: Allow 10 working days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination. If a submittal is to be prioritized then other concurrent submittals shall be granted additional time to review and provide comment.
 2. Resubmittal Review: Allow 10 calendar days for review of each resubmittal.
- D. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- E. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
- F. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

1.6 SUBMITTAL REQUIREMENTS

- A. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard published data are unsuitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's catalog cuts.
 - b. Manufacturer's product specifications.
 - c. Standard color charts.
 - d. Statement of compliance with specified referenced standards.
 - e. Testing by recognized testing agency.
 - f. Application of testing agency labels and seals.
 - g. Notation of coordination requirements.
 - h. Availability and delivery time information.
 - i. Sustainability documentation
 4. For equipment, include the following in addition to the above, as applicable:
 - a. Wiring diagrams that show factory-installed wiring.
 - b. Printed performance curves.
 - c. Operational range diagrams.
 - d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.
 5. Submit Product Data before Shop Drawings, and before or concurrent with Samples.

- B. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data unless submittal based on Architect's digital data drawing files is otherwise permitted.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Identification of products.
 - b. Schedules.
 - c. Compliance with specified standards.
 - d. Notation of coordination requirements.
 - e. Notation of dimensions established by field measurement.
 - f. Relationship and attachment to adjoining construction clearly indicated.
 - g. Seal and signature of professional engineer if specified.
 - h. Sustainability documentation
- C. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other materials.
1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Permanently attach label on unexposed side of Samples that includes the following:
 - a. Project name and submittal number.
 - b. Generic description of Sample.
 - c. Product name and name of manufacturer.
 - d. Sample source.
 - e. Number and title of applicable Specification Section.
 - f. Specification paragraph number and generic name of each item.
 - g. Provide a label with space approximately 6 by 8 inches on label to record Architect's review and action taken (6 by 4-inches).
 - h. Sustainability documentation
 3. Email Transmittal: Provide PDF transmittal. Include digital image file illustrating Sample characteristics, and identification information for record.
 4. Web-Based Project Software: Prepare submittals in PDF form, and upload to web-based Project software website. Enter required data in web-based software site to fully identify submittal.
 5. Paper Transmittal: Include paper transmittal including complete submittal information indicated, with physical samples shipped to the office of the Architect for review.
 6. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
 - a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.

- b. Samples not incorporated into the Work, or otherwise designated as Client's property, are the property of Contractor.
- 7. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.
 - a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.
- 8. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit two sets of Samples. Architect will retain one Sample set; remainder will be returned.
 - 1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
 - 2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- D. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
- E. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- F. Design Data: Prepare and submit written and graphic information indicating compliance with indicated performance and design criteria in individual Specification Sections. Include list of assumptions and summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Number each page of submittal.
- G. Certificates:
 - 1. Certificates and Certifications Submittals: Submit a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign

- documents on behalf of that entity. Provide a notarized signature where indicated.
2. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.
 3. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
 4. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
 5. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
 6. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

H. Test and Research Reports:

1. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
2. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
3. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
4. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
5. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
6. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
 - a. Name of evaluation organization.
 - b. Date of evaluation.
 - c. Time period when report is in effect.
 - d. Product and manufacturers' names.
 - e. Description of product.
 - f. Test procedures and results.
 - g. Limitations of use.

1.7 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
 - 1. If criteria indicated are insufficient to perform services or certification required, submit a written request for additional information to Contractor.
- B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF file and one paper copy of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a State of Illinois licensed design professional.
 - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. Compliance with Authorities Having Jurisdiction: Design services provided by the Contractor shall be completed by a State of Illinois licensed Architect or Engineer. All designs shall be in compliance with location codes and regulations, in the event that a performance or design criteria is in conflict with a local code or regulation the Contractor shall notify the Contractor within 5 calendar days of identifying the conflict and propose a solution which complies with the local code and regulations.

1.8 CONTRACTOR'S REVIEW

- A. Action Submittals and Informational Submittals: Review each submittal prior to issuance and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Contractor's Approval: Indicate Contractor's approval for each submittal with a uniform approval stamp. Include name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.
 - 1. Architect will not review submittals received from Contractor that do not have Contractor's review and approval.

1.9 ARCHITECT'S REVIEW

- A. Action Submittals: Architect will review each submittal, indicate corrections or revisions required, and return it.
 - 1. PDF Submittals: Architect will indicate, via markup on each submittal, the appropriate action.

2. Paper Submittals: Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Informational Submittals: Contractor will review each submittal and will not return it, or will return it if it does not comply with requirements. Contractor will forward each submittal to appropriate party.
 - C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
 - D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.
 - E. Architect will discard submittals received from sources other than Contractor.
 - F. Submittals not required by the Contract Documents will be returned by Architect without action.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 33 00

SECTION 01 40 00 – QUALITY REQUIREMENTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for quality assurance and quality control.
- B. Related Requirements:
 - 1. 01 33 00 – SUBMITTAL PROCEDURES
- C. Testing and inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
 - 1. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and quality-control procedures that facilitate compliance with the Contract Document requirements.
 - 2. Requirements for Contractor to provide quality-assurance and quality-control services required by Contractor, Owner, or Authorities Having Jurisdiction are not limited by provisions of this Section.

1.2 DEFINITIONS

- A. Experienced: When used with an entity or individual, "experienced" unless otherwise further described means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.
- B. Field Quality-Control Tests: Tests and inspections that are performed on-site for installation of the Work and for completed Work.
- C. Installer/Applicator/Erector: Subcontractor or another entity engaged by Contractor as an employee or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, assembly, and similar operations.
 - 1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s). Terms established by the Contractor will dictate how trade work is to be performed.
- D. Mockups: Full-size physical assemblies that are constructed on-site either as freestanding temporary built elements or as part of permanent construction. Mockups are constructed to verify selections made under Sample submittals; to demonstrate

aesthetic effects and qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.

- E. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- F. Product Tests: Tests and inspections that are performed by a nationally recognized testing laboratory (NRTL) according to 29 CFR 1910.7, by a testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program (NVLAP), or by a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.
- G. Source Quality-Control Tests: Tests and inspections that are performed at the source; for example, plant, mill, factory, or shop.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- J. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Contractor 's quality-control services do not include contract administration activities performed by Architect.

1.3 DELEGATED-DESIGN SERVICES

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1.4 CONFLICTING REQUIREMENTS

- A. Conflicting Standards and Other Requirements: If compliance with two or more standards or requirements are specified and the standards or requirements establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Contractor for direction before proceeding.
- B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply

exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 ACTION SUBMITTALS

- A. Delegated-Design Services Submittal: In addition to Shop Drawings, Product Data, and other required submittals, submit a statement signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional, indicating that the products and systems are in compliance with performance and design criteria indicated. Include list of codes, loads, and other factors used in performing these services. For additional requirements refer to Section 01 33 00 – SUBMITTALS PROCEDURES.

1.6 INFORMATIONAL SUBMITTALS

- A. Contractor 's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility submitted to authorities having jurisdiction before starting work on the following systems:
 - 1. Main wind-force-resisting system or a wind-resisting component listed in the Statement of Special Inspections.
- B. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.
- C. Permits, Licenses, and Certificates: For Contractor's record, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents established for compliance with standards and regulations bearing on performance of the Work.

1.7 REPORTS AND DOCUMENTS

- A. Test and Inspection Reports: Prepare and submit certified written reports specified in other Sections. Include the following:
 - 1. Date of issue.
 - 2. Project title and number.
 - 3. Name, address, telephone number, and email address of testing agency.
 - 4. Dates and locations of samples and tests or inspections.
 - 5. Names of individuals making tests and inspections.
 - 6. Description of the Work and test and inspection method.
 - 7. Identification of product and Specification Section.
 - 8. Complete test or inspection data.

9. Test and inspection results and an interpretation of test results.
 10. Record of temperature and weather conditions at time of sample taking and testing and inspection.
 11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
 12. Name and signature of laboratory inspector.
 13. Recommendations on retesting and re-inspecting.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
1. Statement on condition of substrates and their acceptability for installation of product.
 2. Statement that products at Project site comply with requirements.
 3. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
 4. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 5. Other required items indicated in individual Specification Sections.
- C. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:
1. Statement that equipment complies with requirements.
 2. Results of operational and other tests and a statement of whether observed performance complies with requirements.
 3. Other required items indicated in individual Specification Sections.
- 1.8 QUALITY ASSURANCE
- A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units. As applicable, procure products from manufacturers able to meet qualification requirements, warranty requirements, and technical or factory-authorized service representative requirements.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.
- D. Installer Qualifications: A firm or individual experienced in installing, erecting, applying, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.
- F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.
 - 1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspection indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.
- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
 - 1. Contractor responsibilities include the following:
 - a. Provide test specimens representative of proposed products and construction.
 - b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
 - c. When testing is complete, remove test specimens and test assemblies, and mockups; do not reuse products on Project.
 - 2. Testing Agency Responsibilities: Submit a certified written report of each test, inspection, and similar quality-assurance service to Contractor, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from the Contract Documents.
- K. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups of size indicated.
2. Build mockups in location indicated or, if not indicated, as directed by Contractor.
3. Notify Contractor seven days in advance of dates and times when mockups will be constructed.
4. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed to perform same tasks during the construction at Project.
5. Demonstrate the proposed range of aesthetic effects and workmanship.
6. Obtain Contractor's approval of mockups before starting corresponding work, fabrication, or construction.
 - a. Allow seven days for initial review and each re-review of each mockup.
7. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
8. Demolish and remove mockups when directed unless otherwise indicated.

1.9 QUALITY CONTROL

- A. Owner Responsibilities: Where quality-control services are indicated as Contractor's responsibility, Contractor will engage a qualified testing agency to perform these services.
 1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspection they are engaged to perform.
 2. Costs for retesting and re-inspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Contractor are Contractor's responsibility. Perform additional quality-control activities, whether specified or not, to verify and document that the Work complies with requirements.
 1. Engage a qualified testing agency to perform quality-control services.
 - a. Contractor shall not employ same entity engaged by Contractor, unless agreed to in writing by Contractor.
 2. Notify testing agencies at least 24-hours in advance of time when Work that requires testing or inspection will be performed.
 3. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
 4. Testing and inspection requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
 5. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Re-testing/Re-inspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including re-testing and re-inspecting, for construction that replaced Work that failed to comply with the Contract Documents.

- D. **Manufacturer's Field Services:** Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 - SUBMITTAL PROCEDURES.
- E. **Manufacturer's Technical Services:** Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- F. **Associated Contractor Services:** Cooperate with agencies and representatives performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:
 - 1. Access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.
 - 3. Adequate quantities of representative samples of materials that require testing and inspection. Assist agency in obtaining samples.
 - 4. Facilities for storage and field curing of test samples.
 - 5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
 - 6. Security and protection for samples and for testing and inspection equipment at Project site.
- G. **Coordination:** Coordinate sequence of activities to accommodate required quality-assurance and quality-control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspection.
 - 1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

- A. **Special Tests and Inspections:** Contractor will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Contractor, and as follows:
 - 1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
 - 2. Notifying Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
 - 3. Submitting a certified written report of each test, inspection, and similar quality-control service to Contractor and to Authorities Having Jurisdiction.
 - 4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
 - 5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.

6. Retesting and re-inspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

- A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:
 1. Date test or inspection was conducted.
 2. Description of the Work tested or inspected.
 3. Date test or inspection results were transmitted to Architect.
 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.
 1. Submit log at Project closeout as part of Project Record Documents.

3.2 REPAIR AND PROTECTION

- A. General: On completion of testing, inspection, sample taking, and similar services, repair damaged construction and restore substrates and finishes.
 1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 - EXECUTION.
- B. Protect construction exposed by or for quality-control service activities.
- C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 20 - REFERENCES

PART 1 - GENERAL

1.1 DEFINITIONS

- A. General: Basic Contract definitions are included in the Conditions of the Contract.
- B. "Approved": When used in conjunction with Architect/Engineer of Record's action on Contractor's submittals, applications, and requests, the term "Approved" is limited to Architect/Engineer of Record's duties and responsibilities as stated in the General Contracting Services Agreement.
- C. "Cutting": Removal of existing construction necessary to permit installation or performance of other Work.
- D. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."
- E. "Experienced": When used with the term "installer," means having successfully completed a minimum of five (5) previous projects similar in size and scope to this Project; being familiar with the special requirements indicated; and having complied with requirements of authorities having jurisdiction.
 - 1. Using a term such as "carpentry" does not imply that certain construction activities must be performed by accredited or unionized individuals of a corresponding generic name, such as "carpenter." It also does not imply that requirements specified apply exclusively to tradespeople of the corresponding generic name.
- F. "Furnish": To supply, deliver to Project site, unload, and inspect for damage.
- G. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."
- H. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.
- I. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.
- J. "Install": Unload, temporarily store, unpack, assemble, erect, place, anchor, apply, work to dimension, finish, cure, protect, clean, and similar operations at Project site.

- K. "Installer": A contractor or another entity engaged by the Contractor, as an employee, subcontractor, or contractor of lower tier, to perform a particular construction operation, including installation, erection, application, and similar operations.
- L. "Owner": PBC, 2FM; also Client.
- M. "Patching": Fitting and repair work required to restore surfaces to original conditions after installation of other Work.
- N. "Preliminary Acceptance": The date on which Architect/Engineer of Record and the Board have determined that the work required under the Contract Documents has been essentially completed for the Project (except for Punch List Work), such that the Users may occupy and fully use the Work. If the nature of the Work requires a Certificate of Occupancy be issued, Preliminary Acceptance will typically coincide with the date of issuance of the City's Certificate of Occupancy.
- O. "Product": Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- P. "Project Manual": The book-sized volume, or volumes, that includes the procurement requirements, the contracting requirements, and the technical specifications.
- Q. "Project Site": The space available for performing construction activities, either exclusively or in conjunction with others performing other work as part of this Project. The extent of the Project Site is shown on the Drawings and may or may not be identical with the description of the land on which Project is located.
- R. "Provide": To furnish and install complete and ready for the intended use.
- S. "Regulations": Includes laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, as well as rules, conventions, and agreements within the construction industry that control performance of the Work.
- T. "Supply": Same as Furnish.
- U. "Substantial Completion": Same as Preliminary Acceptance.
- V. "User": The principal, students, their parents, teachers, support staff, volunteers, licensees, and local school council members of a particular school, on whose behalf the Board has undertaken this Project.

1.2 INDUSTRY STANDARDS

- A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

- B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.
- C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.
 - 1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.3 ABBREVIATIONS AND ACRONYMS

- A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities indicated in Gale's "Encyclopedia of Associations: National Organizations of the U.S." or in Columbia Books' "National Trade & Professional Associations of the United States."
- B. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
 - 1. AABC - Associated Air Balance Council; www.aabc.com.
 - 2. AAPFCO - Association of American Plant Food Control Officials; www.aapfco.org.
 - 3. AASHTO - American Association of State Highway and Transportation Officials; www.transportation.org.
 - 4. ABMA - American Bearing Manufacturers Association; www.americanbearings.org.
 - 5. ACI - American Concrete Institute; (Formerly: ACI International); www.concrete.org.
 - 6. ACPA - American Concrete Pipe Association; www.concrete-pipe.org.
 - 7. AGA - American Gas Association; www.aga.org.
 - 8. AISC - American Institute of Steel Construction; www.aisc.org.
 - 9. ANSI - American National Standards Institute; www.ansi.org.
 - 10. AOSA - Association of Official Seed Analysts, Inc.; www.aosaseed.com.
 - 11. ASCE - American Society of Civil Engineers; www.asce.org.
 - 12. ASCE/SEI - American Society of Civil Engineers/Structural Engineering Institute; (See ASCE).
 - 13. ASME - ASME International; (American Society of Mechanical Engineers); www.asme.org.
 - 14. ASSE - American Society of Safety Engineers (The); www.asse.org.
 - 15. ASSE - American Society of Sanitary Engineering; www.asse-plumbing.org.
 - 16. ASTM - ASTM International; (American Society for Testing and Materials International); www.astm.org.
 - 17. AWS - American Welding Society; www.aws.org.
 - 18. CFSEI - Cold-Formed Steel Engineers Institute; www.cfsei.org.
 - 19. CLFMI - Chain Link Fence Manufacturers Institute; www.chainlinkinfo.org.
 - 20. CRSI - Concrete Reinforcing Steel Institute; www.crsi.org.

21. CSI - Construction Specifications Institute (The); www.csinet.org.
22. CTI - Cooling Technology Institute; (Formerly: Cooling Tower Institute); www.cti.org.
23. FSA - Fluid Sealing Association; www.fluidsealing.com.
24. ICC - International Code Council; www.iccsafe.org.
25. ICEA - Insulated Cable Engineers Association, Inc.; www.icea.net.
26. Intertek - Intertek Group; (Formerly: ETL SEMCO; Intertek Testing Service NA); www.intertek.com.
27. ISO - International Organization for Standardization; www.iso.org.
28. MFMA - Metal Framing Manufacturers Association, Inc.; www.metalframingmfg.org.
29. MHIA - Material Handling Industry of America; www.mhia.org.
30. NAAMM - National Association of Architectural Metal Manufacturers; www.naamm.org.
31. NACE - NACE International; (National Association of Corrosion Engineers International); www.nace.org.
32. NAIMA - North American Insulation Manufacturers Association; www.naima.org.
33. NCMA - National Concrete Masonry Association; www.ncma.org.
34. NECA - National Electrical Contractors Association; www.necanet.org.
35. NEMA - National Electrical Manufacturers Association; www.nema.org.
36. NETA - InterNational Electrical Testing Association; www.netaworld.org.
37. NRMCA - National Ready Mixed Concrete Association; www.nrmca.org.
38. NSF - NSF International; (National Sanitation Foundation International); www.nsf.org.
39. NSPE - National Society of Professional Engineers; www.nspe.org.
40. PDI - Plumbing & Drainage Institute; www.pdionline.org.
41. RCSC - Research Council on Structural Connections; www.boltcouncil.org.
42. SEI/ASCE - Structural Engineering Institute/American Society of Civil Engineers; (See ASCE).
43. SMA - Screen Manufacturers Association; www.smainfo.org.
44. SMACNA - Sheet Metal and Air Conditioning Contractors' National Association; www.smacna.org.
45. SSPC - SSPC: The Society for Protective Coatings; www.sspc.org.
46. SWPA - Submersible Wastewater Pump Association; www.swpa.org.
47. UL - Underwriters Laboratories Inc.; www.ul.com.

C. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. This information is believed to be accurate as of the date of the Contract Documents.

1. ICC - International Code Council; www.iccsafe.org.
2. ICC-ES - ICC Evaluation Service, LLC; www.icc-es.org.

D. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Information is subject to change and is up-to-date as of the date of the Contract Documents.

1. COE - Army Corps of Engineers; www.usace.army.mil.

2. DOC - Department of Commerce; National Institute of Standards and Technology; www.nist.gov.
 3. DOE - Department of Energy; www.energy.gov.
 4. EPA - Environmental Protection Agency; www.epa.gov.
 5. FG - Federal Government Publications; www.gpo.gov.
 6. GSA - General Services Administration; www.gsa.gov.
 7. OSHA - Occupational Safety & Health Administration; www.osha.gov.
 8. USDJ - Department of Justice; Office of Justice Programs; National Institute of Justice; www.ojp.usdoj.gov.
- E. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. This information is subject to change and is believed to be accurate as of the date of the Contract Documents.
1. CFR - Code of Federal Regulations; Available from Government Printing Office; www.gpo.gov/fdsys.
 2. FED-STD - Federal Standard; (See FS).
 3. FS - Federal Specification; Available from Department of Defense Single Stock Point; <http://dodssp.daps.dla.mil>.
 - a. Available from Defense Standardization Program; www.dsp.dla.mil.
 - b. Available from General Services Administration; www.gsa.gov.
 - c. Available from National Institute of Building Sciences/Whole Building Design Guide; www.wbdg.org/ccb.
 4. USAB - United States Access Board; www.access-board.gov.
 5. USATBCB - U.S. Architectural & Transportation Barriers Compliance Board; (See USAB).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 42 20

SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.
- B. Related Requirements:
 - 1. Section 01 10 00 - SUMMARY for work restrictions and limitations on utility interruptions.
 - 2. Section 31 23 19 - DEWATERING for disposal of ground water at Project site.
 - 3. Section 32 12 16 - ASPHALT PAVING for construction and maintenance of asphalt pavement for temporary roads and paved areas.
 - 4. Section 32 13 13 - CONCRETE PAVING for construction and maintenance of cement concrete pavement for temporary roads and paved areas.

1.2 USE CHARGES

- A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Provide and pay for all electrical power, lighting, water, heating and cooling, ventilation, and sewer service required by all entities for construction purposes at the Project site.
 - 1. Install electrical service to comply with NFPA 70.
- C. Implementation and Termination Schedule: Within 15 days of date established for submittal of Contractor's Construction Schedule, submit a schedule indicating implementation and termination of each temporary utility.
- D. Trade Jurisdictions: Assigned responsibilities for installation and operation of temporary utilities are not intended to interfere with trade regulations and union jurisdictions.
- E. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.
 - 1. Obtain required certifications and permits.
 - 2. Provide copies of reports of tests, inspections, meter readings, and similar procedures performed on temporary utilities.

1.3 TELECOMMUNICATIONS SERVICES

- A. Provide, maintain, and pay for telecommunications services to field office and field personnel, as required for adequate Project communication.

- B. Provide, maintain, and pay for broadband and WiFi capability at field offices.

1.4 TEMPORARY SANITARY FACILITIES AND PEST CONTROL

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization. Comply with regulations and health codes for type, number, location, operation, and maintenance of fixtures and facilities.
 - 1. Self-Contained Toilet Units: Single-occupant units of chemical, aerated recirculation, or combustion type; vented; fully enclosed with a glass-fiber-reinforced polyester shell or similar nonabsorbent material.
 - 2. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
 - 3. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled.
 - a. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.
 - 4. Drinking-Water Facilities: Provide bottled-water, drinking-water units.
 - 5. Locate toilets and drinking-water fixtures so personnel need not walk more than two stories vertically or 200 feet horizontally to facilities.
 - 6. Maintain daily in clean and sanitary condition.
- B. Pest Control: Before deep foundation work has been completed, retain a local exterminator or pest-control company to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests. Engage this pest-control service to perform extermination and control procedures at regular intervals so Project shall be free of pests and their residues at Preliminary Acceptance. Obtain extended warranty for the Board. Perform control operations lawfully, using environmentally safe materials.

1.5 ELEVATORS, STAIRS, AND HOISTS

- A. Provide facilities for hoisting materials and personnel. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- B. Until permanent stairs are available, provide temporary stairs where ladders are not adequate. Cover finished, permanent stairs with protective covering of plywood or similar material so finishes shall be undamaged at time of acceptance.
- C. Use of the Client's existing elevators will be permitted, as long as elevators are cleaned and maintained in a condition acceptable to the Client.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.
 - 2. Comply with loading restrictions of existing elevator.

- D. Use of the Client's existing stairs will be permitted, as long as stairs are cleaned and maintained in a condition acceptable to the Client.
 - 1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If, despite such protection, stairs become damaged, restore damaged areas so no evidence remains of correction work.

1.6 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
 - 1. Paint with appropriate colors, graphics, and warning signs to inform personnel and public of possible hazard.
 - 2. Where appropriate and needed, provide lighting, including flashing red or amber lights.
- B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building. Comply with authorities having jurisdiction.
- C. Provide barriers and covered walkways on school property to the satisfaction of the Board at all walkways and entrances/exits. Covered walkways shall extend a minimum of 20 feet from entrances. Barriers shall be provided to restrict patch of travel to protected areas.
 - 1. Construct covered walkways using scaffold or shoring framing.
 - 2. Provide wood-plank overhead decking, protective plywood enclosure walls, handrails, barricades, warning signs, lights, safe, clean, and well-drained walkways, and similar provisions for protection and safe passage.
 - 3. Paint and maintain in a manner approved by the Board and Architect/Engineer of Record.
 - 4. For safety barriers, sidewalk canopies, and similar uses, provide minimum 5/8-inch thick exterior plywood.
- D. Provide protection for trees and plants designated to remain. Install temporary fencing as indicated or outside the drip line of trees to protect vegetation from construction damage. Protect tree root systems from damage, flooding, and erosion. Replace damaged plants.

1.7 FENCING

- A. Provide 8 foot high fence around construction site; equip with vehicular and pedestrian gates with locks. Locate where indicated.
- B. Construction: Commercial grade chain link fence.
 - 1. 9 gauge 2" galvanized steel mesh, 8 feet high. Temporary fencing (where allowed) may be 6 feet high).
 - 2. 3" outside dimension galvanized end posts with caps
 - 3. 2" outside dimension galvanized line (intermediate) posts
 - 4. 10 ft. max. center to center, with caps

5. 1-5/8" outside dimension galvanized top and bottom rails
 6. 12 gauge min. galvanized ties
 7. Required fittings for proper installation of above.
 8. Opaque fabric meshing affixed to fence as required by Chicago Municipal Code Section 13-32-125.
- C. Construction: Wood. At Contractor's option, or as indicated.
1. Plywood, 8 feet high.
 2. Framing: four 2-by-4-inch rails.
 3. Preservative-treated wood posts spaced not more than 8 feet apart.
- D. Set fence posts in compacted mixture of gravel and earth.
- E. Provide gates in sizes and at locations necessary to accommodate delivery vehicles and other construction operations.
- F. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Provide the Board with one set of keys.
- 1.8 EXTERIOR ENCLOSURES
- A. Provide temporary weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.
1. Where heating or cooling is needed and permanent enclosure is not complete, provide insulated temporary enclosures. Coordinate enclosure with ventilating and material drying or curing requirements to avoid dangerous conditions and effects.
 2. Vertical Openings: Close openings of 25 sq. ft. or less with plywood or similar materials.
 3. Horizontal Openings: Close openings in floor or roof decks and horizontal surfaces with load-bearing, wood-framed construction.
 4. Install tarpaulins securely using fire-retardant-treated wood framing and other materials.
 5. Where temporary wood or plywood enclosure exceeds 100 sq. ft. in area, use fire-retardant-treated material for framing and main sheathing.
- B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment involved, including temporary utility services. Sheds may be open shelters or fully enclosed spaces within building or elsewhere on-site.
1. Construct framing, sheathing, and siding using fire-retardant-treated lumber and plywood.
 2. Paint exposed lumber and plywood with exterior-grade acrylic-latex emulsion over exterior primer.

1.9 INTERIOR ENCLOSURES AND PROTECTION

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Board-occupied areas, to prevent penetration of dust, noise, odors, and moisture into Board-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction (where adjacent to occupied areas): Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - 1. 1/2-inch fire-retardant plywood is permitted on construction side.
 - 2. Insulate partitions to provide noise protection to occupied areas.
 - 3. Paint surfaces exposed to view from Board-occupied areas.
- C. Construction (where concealed from occupied areas): dustproof, floor-to-ceiling partitions of not less than nominal 4-inch studs, 2 layers of 3-mil polyethylene sheets, inside and outside temporary enclosure.
- D. Protect floors with 2 layers of 3-mil polyethylene sheets, extending sheets 18 inches up the side walls. Overlap and tape full length of joints. Cover floor with 3/4-inch fire-retardant plywood.
- E. Equip partitions with dustproof doors and security locks. Maintain water-dampened foot mats at doors.
- F. Construct a vestibule and airlock at each entrance to temporary enclosure with not less than 48 inches between doors.

1.10 HEATING, VENTILATION, AND COOLING

- A. Provide temporary heating, ventilation, and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment from that specified that shall not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
- B. Maintain a minimum temperature of 50 deg F in permanently enclosed portions of building for normal construction activities, and 65 deg F for finishing activities and areas where finished Work has been installed.
- C. Unless the Client authorizes use of permanent heating system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.
 - 1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
 - 2. Heating Units: Listed and labeled, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use for type of fuel being consumed.

1.11 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Client's operations from unauthorized entry, vandalism, or theft.

- B. Provide temporary enclosures with lockable entrances to protect partially completed areas.

1.12 FIRE PROTECTION

- A. Until fire-protection needs are supplied by permanent facilities, install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241.
 - 1. Provide fire extinguishers, installed on walls on mounting brackets, visible and accessible from space being served, with sign mounted above.
 - a. Field Offices: Class A stored-pressure water-type extinguishers.
 - b. Other Locations: Class ABC dry-chemical extinguishers or a combination of extinguishers of NFPA-recommended classes for exposures.
 - c. Locate fire extinguishers where convenient and effective for their intended purpose; provide not less than one extinguisher on each floor at or near each usable stairwell.
 - 2. Store combustible materials in containers in fire-safe locations.
 - 3. Maintain unobstructed access to fire extinguishers, fire hydrants, temporary fire-protection facilities, stairways, and other access routes for firefighting. Prohibit smoking in hazardous fire-exposure areas.
 - 4. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition.
 - 5. Permanent Fire Protection: At earliest feasible date in each area of Project, complete installation of permanent fire-protection facility, including connected services, and place into operation and use. Instruct key personnel on use of facilities.
 - 6. Develop and supervise an overall fire-prevention and first-aid fire-protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
 - 7. Provide hoses for fire protection of sufficient length to reach construction areas. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.
 - 8. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

1.13 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Client.
- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.

1.14 DEWATERING FACILITIES

- A. Comply with requirements in applicable Division 31 Sections for temporary drainage and dewatering facilities and operations not directly associated with construction activities included in individual Sections. Where feasible, use same facilities. Maintain Project site, excavations, and construction free of water.
- B. Provide earthen embankments and similar barriers in and around excavations and subgrade construction, sufficient to prevent flooding by runoff of stormwater from heavy rains.
- C. Dispose of rainwater in a lawful manner that shall not result in flooding Project or adjoining property nor endanger permanent Work or temporary facilities.
- D. Before connection and operation of permanent drainage piping system, provide temporary drainage where roofing or similar waterproof deck construction is completed.
- E. Remove snow and ice as required to minimize accumulations.

1.15 WASTE REMOVAL

- A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.
- B. Provide containers of adequate size to handle waste from construction operations. Provide containers with lids. Remove trash from site periodically.
- C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.
- D. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.
- E. Containerize and clearly label hazardous, dangerous, or unsanitary waste materials separately from other waste.
- F. If required by authorities having jurisdiction, provide separate containers, clearly labeled, for each type of waste material to be deposited.

1.16 PROJECT IDENTIFICATION

- A. Provide project identification sign of design and construction as indicated by Client.
 - 1. Standard sign is 4'-0" x 8'-0" 1/2 inch thick,
 - 2. Sign vendor will be identified by the Client's representative.
- B. Erect on site at location established by Architect/Engineer of Record.
- C. Provide temporary signs to indicate directional information to construction personnel and visitors; and as required by law.

1. Construct signs of exterior-type Grade B-B high-density concrete form overlay plywood in sizes and thicknesses indicated. Support on posts or framing of preservative-treated wood or steel.
2. Paint sign panel and applied graphics with exterior-grade alkyd gloss enamel over exterior primer.

D. No advertising signage is permitted. Do not allow installation of unauthorized signs.

1.17 FIELD OFFICES

- A. Offices: Prefabricated or Mobile Units with lockable entrances, and operable windows, on foundations adequate for normal loading. Offices to be weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture.
1. Provide incombustible construction for offices, shops, and sheds located within construction area or within 30 feet of building lines. Comply with NFPA 241.
 2. Provide private toilet complete with water closet, lavatory, and medicine cabinet with mirror.
 3. Provide coffee machine and supplies, including regular and decaffeinated coffee, filters, cups, stirring sticks, creamer, sugar, and sugar substitute.
- B. Provide space for Project meetings, with table and chairs to accommodate 10 persons.
- C. An alternative accessible location will be designated for Project meetings when requested. Location will be coordinated and agreed upon by School, Board, and Contractor.
- D. Provide containerized, tap-dispenser, bottled-drinking-water units, including paper cup supply.
1. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 to 55 deg F.

1.18 INFORMATIONAL SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.
- C. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
 2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
 3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with

water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

1.19 QUALITY ASSURANCE

- A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

1.20 PROJECT CONDITIONS

- A. Temporary Use of Permanent Facilities: Engage, via Contractor, Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Chain-Link Fencing: Minimum 2-inch, 0.148-inch-thick, galvanized-steel, chain-link fabric fencing; minimum 6 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch-OD line posts and 2-7/8-inch-OD corner and pull posts, with 1-5/8-inch-OD top rails.
- B. General: Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect/Engineer of Record. Provide materials suitable for use intended.
- C. Tarpaulins: Fire-resistive labeled with flame-spread rating of 15 or less.

2.2 EQUIPMENT

- A. General: Provide equipment suitable for use intended.
- B. Fire Extinguishers: Hand carried, portable, UL rated. Provide class and extinguishing agent as indicated or a combination of extinguishers of NFPA-recommended classes for exposures.
 - 1. Comply with NFPA 10 and NFPA 241 for classification, extinguishing agent, and size required by location and class of fire exposure.
- C. Electrical Outlets: Properly configured, NEMA-polarized outlets to prevent insertion of 110- to 120-V plugs into higher-voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.

- D. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
 - 1. Locate facilities to limit site disturbance as specified in Section 01 10 00 - SUMMARY.
- B. Relocate temporary services and facilities as required by progress of the Work.
- C. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.
- D. Engage appropriate local utility company or authorized personnel to install temporary service or connect to existing service. Where utility company provides only part of the service, provide the remainder with matching, compatible materials and equipment. Comply with utility company recommendations.
- E. Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- F. Provide protection, operate temporary facilities, and conduct construction in ways and by methods that comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects. Avoid using tools and equipment that produce harmful noise. Restrict use of noisemaking tools and equipment to hours that shall minimize complaints from persons or firms near Project site.

3.2 PREPARATION

- A. Arrange with utility company, the Client, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Provide and plan for adequate capacity for temporarily facilities at each stage of construction.
- C. Obtain easements to bring temporary utilities to Project site where the Board's easements cannot be used for that purpose.

3.3 TEMPORARY UTILITY INSTALLATION

- A. General: Install temporary service or connect to existing service.
 - 1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Electric Power Service: Provide weatherproof, grounded electric power service and distribution system of sufficient size, capacity, and power characteristics during construction period. Include meters, transformers, overload-protected disconnecting means, automatic ground-fault interrupters, and main distribution switchgear.
 - 1. Install electric power service underground, unless overhead service must be used.
 - 2. Install power distribution wiring overhead and rise vertically where least exposed to damage.
 - 3. Connect temporary service to the Client's existing power source, as directed by electric company officials.
- C. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
 - 1. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths shall not reach areas where construction activities are in progress. Do not exceed safe length-voltage ratio.
 - 2. Provide warning signs at power outlets other than 110 to 120 V.
 - 3. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or other traffic areas.
 - 4. Provide metal conduit enclosures or boxes for wiring devices.
 - 5. Provide 4-gang outlets, spaced so 100-foot extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
- D. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations and traffic conditions.
 - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
 - 2. Provide one 100-W incandescent lamp per 500 sq. ft., uniformly distributed, for general lighting, or equivalent illumination.
 - 3. Provide one 100-W incandescent lamp every 50 feet in traffic areas.
 - 4. Provide one 100-W incandescent lamp per story in stairways and ladder runs, located to illuminate each landing and flight.
 - 5. Install exterior-yard site lighting that shall provide adequate illumination for construction operations, traffic conditions, and signage visibility when the Work is being performed.
 - 6. Install lighting for Project identification sign.
- E. Sewers and Drainage: If sewers are available, provide temporary connections to remove effluent that can be discharged lawfully. If sewers are not available or cannot be used, provide drainage ditches, dry wells, stabilization ponds, and similar facilities.
 - 1. Filter out excessive soil, construction debris, chemicals, oils, and similar contaminants that might clog sewers or pollute waterways before discharge.

2. Connect temporary sewers to municipal system as directed by sewer department officials.
 3. Maintain temporary sewers and drainage facilities in a clean, sanitary condition. After heavy use, restore normal conditions promptly.
 4. Provide temporary filter beds, settlement tanks, separators, and similar devices to purify effluent to levels acceptable to authorities having jurisdiction.
- F. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.
1. Use trigger-operated nozzles for water hoses, to avoid waste of water.
- G. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
- H. Heating: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- I. Fencing: Unless otherwise indicated on the drawings, posts are to be set at a depth of no less than 3'0" below ground level and anchored in concrete to full depth. Posts shall be properly capped. End posts and line posts will be evenly spaced at a distance of no more than 10'-0" apart, center to center. Fence shall be erected with top and bottom rails of 1-5/8" o.d. and ties of no less than 12 gauge, securing the galvanized steel mesh to the rails. The bottom rail shall be placed at a distance of no greater than 2" from the bottom of the posts and shall be secured by the use of proper fittings to corner and intermediate posts. Top rail shall run continuously through line post caps and shall be fastened to end posts no less than 2" from the top by the use of proper fittings.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
1. Comply with work restrictions specified in Section 01 10 00 - SUMMARY.
- C. Temporary Erosion and Sedimentation Control: Comply with requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent and requirements specified in Section 31 10 00 - SITE CLEARING.
- D. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed

areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
 2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
 3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
 4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- E. Stormwater Control: Comply with requirements of Authorities Having Jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.
- F. Tree and Plant Protection: Comply with requirements specified in Section 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION.
- G. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.
- H. Site Enclosure Fence: Before construction operations begin, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.
1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations as indicated on Drawings.
 2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.
- I. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.
- J. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.
- K. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. exterior.
- 3.5 STORMWATER RUNOFF AND GROUNDWATER MANAGEMENT
- A. Ten (10) days prior to commencing Work, the contractor shall provide the Architect a StormWater Management Plan and MWRD permit schedule. This plan shall stipulate

provisions for dewatering, pumping, collection, temporary storage, and discharge or disposal of stormwater, perched water and other liquids, contaminated and/or uncontaminated, at the site so as to facilitate water and soil removal as well as minimize disposal costs for contaminated fluids. The Architect must review and approve this plan.

- B. The Contractor shall have access to a weather notification system and manage the Work so as not to accumulate storm water on the site during excavation.
- C. The Contractor shall prevent stormwater, groundwater or perched water from entering excavation areas. The Contractor shall implement the approved SWP in accordance with conditions, or as directed by the Architect.
- D. The Contractor shall manage and remove water from site excavation in accordance with the City of Chicago and MWRDGC's requirements. The Contractor shall not discharge onsite water into the City of Chicago sewer without first obtaining all required permits from the City of Chicago Building Department and MWRDGC.

3.6 OPERATION, TERMINATION, AND REMOVAL

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
 - 1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
 - 1. Materials and facilities that constitute temporary facilities are property of The Owner. Owner reserves right to take possession of Project identification signs.
 - 2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
 - 3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 017700 "Closeout Procedures."

3.7 CLEANING

- A. Provide cleaning of temporary facilities on a daily basis; including, but not limited to: temporary offices, first-aid stations, toilets, wash facilities, lunchrooms, and similar areas.
- B. Maintain facilities in good operating condition until removal. Protect from damage caused by freezing temperatures and similar elements.
- C. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.
- D. Prevent water-filled piping from freezing. Maintain markers for underground lines. Protect from damage during excavation operations.

3.8 CLOSEOUT ACTIVITIES

- A. Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Preliminary Acceptance.
 - 1. Except for using permanent fire protection as soon as available, do not change over from using temporary security and protection facilities to permanent facilities until Preliminary Acceptance.
- B. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility.
- C. Materials and facilities that constitute temporary facilities are the property of Contractor. The Board reserves right to take possession of Project identification signs.
- D. Remove temporary paving not intended for or acceptable for integration into permanent paving. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
- E. Prior to Preliminary Acceptance, restore Board's existing facilities to condition established before initial use.
- F. Prior to Preliminary Acceptance, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.
- G. Remove all support facilities near and prior to Preliminary Acceptance. Personnel remaining after Preliminary Acceptance will be permitted to use permanent facilities, under conditions acceptable to the Board.
- H. Clean and repair damage caused by installation or use of temporary work.

- I. Restore new permanent facilities used during construction to specified condition.
- J. Refer to final cleaning requirements in Section 01 77 00 - Closeout Procedures

END OF SECTION 01 50 00

SECTION 01 50 10 - COMMISSION REPRESENTATIVE FIELD OFFICE**PART 1 GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings
- B. Book 1: Project Information, Instructions to Bidders, and Execution Documents
- C. Book 2: Standard Terms and Conditions for Construction Contracts

1.2 COMMISSION REPRESENTATIVE'S FIELD OFFICE

- A. Furnish, erect and maintain a clean, weather-tight office at the site of the Work for the duration of the Contract, through final completion, for the sole and exclusive use of the Commission. No on-site Work may commence until the Commission Representative's Field Office required by this Subsection is in place, fully functional and approved by the Commission. The proposed location of the Commission Representative's Field Office and the pedestrian gate for access to the fenced site is indicated on the Approved Site Utilization Plan.
- B. Provide the Commission Representative's Field Office with toilet facility entirely separate from, unconnected to, and not to be shared with the Contractor's Field Office.

NOTE: PROJECT TEAM TO DETERMINE JOB OFFICE SIZE; EDIT 'C' AND 'D' BELOW AS NEEDED BASED ON SIZE OF PROJECT; ALSO EDIT 'C' FOR ADA COMPLIANCE FOR RAMP / BATHROOM / PATH OF EGRESS IF DEEMED NECESSARY FOR PROJECT FIELD OFFICE APPLICATION

- C. Provide the Commission Representative's Field Office not less than 400 square feet in area and with a ceiling not less than 7 feet high with a minimum of one private offices and one common area, and one toilet. The one private offices and common area shall be equipped with minimum of (4) 110-120v 20amp 3-prong grounded duplex receptacles each section, equally distributed across (2) power circuits each section. The field office shall be equipped with a minimum of 100-amp electrical service. The field office shall include an interior toilet facility, shall be painted, heated, air-conditioned, lighted, provided with lockable windows with blinds or shades that operate, and doors with cylinder locks and deadbolt locks. Provide appropriate signage on the outside of the trailer indicating PBC Field Office. Enclose the air space beneath the trailer with exterior grade plywood panel siding painted to match office exterior. Provide hinged access doors at utility connection area. Provide stair access with handrails per code requirements.
- D. Provide weekly janitorial service for the Commission Representative's Field Office and interior toilet facility.
- E. Pay all expenses in connection with the Commission Representative's Field Office, including but not limited to, the installation and high-speed internet service, heat, air-conditioning, light, water, sewerage, janitorial services, equipment, pest control, snow removal, set up and take down. HVAC filters shall be replaced every month.

NOTE: PBC TEAM GENERALLY CONSISTS OF PROJECT MGR, ASST PROJ MGR, AND DOCUMENT CONTROL REP; ON SMALLER PROJECTS, REDUCE QUANTITIES IN 'F' BELOW AS NEEDED; DETERMINE THE AOR TEAM STAFF.

F. Furnish the following equipment and furniture:

1. (2) - 60" x 30" desks with two (2) drawer (one file and one miscellaneous) pedestal file cabinets and 2 non folding chairs with upholstered seat and back.
2. (2) - 2 drawer lateral file cabinets.
3. (1) - layout table with minimum top size of 42" x 60". An adjustable height drafting stool with upholstered seat and back shall be provided.
4. (2) - 8' x 3' folding conference tables and 20 folding chairs.
5. Provide (1) 48" x 72" (min) and (1) 48" x 96" wall mounted dry erase boards.
6. (1) - equipment cabinet with lock of minimum inside dimensions of 72" high x 48" wide x 24" deep with (5) shelves. The walls shall be of steel with a 3/32" minimum thickness with concealed hinges and enclosed lock constructed to prevent entry by force.
7. (1) 1200-watt Microwave oven.
8. (1) – Keurig Office Pro brewing system or approved equal.
9. (1) - first aid cabinet fully equipped and maintained on monthly basis.
10. (1) - 5 gallon hot and cold water dispenser with cup dispenser, cups and bottled drinking water supply service.
11. Central heating and air conditioning appropriate to trailer size and construction per ASHRAE 90.1 efficiency requirement.
12. (1) - 6 cubic feet refrigerator with freezer compartment.
13. (1) - plan rack with (12) 42" capacity hanging clamps.
14. (1) - fire extinguisher.
15. (1) – space heater
16. Printer: Provide a multifunction color printer (fax, copy, scan and print) the latest version with toner cartridges, paper, and a maintenance service contract for the duration of project.
 - a. Canon Image Runner Advance C3525i III Color Multifunction Printer or equal (Dual Tray - 8-1/2" x 11" and 11" x 17" format) with scanning capability (PDF format)

- b. Provide required toner cartridges throughout duration of the project.
- c. Provide 24lb 8 ½" x 11" and 11" x 17" format paper throughout duration of project.

NOTE: DESIGN TEAM VERIFY IF WIRELESS CONNECTION IS AN OPTION; VERIFY INTERNET CONNECTION WITH PBC'S I.T. DEPARTMENT IF APPLIES; VERIFY ABILITY TO UPLOAD DOCUMENTS TO PBC'S CW

- 17. Network: Provide Local Area Network (LAN) and a Wireless Area Network (WAN) communication and Internet access for Commission computers with all associated equipment, drops, patch cords, power cords, etc., for the duration of the project. Network the printer/scanner to all Commission computers to enable direct printing and scanning to and from any computer.
- 18. Internet Access: Provide an unlimited Internet access account to achieve a minimum of 100MB per second download speed.
- G. The Commission Representative's field office and all furnishing and equipment will remain the property of the Contractor at the completion of the Project.
- H. Provide (2) on-site parking spaces adjacent to Commissions Trailer for duration of project.
- I. Submit two (2) copies of the site field office layout plan required for approval by the Commission Representative.

1.3 SUBMITTALS

- A. Unless provided for elsewhere in the contract documents, prior to any onsite work, the Contractor is to prepare and submit to the Architect for approval the Commission Representative's Site Field Office Location Plan showing field offices and related temporary support facilities. If requested by the Contractor, a preliminary meeting to review site elements and construction operations including trailer and gate locations with the Architect and Commission Representative, prior to submission of the Plan will be held.

PART 2 PRODUCTS

- 2.1 Provide new materials and equipment. Undamaged, previously used materials and equipment in serviceable condition may be used if approved by the Commission Representative. Provide materials suitable for use intended.

PART 3 EXECUTION

- 3.2 The proposed location of the Commission Representatives field office and the pedestrian gate for access to the fenced site is indicated on the approved Site Utilization Plan.
- 3.3 Locate and maintain the field office with temporary walkways providing easy and safe access.
- 3.4 Maintain support facilities until substantial completion or as directed by the Commission Representative.

END OF SECTION 01 50 10

SECTION 01 56 11 – GENERAL DUST, FUME AND ODOR CONTROL

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the following:
 - 1. Dust Control.
 - 2. Fume and Odor Controls.
 - 3. Requirements for VOC-Content-Restricted products Removing debris

1.2 PERFORMANCE STANDARD

- A. Dust and fume emission control is required to maintain a healthful learning environment for students, maintain good public relations with neighbors and employees, prevent damage, minimize cleaning and maintenance costs, and to comply with regulations and laws. All contractors (including subcontractors, lower-tier subcontractors, and suppliers) who perform work or provide services at Chicago Public School facilities are required to control dust and fume emissions from their operations and/or activities.
- B. Controls include the containment or removal of all nuisance or noxious dust, vapors, fumes, odors or emissions caused by construction, demolition, renovation, restoration, or related activities including, but not limited to sawing, cutting, grinding, sanding, abrading, sweeping, crushing, scraping, gluing, prying, plowing, heating, finishing, painting, welding, torch cutting or burning, or any other related processes that can create noxious dust, fumes or odors.
- C. No visible emissions or unreasonable odors shall be permitted outside the work area.

1.3 DEFINITIONS

- A. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- B. CDPH: Chicago Department of Public Health
- C. HEPA Filter: High Efficiency Particulate Air filter capable of trapping 99.97% percent of particles greater than 0.3 micrometers in mass median aerodynamic equivalent diameter.
- D. IDPH: Illinois Department of Public Health.
- E. Interior of Building: Anywhere inside the exterior weather barrier.

- F. MEC: Managing Environmental Consultant. Entity engaged by the Board responsible for the design of environmental work, maintenance of related documents, and conducting oversight and review of the environmental work, submittals, and reports.
- G. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- H. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings.
 - 2. Interior adhesives and sealants, including flooring adhesives.
 - 3. Wet-applied roofing and waterproofing.
 - 4. Other products when specifically stated in the specifications.

1.4 REFERENCE STANDARDS

- A. 29 CFR 1910 - Occupational Safety and Health Standards; current edition.
- B. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- C. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- D. 40 CFR 61 - National Emission Standards For Hazardous Air Pollutants; U.S. Environmental Protection Agency; current edition.
- E. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2013).
- F. Chicago Building Code; current edition
- G. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

1.5 ACTION SUBMITTALS

- A. See Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.
- C. MSDS/SDS: For all products used that could potentially emit dusts, fumes, vapors or odors, etc. shall be submitted to the Architect for approval prior to the use of the product.

1.6 QUALITY ASSURANCE

- A. Contractor is responsible for compliance with all applicable federal, state, county and municipal laws, regulations and ordinances including, but not limited to, those listed below, which are incorporated by reference.
 - 1. 29 CFR 1910
 - 2. 29 CFR 1926
 - 3. 40 CFR Part 61
 - 4. Chicago Building Code: 11-4-2170: Demolition and renovation safeguards.
 - 5. Chicago Building Code: 11-4-2190: Sandblasting, grinding and chemical washing of buildings, facilities or other structures - Dust minimization--Containment, wetting or vacuuming; plan required.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
 - b. Published product data showing compliance with requirements.
 - c. Certification by manufacturer that product complies with requirements.
- C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. VOC-Content-Restricted Products: refer to Section 01 81 16 – VOC LIMITS FOR ADHESIVES, SEALANTS, PAINTS, AND COATINGS.

PART 3 - EXECUTION

3.1 BARRIERS OR WORK AREA ISOLATION

- A. Contractor shall prevent the spread of dust, fumes and odors from their immediate work areas by:
 - 1. Erecting dust-tight barriers between indoor work areas and adjacent occupied areas. Construction barriers may be used for this purpose if suitably constructed to prevent dust, fume or odor migration.
 - 2. Closing and or covering windows, intake vents, louvers, or other building openings in the immediate vicinity of outdoor work, sufficient to prevent dust,

fume or odor migration into the building interior. If such openings cannot be adequately sealed by closing, then poly sheeting, tape, or other impermeable covers shall be used.

3. The Contractor shall provide a filtered, local exhaust system for the isolated work area.
- B. Contractor is prohibited from creating other hazardous or uncomfortable conditions for building occupants, such as very hot, humid, cold, or other conditions created by ventilation system alterations or blockages, closed or open windows in hot or cold weather conditions.
- C. Contractor is responsible for making itself familiar with building conditions and shall take care to isolate its work area in such a manner that building occupant activities and comfort are not unreasonably disrupted.

3.2 DUST, FUME AND ODOR CONTROL

- A. Dust, fume or odor release shall be prevented by a suitable means, including but not limited to:
 1. Tools equipped with shrouds, HEPA filter equipped vacuum pickups.
 2. Alteration, shut down, or isolation of building ventilation systems in the immediate work vicinity.
 3. Shrouding around work activities.
 4. Shrouding stages, scaffolds, or other work platforms.
 5. Local exhaust ventilation systems exhausted to the outside of the building.
 6. Wet work methods.
- B. Contractor is responsible for selecting the means and methods it considers most suitable to achieve dust, fume and odor control.

3.3 FIELD QUALITY CONTROL

- A. Architect reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Contractor or Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.
- C. In the event that dust or fumes escape from the work area or create dirty conditions or contamination to nearby building spaces or grounds, the Contractor is responsible for all costs associated with the cleaning, testing and/or repair deemed necessary by the Owner and Architect.

END OF SECTION 01 56 11

SECTION 01 56 39 - TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.
- B. Related Sections:
 - 1. Section 01 50 00 - TEMPORARY FACILITIES AND CONTROLS for temporary site fencing.
 - 2. Section 31 10 00 - SITE CLEARING for removing existing trees and shrubs.

1.2 DEFINITIONS

- A. Caliper: Diameter of a trunk measured by a diameter tape or the average of the smallest and largest diameters at 6 inches above the ground for trees up to, and including, 4-inch size; and 12 inches above the ground for trees larger than 4-inch size.
- B. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.
- C. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings defined by a circle concentric with each tree with a radius 1.5 times the diameter of the drip line unless otherwise indicated.
- D. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Samples for Verification: For each type of the following:
 - 1. Organic Mulch: 1-pint volume of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.
 - 2. Protection-Zone Signage: Full-size Samples of each size and text, ready for installation.
- C. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.
 - 1. Species and size of tree.
 - 2. Location on site plan. Include unique identifier for each.

3. Reason for pruning.
4. Description of pruning to be performed.
5. Description of maintenance following pruning.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified arborist and tree service firm.
- B. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.
 1. Use sufficiently detailed photographs or videotape.
 2. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

- A. Arborist Qualifications: Certified Arborist as certified by ISA.
- B. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.
- C. Preinstallation Conference: Conduct conference at Project site.
 1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
 - a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
 - b. Enforcing requirements for protection zones.
 - c. Arborist's responsibilities.
 - d. Field quality control.

1.6 PROJECT CONDITIONS

- A. The following practices are prohibited within protection zones:
 1. Storage of construction materials, debris, or excavated material.
 2. Parking vehicles or equipment.

3. Foot traffic.
 4. Erection of sheds or structures.
 5. Impoundment of water.
 6. Excavation or other digging unless otherwise indicated.
 7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.
- B. Do not direct vehicle or equipment exhaust toward protection zones.
- C. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Topsoil: Natural or cultivated top layer of the soil profile or manufactured topsoil; containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 1 inch in diameter; and free of weeds, roots, and toxic and other nonsoil materials.
1. Obtain topsoil only from well-drained sites where topsoil is 4 inches deep or more; do not obtain from bogs or marshes.
- B. Topsoil: Stockpiled topsoil from location shown on Drawings.
- C. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.
1. Chain-Link Protection-Zone Fencing: Galvanized-steel fencing fabricated from minimum 2-inch opening, 0.148-inch-diameter wire chain-link fabric; with pipe posts, minimum 2-3/8-inch-OD line posts, and 2-7/8-inch-OD corner and pull posts and 0.177-inch-diameter bottom tension wire; with tie wires, hog ring ties, and other accessories for a complete fence system.
 - a. Height: 6 feet.
 2. Plywood Protection-Zone Fencing: Plywood framed with four 2-by-4-inch rails, with 4-by-4-inch preservative-treated wood posts spaced not more than 8 feet apart.
 - a. Height: 6 feet.
 - b. Plywood and Lumber: Comply with requirements in Section 061000 "Rough Carpentry."
 3. Gates: Single swing access gates matching material and appearance of fencing, to allow for maintenance activities within protection zones; leaf width 36 inches.

- D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:
 - 1. Size and Text: As shown on Drawings.
 - 2. Lettering: 3-inch- high minimum, black characters on white background.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.
- B. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

- A. Locate and clearly identify trees, shrubs, and other vegetation to remain or to be relocated. Tie a 1-inch blue-vinyl tape around each tree trunk at 54 inches above the ground.
- B. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- C. Tree-Protection Zones: Mulch areas inside tree-protection zones and other areas indicated.
 - 1. Apply 4-inch average thickness of organic mulch. Do not place mulch within 6 inches of tree trunks.

3.3 TREE- AND PLANT-PROTECTION ZONES

- A. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.
 - 1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.

2. Posts: Set or drive posts into ground one-third the total height of the fence without concrete footings. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Architect.
 3. Access Gates: Install where indicated; adjust to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Client and Architect. Install one sign spaced approximately every 20 feet on protection-zone fencing, but no fewer than signs with each facing a different direction.
- C. Maintain protection zones free of weeds and trash.
- D. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Client and Architect.
- E. Maintain protection-zone fencing and signage in good condition as acceptable to Client and remove when construction operations are complete and equipment has been removed from the site.
1. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
 2. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

- A. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 "Earth Moving."
- B. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.
- C. Redirect roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and redirect them without breaking. If encountered immediately adjacent to location of new construction and redirection is not practical, cut roots approximately 3 inches back from new construction and as required for root pruning.
- D. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

- A. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:
 - 1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
 - 2. Cut Ends: Coat cut ends of roots more than 1-1/2 inches in diameter with an emulsified asphalt or other coating formulated for use on damaged plant tissues and that is acceptable to arborist.
 - 3. Temporarily support and protect roots from damage until they are permanently redirected and covered with soil.
 - 4. Cover exposed roots with burlap and water regularly.
 - 5. Backfill as soon as possible according to requirements in Section 312000 "Earth Moving."
- B. Root Pruning at Edge of Protection Zone: Prune roots 12 inches outside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.
- C. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

- A. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:
 - 1. Prune trees to remain to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by arborist.
 - 2. Pruning Standards: Prune trees according to ANSI A300 (Part 1).
 - 3. Cut branches with sharp pruning instruments; do not break or chop.
 - 4. Do not apply pruning paint to wounds.
- B. Chip removed branches and dispose of off-site.

3.7 REGRADING

- A. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- B. Lowering Grade within Protection Zone: Where new finish grade is indicated below existing grade around trees, slope grade away from trees as recommended by arborist unless otherwise indicated.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.
- C. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.
- D. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- 3.8 FIELD QUALITY CONTROL
- A. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.
- 3.9 REPAIR AND REPLACEMENT
- A. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Client.
1. Submit details of proposed root cutting and tree and shrub repairs.
 2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
 3. Treat damaged trunks, limbs, and roots according to arborist's written instructions.
 4. Perform repairs within 24 hours.
 5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Client and Architect.
- B. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition or are damaged during construction operations that The Contractor determines are incapable of restoring to normal growth pattern.
1. Provide new trees of same size and species as those being replaced for each tree that measures 4 inches or smaller in caliper size.
 2. Plant and maintain new trees as specified in Section 329300 "Plants."
- C. Soil Aeration: Where directed by The Architect, aerate surface soil compacted during construction. Aerate 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch- diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augered soil and sand.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them as per direction from the The Architect.

END OF SECTION 01 56 39

SECTION 01 57 13 - LEED TEMPORARY EROSION AND SEDIMENT CONTROL**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Prevention of erosion due to construction activities.
- B. Prevention of sedimentation of waterways, and storm and sanitary sewers due to construction activities.

1.02 REFERENCE STANDARDS

- A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus; 2014.
- B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity; 1999a (Reapproved 2014).
- C. ASTM D4533/D4533M - Standard Test Method for Trapezoid Tearing Strength of Geotextiles; 2015.
- D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles; 2015a.
- E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile; 2016.
- F. ASTM D4873/D4873M - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples; 2017.
- G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit; Current Edition.

1.03 PERFORMANCE REQUIREMENTS

- A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP), whether the project is required by law to comply or not.
- B. Also comply with all more stringent requirements of City of Chicago and the State of Illinois.
- C. Develop and follow an Erosion and Sedimentation Prevention Plan and submit periodic inspection reports.
- D. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

- E. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
 - 1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
- F. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
 - 1. Control movement of sediment and soil from temporary stockpiles of soil.
 - 2. Prevent development of ruts due to equipment and vehicular traffic.
 - 3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to the Owner.
- G. Prevent polluting the air with dust and particulate matter from stored materials or construction debris.
- H. Sedimentation of Storm Sewer and Receiving Waterways: Prevent sedimentation of waterways, storm sewers, and sanitary sewers.
 - 1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Board; remove deposited sediments; comply with requirements of authorities having jurisdiction.
 - 2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.
- I. Open Water: Prevent standing water that could become stagnant.
- J. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Sustainable Design Documentation: Submit all submittals required in this section in accordance with procedures specified in Section 01 33 29 - LEED Sustainable Design Reporting.
- C. Erosion and Sedimentation Control Plan:
 - 1. Submit within 10 Days after Notice to Proceed.
 - 2. Include:
 - a. Site plan identifying soils and vegetation, existing erosion problems, and areas vulnerable to erosion due to topography, soils, vegetation, or drainage.
 - b. Site plan showing grading; new improvements; temporary roads, traffic accesses, and other temporary construction; and proposed preventive measures.
 - c. Where extensive areas of soil will be disturbed, include storm water flow and volume calculations, soil loss predictions, and proposed preventive measures.
 - d. Schedule of temporary preventive measures, in relation to ground disturbing activities. Coordinate with construction schedule

- e. Include narrative describing the program and maintenance.
- D. Certificate: Mill certificate for silt fence fabric attesting that fabric and factory seams comply with specified requirements, signed by legally authorized official of manufacturer; indicate actual minimum average roll values; identify fabric by roll identification numbers.
- E. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Bales: Air dry, rectangular straw bales.
 - 1. Cross Section: 14 by 18 inches, minimum; containing 5 cu. ft. or more of material.
 - 2. Bindings: Wire or nylon string, around long dimension.
- B. Bale Stakes: One of the following, minimum 3 feet long:
 - 1. Steel U-, C- or T-section, with minimum mass of 1.33 lb per linear foot.
 - 2. Wood, 2 by 2 inches, or 4 inches in diameter in cross section.
- C. Silt Fence Fabric: Polypropylene geotextile resistant to common soil chemicals, mildew, and insects; non-biodegradable; in longest lengths possible; fabric including seams with the following minimum average roll lengths:
 - 1. Average Opening Size: 30 U.S. Std. Sieve, maximum, when tested in accordance with ASTM D4751.
 - 2. Permittivity: 0.05 sec^{-1} , minimum, when tested in accordance with ASTM D4491.
 - 3. Ultraviolet Resistance: Retaining at least 70 percent of tensile strength, when tested in accordance with ASTM D4355/D4355M after 500 hours exposure.
 - 4. Tensile Strength: 90 lb-f, minimum, in cross-machine direction; 124 lb-f, minimum, in machine direction; when tested in accordance with ASTM D4632/D4632M.
 - 5. Elongation: 50 percent maximum, when tested in accordance with ASTM D4632/D4632M.
 - 6. Tear Strength: 55 pounds-force, minimum, when tested in accordance with ASTM D4533/D4533M.
 - 7. Color: Manufacturer's standard, with embedment and fastener lines preprinted.
- D. Silt Fence Posts: One of the following, minimum 5 feet long:
 - 1. Steel U-, C- or T-section, with minimum mass of 1.33 lb per linear foot.
 - 2. Hardwood, 2 by 2 inches, or 4 inches diameter in cross section.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.02 PREPARATION

- A. Do not start operations until the erosion and sediment control plan has been submitted and features are in place.
- B. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.03 SCOPE OF PREVENTIVE MEASURES

- A. In all cases, if permanent erosion resistant measures have been installed temporary preventive measures are not required.
- B. Do not allow storm water to flow into excavations and disturbed areas.
- C. Do not discharge water into sanitary sewers, watercourses or offsite.
- D. Do not allow sediment to flow into vegetated areas.
- E. Do not discharge water-containing sediment in accordance with Performance Requirements and as presented in the erosion and sediment control plan submittal or a maximum retained as 30 milligrams of sediment per liter of water. Conduct continuous monitoring of sediment.
- F. Construction Entrances: Traffic-bearing aggregate surface.
 - 1. Width: As required; 20 feet, minimum.
 - 2. Length: 50 feet, minimum.
 - 3. Provide at each construction entrance to prevent tracking of mud onto right-of-way.
- G. Linear Sediment Barriers: Made of silt fences.
 - 1. Provide linear sediment barriers:
 - a. Along downhill perimeter edge of disturbed areas, including soil stockpiles.
 - 2. Space sediment barriers with the following maximum slope length upslope from barrier:
 - a. Slope of Less Than 2 Percent: 100 feet..
 - b. Slope Between 2 and 5 Percent: 75 feet.
 - c. Slope Between 5 and 10 Percent: 50 feet.
 - d. Slope Between 10 and 20 Percent: 25 feet.
 - e. Slope Over 20 Percent: 15 feet.
- H. Storm Drain Inlet Sediment Trap: Protect each inlet using one of the following measures:
 - 1. For manholes, the filter fabric can be placed around the lid and secured by the lid weight

2. Filter fabric wrapped around hollow concrete blocks blocking entire inlet face area; use one piece of fabric wrapped at least 1-1/2 times around concrete blocks and secured to prevent dislodging; orient cores of blocks so runoff passes into inlet.

- I. Soil Stockpiles: Mist or provide other means to keep dust from being scattered to the air.

3.04 INSTALLATION

- A. General: Control surface water runoff on-site and provide temporary soil stabilization measures as required to prevent erosion of soil by action of water. Protect storm sewers adjacent to work site from sedimentation by installation of erosion and sediment control measures. Provide, as a first step in construction operations, barriers, and other measures intended to deter erosion and transport of sediment associated with construction activities before construction starts or as it progresses.
- B. Traffic-Bearing Aggregate Surface:
 1. Excavate minimum of 6 inches.
 2. Place geotextile fabric full width and length, with minimum 12 inch overlap at joints.
 3. Place and compact at least 6 inches of 1 1/2 to 3 1/2 inch diameter stone.
- C. Silt Fences:
 1. Store and handle fabric in accordance with ASTM D4873/D4873M.
 2. Where slope gradient is less than 3:1 or barriers will be in place less than 6 months, use nominal 16 inch high barriers with minimum 36 inch long posts spaced at 6 feet maximum, with fabric embedded at least 4 inches in ground.
 3. Where slope gradient is steeper than 3:1 or barriers will be in place over 6 months, use nominal 28 inch high barriers, minimum 48 inch long posts spaced at 6 feet maximum, with fabric embedded at least 6 inches in ground.
 4. Where slope gradient is steeper than 3:1 and vertical height of slope between barriers is more than 20 feet, use nominal 32 inch high barriers with woven wire reinforcement and steel posts spaced at 4 feet maximum, with fabric embedded at least 6 inches in ground.
 5. Install with top of fabric at nominal height and embedment as specified.
 6. Do not splice fabric width; minimize splices in fabric length; splice at post only, overlapping at least 18 inches, with extra post.
 7. Fasten fabric to wood posts using one of the following:
 - a. Four nails per post with 3/4 inch diameter flat or button head, 1 inch long, and 14 gage, 0.083 inch shank diameter.
 - b. Five staples per post with at least 9 gauge wire, 3/4 inch crown width and 1 inch long legs.
 - c. Do not staple fabric to trees.
 8. Fasten fabric to steel posts using wire, nylon cord, or integral pockets.
 9. Wherever runoff will flow around end of barrier or over the top, provide temporary splash pad or other outlet protection; at such outlets in the run of the barrier, make barrier not more than 12 inches high with post spacing not more than 4 feet.
- D. Straw Bale Rows:

1. Install bales in continuous rows with ends butting tightly, with one bale at each end of row turned uphill.
2. Install bales so that bindings are not in contact with the ground.
3. Embed bales at least 4 inches in the ground.
4. Anchor bales with at least two stakes per bale, driven at least 18 inches into the ground; drive first stake in each bale toward the previously placed bale to force bales together.
5. Fill gaps between ends of bales with loose straw wedged tightly.
6. Place soil excavated for trench against bales on the upslope side of the row, compacted.

3.05 MAINTENANCE

- A. Inspect preventive measures weekly, within 24 hours after the end of any storm that produces 0.5 inches or more rainfall at the project site, and daily during prolonged rainfall.
- B. Repair deficiencies immediately.
- C. Silt Fences:
 1. Promptly replace fabric that deteriorates unless need for fence has passed.
 2. Remove silt deposits that exceed one-third of the height of the fence.
 3. Repair fences that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- D. Straw Bale Rows:
 1. Promptly replace bales that fall apart or otherwise deteriorate unless need has passed.
 2. Remove silt deposits that exceed one-half of the height of the bales.
 3. Repair bale rows that are undercut by runoff or otherwise damaged, whether by runoff or other causes.
- E. Clean out temporary sediment control structures weekly and relocate soil on site.
- F. Place sediment in appropriate locations on site; do not remove from site.

3.06 CLEAN UP

- A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Architect/Engineer of Record.
- B. Clean out temporary sediment control structures that are to remain as permanent measures.
- C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 57 13

SECTION 01 60 00 - PRODUCT REQUIREMENTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.
- B. Related Requirements:
 - 1. Section 01 23 00 - ALTERNATES for products selected under an alternate.
 - 2. Section 01 25 00 - SUBSTITUTION PROCEDURES for requests for substitutions.
 - 3. Section 01 42 00 - REFERENCES for applicable industry standards for products specified.

1.2 DEFINITIONS

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.
 - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
 - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
 - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.3 ACTION SUBMITTALS

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
 - 1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
 - 2. Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 working days of receipt of request, or seven calendar days of receipt of additional information or documentation, whichever is later.
 - a. Form of Approval: As specified in Section 01 33 00 - SUBMITTAL PROCEDURES.
 - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 - SUBMITTAL PROCEDURES. Show compliance with requirements.

1.4 QUALITY ASSURANCE

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
 - 1. Each Contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors and sub-contractors.
 - 2. If a dispute arises between contractors or sub-contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.5 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
 - 1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
 - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.

3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.6 PRODUCT WARRANTIES

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. **Manufacturer's Warranty:** Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Client.
2. **Special Warranty:** Written warranty required by the Contract Documents to provide specific rights for Client.

- B. **Special Warranties:** Prepare a written document that contains appropriate terms and identification, ready for execution.

1. **Manufacturer's Standard Form:** Modified to include Project-specific information and properly executed.
2. **Specified Form:** When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

- C. **Submittal Time:** Comply with requirements in Section 01 77 00 - CLOSEOUT PROCEDURES.

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
 2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
 3. Client reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
 4. Where products are accompanied by the term "as selected," Architect will make selection.
 5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
 6. "Products" or "Manufacturers" paragraphs where Client allows naming of available products or manufacturers but does not limit selection to those named and does not consider unnamed products as substitutions, which may require a Change Order or Construction Change Directive.
- B. Product Selection Procedures:
1. It shall be the responsibility of the Contractor to select and provide products that comply with the Buy American ACT and all quality and performance standards set forth on the Drawings and in the Project Manual.
 2. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 3. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
 4. Products:
 - a. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
 5. Manufacturers:
 - a. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

6. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

2.2 COMPARABLE PRODUCTS

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
 1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
 2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
 3. Evidence that proposed product provides specified warranty.
 4. List of similar installations for completed projects with project names and addresses and names and addresses of Client, if requested.
 5. Samples, if requested.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION REQUIREMENTS**PART 1 - GENERAL****1.01 SECTION INCLUDES**

- A. Examination, preparation, and general installation procedures.
- B. Pre-installation meetings.
- C. Surveying for laying out the work.
- D. Shoring, bracing, and scaffolding.
- E. Progress cleaning and protection of work.
- F. Starting of systems and equipment.
- G. Correction of the Work.
- H. Final cleaning.

1.02 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. See Section 01 33 29 - LEED Sustainable Design Reporting, when required.
- C. See Division 02 for requirements related to removal and waste management.
- D. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.
 - 1. Qualification Data: Demonstrate Surveyor's capabilities and experience. Include list of completed projects with project names and addresses, names and addresses of architects and owners, and size and type of project.
 - 2. On request, submit documentation verifying accuracy of survey work.
 - 3. Submit six (6) copies of site drawing signed/certified by the Land Surveyor, that the elevations and locations of the work are in conformance with Contract Documents. Provide electronic drawings in both *.dwg and *.pdf format.
 - 4. Submit 2 copies of certified surveys and survey logs for the project record.
- E. Cleaning:
 - 1. Product Data: Submit complete printed data for cleaning agents and floor sealers finishes.
 - 2. Qualification Data: Submit supporting documentation demonstrating personnel engaged for Final Cleaning are regularly engaged in commercial and institutional building cleaning and maintenance as a primary business for a minimum of five (5) years.
 - 3. Certification: Submit a statement that all final cleaning as specified is complete on company letter head signed by an officer of the cleaning company.
- F. Project Record Documents: Submit 6 copies of record documents. Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

- A. For surveying work, employ a land surveyor registered in Illinois and acceptable to Architect/Engineer of Record. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

1.05 PROJECT CONDITIONS

- A. All work shall comply with all applicable laws, codes and regulations.
- B. Signs: No signs advertising the work or identifying any person, firm or entity concerned with the work shall be allowed at the site unless approved in advance by the Client's Representative. The Contractor is to maintain the project sign provided by the Client.
- C. No press or public relation releases are to be made without approval of the Client.
- D. Use of explosives is not permitted.
- E. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- F. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.
- G. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- H. Conduct operations to minimize fumes or odors to building air intakes. Advise Client's Representative if a problem is foreseen so that concerned parties can be notified in advance.
- I. The Contractor shall include in the bid costs for all standby trades should work need to be performed during other than normal work hours. This may include electrical tie-in, water taps, abatement (lead/asbestos/tank removal), work which is excessively noisy (i.e. grinding, demolition etc.); removal of materials containing lead based paints etc. Costs for inspections and any other additional work related to the Contract scope deemed necessary by Commonwealth Edison, City - Water, Sewer and Sanitary department are to borne by the Contractor.
- J. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
 - 1. Install, maintain and effectively operate appliances, machines or equipment in a manner approved by authorities having jurisdiction for the elimination of dust.
- K. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations. Do not use tools or equipment that produce harmful noise levels.
- L. Dewatering: If required, dewater trenches, footings, pits and excavations made for the work. Discharge the water so as not to interfere or create safety hazards to the public or allow water to run on other property. Adhere to all federal, state and city regulations.
- M. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Coordinate scheduling and timing of required administrative procedures with construction activities and activities of other contractors (where applicable) to avoid conflicts and to ensure orderly progress of the Work.
- C. Notify affected utility companies and comply with their requirements.
- D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- E. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials.
- F. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- G. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- H. Coordinate completion and clean-up of work of separate sections.
- I. After Client occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Client's activities.

PART 2 - PRODUCTS - NOT USED**2.01 CLEANING MATERIALS**

- A. Cleaning Agents and floor sealers-finishes: Use cleaning materials and agents and floor sealers- finishes recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.
- B. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION**3.01 EXAMINATION**

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Review conditions with installer or applicator present where indicated to confirm compliance with requirements for installation tolerances and other conditions affecting performance.
 - 1. Record observations. Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:
 - a. Description of the Work.

- b. List of detrimental conditions, including substrates.
 - c. List of unacceptable installation tolerances.
 - d. Recommended corrections.
- B. Verify that existing substrate is suitable for new work being applied or attached including structural readiness and compatibility with finishes.
 - C. Examine and verify specific conditions described in individual specification sections.
 - D. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
 - E. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or mis fabrication.
 - F. Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Verify space requirements and dimensions of items shown diagrammatically on Drawings.
 - G. Do not scale drawings.
 - H. Verify that utility services are available, of the correct characteristics, and in the correct locations. Failure to do so does not constitute a change order to the Work. The existence and location of underground and other utilities and construction indicated as existing are not guaranteed.
 - 1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; and underground electrical services.
 - 2. Furnish information to the Client that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.
 - I. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.
 - J. Notify Client's Representative in writing, immediately on discovery of errors, omissions, discrepancies and non-compliance with applicable codes and regulations within the documents or any work which will not fit, meet acceptable tolerances, or properly function if it were to be installed as indicated in the Contract Documents. Use Request or Information processes indicated in Section 01 30 00 - Administrative Requirements. This item is in no way intended to relieve the Architect/Engineer of Record of design responsibility.
 - K. Start of work specified in each section indicates contractor's acceptance of conditions related to the work including existing construction and substrates.
- 3.02 PREPARATION
- A. See Division 02 for requirements related to removal and waste management.
 - B. Clean substrate surfaces prior to applying next material or substance.
 - C. Seal cracks or openings of substrate prior to applying next material or substance.

- D. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.03 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, or as requested by the Architect/Engineer of Record or Client's Representative, or as required by the progress of the work, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section; including the following:
 - 1. Contractor.
 - 2. Client
 - 3. Client's Representative.
 - 4. Architect/Engineer of Record.
 - 5. Installer's affected by the work.
 - 6. Manufacturer's or Fabricator's Representatives affected by the work.
 - 7. All participants shall be familiar with Project and authorized to conclude matters relating to the Work.
- C. Prepare agenda and preside at meeting:
 - 1. Review conditions of examination, preparation and installation procedures.
 - 2. Review coordination with related work.
 - 3. Review installation requirements with approved submittals.
- D. Record minutes and distribute copies within 5 days of meeting, to participants and those affected by decisions made.
- E. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and if necessary, reconvene the conference at earliest feasible date.

3.04 SURVEYING FOR LAYING OUT THE WORK

- A. Verify locations of survey benchmark or control points prior to starting work.
- B. Promptly notify Architect/Engineer of Record of any discrepancies discovered.
- C. Protect survey benchmark or control points prior to starting site work; preserve permanent benchmark or control points during construction.
- D. Promptly report to Architect/Engineer of Record the loss or destruction of any benchmark or control point or relocation required because of changes in grades or other reasons.
- E. Replace dislocated survey benchmark control points based on original survey control. Make no changes without prior written notice to Architect/Engineer of Record.
- F. Utilize recognized engineering survey practices.
- G. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.
- H. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
 2. Grid or axis for structures.
 3. Building foundation, column locations, ground floor elevations.
- I. Periodically verify layouts by same means.
 - J. Maintain a complete and accurate log of benchmark, control, and survey work as it progresses. Make log accessible to Client at all times.
 - K. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.
 - L. On completion of foundation walls and major site improvements, prepare a certified survey illustrating dimensions, locations, angles, and elevations of construction and site work.
 - M. Prepare a final property survey showing significant features (real property) for Project. Include on the survey a certification, signed by land surveyor, that principal metes, bounds, lines, and levels of Project are accurately positioned as shown on the survey.
 1. Show boundary lines, monuments, streets, site improvements and utilities, existing improvements and significant vegetation, adjoining properties, acreage, grade contours, and the distance and bearing from a site corner to a legal point.
 2. At Preliminary Acceptance, have the final property survey recorded by or with authorities having jurisdiction as the official property survey.

3.05 GENERAL INSTALLATION REQUIREMENTS

- A. In addition to compliance with regulatory requirements, conduct construction operations in compliance with NFPA 241, including applicable recommendations in Appendix A.
- B. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- C. Contractor is to provide equipment necessary for the completion of the work including equipment for hoisting and staging of materials.
- D. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- E. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- F. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
- G. Conceal pipes, ducts, and wiring in finished areas, unless otherwise indicated.
- H. Lay out required blocking, backings and grounds in concealed areas.
- I. Install products at the time and under conditions that shall ensure the best possible results. Maintain conditions required for product performance until Preliminary Acceptance.
- J. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

- K. Anchors and Fasteners: Provide anchors and fasteners as required to anchor each component securely in place, accurately located and aligned with other portions of the Work.
 - 1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect/Engineer of Record.
 - 2. Allow for building movement, including thermal expansion and contraction.
 - L. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.
 - M. Provide necessary access panels for work provided under the contract.
 - N. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.
 - O. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
 - P. Make neat transitions between different surfaces, maintaining texture and appearance.
- 3.06 CLIENT -INSTALLED PRODUCTS/WORK BY OTHER CONTRACTORS
- A. Provide access to Project site for Client 's construction forces.
 - B. Coordinate construction and operations of the Work with work performed by Client 's construction forces.
 - C. Inform Client of Contractor's preferred construction schedule for Client's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Client if changes to schedule are required due to differences in actual construction progress.
 - D. Include Client 's construction forces at preinstallation conferences covering portions of the Work that are to receive Client 's work. Attend preinstallation conferences conducted by Client 's construction forces if portions of the Work depend on Client 's construction.
- 3.07 ALTERATIONS
- A. See Section 01 73 29 - Cutting and Patching
 - B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions as necessary to protect Client s property and operations .
 - C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.
 - 1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
 - 2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.
 - D. Protect existing work to remain from damage or loss at all times during the execution of the Work. This includes all existing fixed, movable, or built-in furniture, equipment, and materials.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.

2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Protection of items to remain is to include all measures necessary to prevent any accumulation of dust, dirt, construction debris or any physical damage. The Contractor shall be responsible for the cost of any cleaning, repair, or replacement required due to inadequate protection.

3.08 SHORING, BRACING, AND SCAFFOLDING

- A. Provide all shoring and bracing required for safety and the proper execution of the work. Install bracing and shoring so it does not interfere with the work of the Client or other Contractors.
- B. Remove shoring and/or bracing that is no longer required.
- C. Scaffolding - Provide and maintain scaffolding required in connection with the work. All scaffolding shall conform to the rules and regulations of all authorities having jurisdiction.

3.09 PROGRESS CLEANING

- A. Contractor is to comply with all requirements of the City of Chicago Construction Site Cleanliness Ordinance as applicable to this project.
 1. Portions of the ordinance that become effective subsequent to the commencement of this Contract shall be followed from the time they become effective. No change orders shall be considered for work related to provisions of the Construction Site Cleanliness Ordinance.
- B. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition. Clean debris outside of work area, including public spaces, which has resulted from construction activities.
- C. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- D. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- E. Clean areas of cutting and patching.
- F. Collect and remove waste materials, debris, and trash/rubbish from site and work areas daily and dispose in dumpsters; do not burn or bury. Do not allow washed-down debris to enter sewers or waterways.
 1. All crates and boxes are to be dismantled or flattened before being placed in the container.
 2. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
 3. Do not hold materials more than 7 days during normal weather or 3 days if the temperature is expected to rise above 80 deg F.
 4. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.
 5. See Division 02 for additional waste disposal requirements.

- G. Provide and maintain all dumpsters and/or disposal boxes as may be required for the execution of the work. Dumpsters are to be immediately removed from the site when level full. Do not over-fill.
 - 1. Use of dumpsters and waste containers belonging to the Client (Chicago Client of Education) or User (School) is strictly prohibited
- H. Snow Removal: Remove snow and ice from the site and in all work areas for access, equipment, and material storage. This includes all fenced boundaries of the construction site and sidewalks. No salt or calcium chloride is to be used in snow and ice removal.
- I. Maintain haul roads, public roads, stockpiles and paving areas that are used for construction operations free from any debris or damage. .

3.10 PROTECTION OF INSTALLED WORK

- A. Protect installed and existing work from damage by construction operations. Keep installed work clean.
 - 1. Comply with manufacturer's written instructions for temperature and relative humidity.
 - 2. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended and that are not hazardous to health or property.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Protect work from spilled liquids. If work is exposed to spilled liquids, immediately remove protective coverings, dry out work, and replace protective coverings.
- G. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.
- H. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer. Any damage resulting from roof leaks caused by roof operations shall be the responsibility of the Contractor.
- I. Prohibit traffic from landscaped areas.
- J. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.
- K. Refinish or replace all damaged surfaces, assemblies, and equipment representing the finished work.
- L. Clean concealed areas before enclosing.
- M. Supervise work to prevent damage to existing and installed construction.

3.11 SAFETY, SECURITY, AND FIRE PROTECTION

- A. The Contractor is solely responsible for all safety and security at the project site. Assign a designated job safety person.

- B. Conduct operations in accordance with all applicable regulations and requirements of local state and federal laws, including OSHA.
 - C. Provide safety protection, fall protection, barricades, warning signs, and coverings as required by the City of Chicago Building Code and Ordinance, OSHA or by the Client. Maintain lights or signals as warning during the work, removing same when completed. Maintain MSDS/SD Sheets on site for products used in the work. Submit with close-out documents.
 - D. Replace protection, barriers, safety devices or warnings immediately upon completion of work requiring the removal of same or at the end of a working day should the work exceed one day.
 - E. Provide all safety equipment or weather protective gear required to perform the work including personal protective equipment such as eye, ear protection, and hard hats. Access to roofs shall be through roof scuttles where available, otherwise use properly anchored, OSHA approved ladders.
 - F. Furnish all flagmen required for deliveries to the site.
 - G. Watchman Service: No watchmen will be provided. The Client will not be responsible for a loss on account of theft of or damage to the property and/or equipment of any Contractor.
 - H. When working in the existing facility, lock and secure the premises at the end of the workday. Protect all work from damage, vandalism, and theft.
 - I. Fire Protection: Conform with all regulations for the City of Chicago Fire Department and of the Contractor's and Client 's Fire Insurance carrier for storage of flammable materials on site.
 - J. Provide blankets and auxiliary fire protection as required to prevent damage to adjacent work or materials as a result of welding, burning, or cutting by torch. Obtain Client's approval of welding or torch work in the existing facility before starting.
 - K. Fire prevention facilities shall include fire extinguishers in adequate supply where flammable demolished materials accumulate and as otherwise required by OSHA and NFPA regulations.
- 3.12 SYSTEM STARTUP
- A. Coordinate schedule for start-up of various equipment and systems.
 - B. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage. Adjust for proper operation.
 - C. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
 - D. Verify that wiring and support components for equipment are complete and tested.
 - E. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
 - F. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
 - G. See Section 01 40 00 - Quality Requirements for additional requirements.

- H. Start equipment and operating components and test to confirm proper operation. Remove damaged or malfunctioning units, replace with new units, and retest.

3.13 CORRECTION OF THE WORK

- A. Repair or remove and replace defective construction. Restore damaged substrates and finishes.
 - 1. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment.
- B. See Section 01 73 29 - Cutting and Patching for additional requirements.
- C. Restore permanent facilities used during construction to their specified condition.
- D. Remove and replace damaged surfaces that are exposed to view if surfaces cannot be repaired without visible evidence of repair.
- E. Repair components that do not operate properly. Remove and replace operating components that cannot be repaired.
- F. Remove and replace chipped, scratched, and broken glass or reflective surfaces.

3.14 FINAL CLEANING

- A. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial/institutional building cleaning and maintenance program.
- B. Use cleaning materials that are nonhazardous. Comply with manufacturer's written instructions.
- C. Complete the following cleaning operations before requesting inspection for certification of Preliminary Acceptance for entire project or for a portion of project:
 - 1. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - 2. Sweep paved areas broom clean and power wash to remove equipment marks. Remove petrochemical spills, stains, and other foreign deposits.
 - 3. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - 4. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - 5. Remove snow and ice to provide safe access to building.
 - 6. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
 - 7. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
 - 8. Sweep concrete floors broom clean in unoccupied spaces using sweeping compound or other non-dust producing product.
 - 9. Vacuum carpet and similar soft surfaces, removing debris and excess nap; shampoo if visible soil or stains remain.

10. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Replace chipped or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces.
 11. Clean washroom floor, walls, fixtures, toilet partitions, mirrors and etc. with non-acid cleaning products and provide a sanitary condition.
 12. Clean, mop all wood floors in areas of new construction and renovation work. Clean walls, woodwork in classrooms, offices and corridors.
 13. Scrub tile floors in all food service areas and finish according to manufacturers' specifications. Comply with requirements of CDPH.
 14. Clean resilient floors in accordance with manufacturer's written instructions for post installation initial cleaning. Use only manufacturer recommended products and materials. Seal floors as directed in product specifications.
 15. Clean terrazzo floors in accordance with manufacturer's written instructions for post installation initial cleaning. Use only manufacturer recommended products and materials. Polish floors as directed in product specifications.
 16. Remove labels that are not permanent. Do not remove "UL" labels and other similar identifiers including mechanical and electrical nameplates.
 17. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 18. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 19. Replace parts subject to unusual operating conditions.
 20. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
 21. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
 22. Clean ducts, blowers, and coils if units were operated without filters during construction.
 23. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 24. Verify entire project area is clean and ready for occupancy.
- D. Pest Control: Engage an experienced, licensed exterminator to make a final inspection and rid Project of rodents, insects, and other pests. Prepare a report.

END OF SECTION 01 73 00

SECTION 01 73 29 - CUTTING AND PATCHING**PART 1 - GENERAL**

1.01 SECTION INCLUDES

- A. Cutting and patching of existing construction.

1.02 SUBMITTALS

- A. Alterations to Existing Construction: Submit written request in advance of cutting or alteration that affects:
 1. Structural integrity of any element or assembly
 2. Integrity of weather exposed or moisture resistant element.
 3. Efficiency, maintenance, or safety of any operational element.
 4. Visual qualities of sight exposed elements.
 5. Work of Board or separate Contractor.

1.03 QUALITY ASSURANCE

- A. General: Contractor shall take reasonable care prior to all cutting and drilling in order to minimize unintended damage to concealed conduits, cables, pipes, reinforcing steel, etc. In circumstances where the absence of such concealed elements is not established conclusively, utilize detection and mapping technology, e.g., X-ray or Sub-surface Interface Radar (SIR), to locate any such elements that may be present before proceeding with the cutting or drilling work.
- B. Structural Elements: Do not cut and patch structural elements in a manner that could change their load-carrying capacity or load-deflection ratio. Notify Architect/Engineer of Record if progress of work may have structural impact.
- C. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Notify Architect/Engineer of Record if progress of work may have operational impact.
Operational Elements include the following:
 1. Air or smoke barriers.
 2. Fire-protection systems.
 3. Control systems.
 4. Communication systems.
 5. Conveying systems.
 6. Electrical wiring systems.
 7. Operating systems of special construction.
- D. Miscellaneous Elements: Do not cut and patch building elements or related components in a manner that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Notify Architect/Engineer of Record progress of work may have performance impact.
Miscellaneous Elements include the following:
 1. Water, moisture, or vapor barriers.

2. Membranes and flashings.
3. Exterior curtain-wall construction.
4. Equipment supports.
5. Piping, ductwork, vessels, and equipment.
6. Noise- and vibration-control elements and systems.

- E. Physical Appearance: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch construction exposed on the exterior or in occupied spaces in a manner that would, in Architect/Engineer of Record's opinion, reduce the building's aesthetic qualities.

1.04 FIELD CONDITIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
1. Verify that construction and utility arrangements are as indicated. Failure to do so does not constitute a change order to the Work.
 2. Report discrepancies to Architect/Engineer of Record before disturbing existing installation.
 3. Beginning of cutting and patching work constitutes acceptance of existing conditions.

1.05 WARRANTY

- A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during cutting and patching operations, by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. New Materials: As specified in product sections; match existing adjacent products and work for patching and extending work.
- B. Existing and In-Place Materials: Use materials identical to existing materials.
1. For exposed surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible.
 2. If identical materials are unavailable or cannot be used, use materials that, when installed, shall match the visual and functional performance of existing materials.

PART 3 - EXECUTION

3.01 GENERAL

- A. Perform whatever cutting and patching is necessary to:
1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.

5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-conforming work.

3.02 EXAMINATION

- A. Examine surfaces to be cut and patched and conditions under which cutting and patching are to be performed.
 1. Compatibility: Before patching, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
 2. Proceed with installation only after unsafe or unsatisfactory conditions have been corrected.

3.03 PREPARATION

- A. Temporary Support: Provide temporary support of Work to be cut.
- B. Protection: Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.
- C. Adjoining Areas: Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.
- D. Existing Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 2. Where existing services are required to be removed, relocated, or abandoned, bypass such services before cutting to prevent interruption of services to occupied areas.
 3. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 4. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 5. Verify that abandoned services serve only abandoned facilities.
 6. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
 7. If existing services to occupied areas must be interrupted, coordinate and receive approval of the interruption of services prior to starting work.

3.04 PERFORMANCE

- A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.
1. Cut existing construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.
 2. Remove existing work as indicated and as required to accomplish new work.
 3. Prior to starting work in an area, make arrangements for moving of and subsequent reinstallation of any existing items which may conflict with the work area.
 4. Remove and replace existing walls and ceilings as required to facilitate installation of new work. Replacement of the existing walls & ceilings shall be coordinated as directed by the Architect/Engineer of Record and as delineated in the Contract Documents.
 5. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 6. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
 7. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.
- B. Cutting: Cut existing construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.
1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots as small as possible, neatly to size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
 2. Existing Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
 3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
 4. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
 5. Proceed with patching after construction operations requiring cutting are complete.
 6. See Section 31 23 16 - Excavation and 31 23 17 - Excavating, Backfilling, and Compacting for Utilities for site work,
- C. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other Work. Patch with durable seams that are as invisible as possible.
1. Finish patched surfaces to match finish that existed prior to patching, unless noted otherwise. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 2. Match color, texture, and appearance.

3. Comply with installation requirements of individual sections.
4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.
5. Restore work with new products in accordance with requirements of Contract Documents.
6. Where feasible test and inspect patched areas after completion to demonstrate integrity of installation.
7. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
8. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that shall eliminate evidence of patching and refinishing.
 - a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
 - b. Restore damaged pipe covering to its original condition.
9. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove existing floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
 - a. Where patching occurs in a painted surface, apply primer and intermediate paint coats over the patch and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
 - b. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material, to full thickness of the penetrated element. Maintain designated fire rating of the wall, partition, ceiling, or floor construction.
10. Ceilings: Patch, repair, or rehang existing ceilings as necessary to provide an even-plane surface of uniform appearance.
11. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition.

3.05 CLEANING

- A. Clean areas and spaces where cutting and patching are performed. Completely remove paint, mortar, oils, putty, and similar materials.
- B. Refinish, repair, or remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

END OF SECTION 01 73 29

SECTION 01 74 19 – LEED CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes administrative and procedural requirements for the following:
 - 1. Recycling nonhazardous demolition and construction waste.
 - 2. Disposing of nonhazardous demolition and construction waste.
- B. Related Requirements:
 - 1. Section 31 10 00 - SITE CLEARING for disposition of waste resulting from site clearing and removal of above- and below-grade improvements.

1.2 WASTE MANAGEMENT REQUIREMENTS

- A. Owner requires that this project generate the least amount of trash and waste possible. Project requirement is to divert at least 80% of the total construction and demolition material from landfill from at least four material streams and generate no more than 2.5 pounds of construction waste per square foot of the building's floor area.
- B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.
- C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.
- D. Contractor shall submit monthly Waste Disposal Reports; all landfill disposal, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrue; use the same units of measure on all reports.
- E. Contractor shall develop and follow a Construction Waste Management Plan designed to implement these requirements.
- F. Methods of trash/waste disposal that are not acceptable are:
 - 1. Burning on the project site.
 - 2. Burying on the project site.
 - 3. Dumping or burying on other property, public or private.
 - 4. Other illegal dumping or burying.
- G. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.3 DEFINITIONS

- A. **Alternative Daily Cover:** Alternative daily cover (ADC) means cover material other than earthen material placed on the surface of the active face of a municipal solid waste landfill at the end of each operating day to control vectors, fires, odors, blowing litter, and scavenging.
- B. **Commingled collection (or single-stream recycling)** is when recyclable materials are mixed in one container but sorted and processed at an off-site recycling facility, which separates them from the waste going to a landfill. Commingled waste may be considered only one material stream unless the facility can provide diversion rates for specific materials.
- C. **Clean:** Untreated and unpainted; not contaminated with oils, solvents, mastics, caulk, or the like.
- D. **Construction and Demolition Waste:** Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.
- E. **Disposal:** Removal off-site of waste and subsequent recycling, reuse, or deposit in a Subtitle D landfill, Clean Construction Demolition Debris site, or incinerator acceptable to authorities having jurisdiction.
- F. **Hazardous:** Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.
- G. **Land-clearing debris and excavated soil:** Natural materials on-site (e.g., rock, soil, stone, vegetation) and are not considered construction or demolition waste. Materials that are manmade (e.g., concrete, brick, cement) are considered construction waste even if they were on site.
- H. **Nonhazardous:** Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.
- I. **Nontoxic:** Neither immediately poisonous to humans nor poisonous after a long period of exposure.
- J. **Recyclable:** The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.
- K. **Recycle:** To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.
- L. **Recycling:** The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.
- M. **Return:** To give back reusable items or unused products to vendors for credit.
- N. **Reuse:** To reuse a construction waste material in some manner on the project site.

- O. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.
- P. Salvage and Reuse: Recovery of waste and subsequent incorporation into the Work.
- Q. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.
- R. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.
- S. Toxic: Poisonous to humans either immediately or after a long period of exposure.
- T. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.
- U. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.4 SUBMITTALS

- A. Landfill Alternatives Proposal: Within 15 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.
 - 1. Submit to Design-Builder for review and approval.
 - 2. Include an analysis of trash/waste to be generated and landfill options as specified for Construction Waste Management Plan described below.
 - 3. Describe as many alternatives to landfilling as possible:
 - a. List each material proposed to be salvaged, reused, or recycled.
 - b. List the proposed local market for each material.
 - c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
 - 4. Provide alternatives to landfilling for at least the following materials:
 - a. Aluminum and plastic beverage containers.
 - b. Corrugated cardboard.
 - c. Wood pallets.
 - d. Clean dimensional wood.
 - e. Land clearing debris, including brush, branches, logs, and stumps.
 - f. Concrete.
 - g. Bricks.
 - h. Concrete masonry units.
 - i. Asphalt paving.
 - j. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
 - k. Glass.
 - l. Gypsum drywall and plaster.

- m. Carpet, carpet cushion, carpet tile, and carpet remnants, both new and removed: DuPont (<http://flooring.dupont.com>) and Interface (www.interfaceinc.com) conduct reclamation programs.
 - n. Plumbing fixtures.
 - o. Electrical equipment.
 - 1) Lighting fixtures: separate lamps by type and protect from breakage.
 - 2) Electrical Devices: separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
 - 3) Conduit: Reduce conduit to straight lengths and store by type and size.
- B. Once Builder has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Construction Waste Management Plan; submit within 15 calendar days after notification by Design-Builder.
- C. Construction Waste Management Plan: Include the following information:
- 1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
 - 2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
 - 3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
 - a. List each material proposed to be salvaged, reused, or recycled.
 - b. List the local market for each material.
 - c. State the estimated net cost, versus landfill disposal.
 - 4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
 - 5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
 - 6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
 - 7. Communication: Describe signage and placement, in all languages spoken on the job site instructing construction waste management procedures.
 - 8. Signature blocked attesting that contractor and subcontractors will adhere to the construction waste management plan.
- D. Waste Disposal Reports: On a monthly basis submit reports with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.
- 1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
 - 2. Submit Report on a form acceptable to Design-Builder.
 - 3. Landfill Disposal: Include the following information:
 - a. Identification of material.

- b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
 - c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
 - d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 4. Incinerator Disposal: Include the following information:
 - a. Identification of material.
 - b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.
 - c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.
 - d. Include signed manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 5. Recycled and Salvaged Materials: Include the following information for each:
 - a. Identification of material, including those retrieved by installer for use on other projects.
 - b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.
 - c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.
 - d. Include signed manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
 - e. Certification by receiving party that materials will not be disposed of in landfills or by incineration, including Alternative Daily Cover (ADC). ADC does not qualify as material diverted from disposal, include materials destined for ADC in the calculations as waste. Land-clearing debris is not considered construction, demolition, or renovation waste that can contribute to waste diversion.
 6. Material Reused on Project: Include the following information for each:
 - a. Identification of material and how it was used in the project.
 - b. Amount, in tons or cubic yards.
 - c. Include weight tickets as evidence of quantity.
 7. Exclusions:
 - a. Land clearing debris and excavated soil do not contribute to this credit.
 - b. Any waste-to-energy is not considered recycling for this credit.
 - c. Materials destined for alternative daily cover (ADC) are considered as waste (not diversion).
 - 8.
 9. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.
 10. Waste Reduction Calculations: Before request for Substantial Completion, submit calculated end-of-Project rates for salvage, recycling, and disposal as a percentage of total waste generated by the Work.
 - 11.
- E. Subtitle D Landfill and Incinerator Disposal Records: Submit record indicating receipt and acceptance of waste by the permitted Subtitle D landfills and incinerator facilities licensed to accept them. Include manifests, weight tickets, receipts, and invoices. Submit concurrently with waste reduction progress reports.

- F. Statement of Refrigerant Recovery (if applicable): Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed according to EPA regulations. Include name and address of technician and date refrigerant was recovered.

1.5 QUALITY ASSURANCE

- A. Refrigerant Recovery Technician Qualifications: Certified by EPA-approved certification program.
- B. Regulatory Requirements: Comply with hauling and disposal regulations of Authorities Having Jurisdiction.

PART 2 - PRODUCTS

2.1 PRODUCT SUBSTITUTIONS

- A. See Sections 01 25 00 – SUBSTITUTION PROCEDURES for substitution submission procedures.
- B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 60 00 - PRODUCT REQUIREMENTS:
 - 1. Relative amount of waste produced, compared to specified product.
 - 2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Price.
 - 3. Proposed disposal method for waste product.
 - 4. Markets for recycled waste product.

PART 3 - EXECUTION

3.1 CONSTRUCTION WASTE MANAGEMENT PLAN IMPLEMENTATION

- A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Construction Waste Management Plan.
- B. Communication: Distribute copies of the Construction Waste Management Plan to job site foreman, each subcontractor, Design-Builder, and Owner.
- C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.
- D. Meetings: Discuss trash/waste management goals and issues at project meetings.
 - 1. Pre-bid meeting.
 - 2. Pre-construction meeting.
 - 3. Regular job-site meetings.

- E. Site Access and Temporary Controls: Conduct waste management operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.
- F. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.
 - 1. Provide containers as required.
 - 2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
 - 3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.
- G. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.
- H. Recycling, General: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.
 - 1. Recycle paper and beverage containers used by on-site workers in addition to construction waste.
 - 2. Revenues, savings, rebates, tax credits, and other incentives received for recycling waste materials shall accrue to Contractor
 - 3. Waste may be co-mingled at the site and separated at a recycling facility.
 - 4. Provide appropriately marked containers or bins for controlling recyclable waste until they are removed from Project site. Include list of acceptable and unacceptable materials at each container and bin.
 - 5. Inspect containers and bins for contamination and remove contaminated materials if found.
 - 6. Stockpile processed materials on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 7. Stockpile materials away from construction area. Do not store within drip line of remaining trees.
 - 8. Store components off the ground and protect from the weather.
- I. Recycling Demolition Waste:
 - 1. Asphaltic Concrete Paving: Break up and transport paving to asphalt-recycling facility.
 - 2. Concrete: Remove reinforcement and other metals from concrete and sort with other metals.
 - a. Pulverize concrete to maximum 1-1/2-inch (38-mm) size.
 - b. Crush concrete and screen to comply with requirements in other Sections for use as satisfactory soil for fill or sub-base.
 - 3. Masonry: Remove metal reinforcement, anchors, and ties from masonry and sort with other metals.
 - a. Clean and stack undamaged, whole masonry units on wood pallets.

4. Wood Materials: Sort and stack members according to size, type, and length. Separate lumber, engineered wood products, panel products, and treated wood materials.
 5. Metals: Separate metals by type.
 - a. Structural Steel: Stack members according to size, type of member, and length.
 - b. Remove and dispose of bolts, nuts, washers, and other rough hardware.
 6. Asphalt Shingle Roofing: Separate organic and glass-fiber asphalt shingles and felts. Remove and dispose of nails, staples, and accessories.
 7. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location. Remove edge trim and sort with other metals. Remove and dispose of fasteners.
 8. Acoustical Ceiling Panels and Tile: Stack large clean pieces on wood pallets and store in a dry location.
 - a. Separate suspension system, trim, and other metals from panels and tile and sort with other metals.
 9. Carpet: Roll large pieces tightly after removing debris, trash, adhesive, and tack strips.
 - a. Store clean, dry carpet and pad in a closed container or trailer provided by Carpet Reclamation Agency or carpet recycler.
 10. Equipment: Drain tanks, piping, and fixtures. Seal openings with caps or plugs. Protect equipment from exposure to weather.
 11. Plumbing Fixtures: Separate by type and size.
 12. Piping: Reduce piping to straight lengths and store by type and size. Separate supports, hangers, valves, sprinklers, and other components by type and size.
 13. Lighting Fixtures: Separate lamps by type and protect from breakage.
 14. Electrical Devices: Separate switches, receptacles, switchgear, transformers, meters, panelboards, circuit breakers, and other devices by type.
 15. Conduit: Reduce conduit to straight lengths and store by type and size.
- J. Recycling Construction Waste:
1. Packaging:
 - a. Cardboard and Boxes: Break down packaging into flat sheets. Bundle and store in a dry location.
 - b. Polystyrene Packaging: Separate and bag materials.
 - c. Pallets: As much as possible, require deliveries using pallets to remove pallets from Project site. For pallets that remain on-site, break down pallets into component wood pieces and comply with requirements for recycling wood.
 - d. Crates: Break down crates into component wood pieces and comply with requirements for recycling wood.
 2. Site-Clearing Wastes: Chip brush, branches, and trees on-site.
 - a. Comply with requirements in Division 32 Sections for use of chipped organic waste as organic mulch.
 3. Wood Materials:
 - a. Clean Cut-Offs of Lumber: Grind or chip into small pieces.
 - b. Clean Sawdust: Bag sawdust that does not contain painted or treated wood.
 4. Gypsum Board: Stack large clean pieces on wood pallets and store in a dry location.

- a. Clean Gypsum Board: Grind scraps of clean gypsum board using small mobile chipper or hammer mill. Screen out paper after grinding.
- K. Salvaged Items for Reuse in the Work:
- 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until installation.
 - 4. Protect items from damage during transport and storage.
 - 5. Install salvaged items to comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make items functional for use indicated.
- L. Salvaged Items for Design-Builder's Use:
- 1. Clean salvaged items.
 - 2. Pack or crate items after cleaning. Identify contents of containers.
 - 3. Store items in a secure area until delivery to Design-Builder.
 - 4. Transport items to Board's storage area designated by Design-Builders.
 - 5. Protect items from damage during transport and storage.
 - 6. Doors and Hardware: Brace open end of door frames. Except for removing door closers, leave door hardware attached to doors.

3.2 DISPOSAL OF WASTE

- A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.
- 1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
 - 2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
- B. Burning: Do not burn waste materials.
- C. Disposal: Remove waste materials from Owner's property and legally dispose of them.

END OF SECTION 01 74 19

SECTION 01 77 00 - CLOSEOUT PROCEDURES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Substantial Completion procedures.
 - 2. Final Completion procedures.
 - 3. Warranties.
 - 4. Final cleaning.
 - 5. Repair of the Work.

- B. Related Requirements:
 - 1. Section 01 32 33 - PHOTOGRAPHIC DOCUMENTATION for submitting final completion construction photographic documentation.
 - 2. Section 01 73 00 - EXECUTION for progress cleaning of Project site.
 - 3. Section 01 78 23 - OPERATION AND MAINTENANCE DATA for operation and maintenance manual requirements.
 - 4. Section 01 78 39 - PROJECT RECORD DOCUMENTS for submitting record Drawings, record Specifications, and record Product Data.
 - 5. Section 01 79 00 - DEMONSTRATION AND TRAINING for requirements for instructing Client's personnel.

1.2 ACTION SUBMITTALS

- A. Product Data: For cleaning agents.
- B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.
- C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

- A. Certificates of Release: From authorities having jurisdiction.
- B. Certificate of Insurance: For continuing coverage.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 SUBSTANTIAL COMPLETION PROCEDURES

- A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.
- B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Certificates of Release: Obtain and submit releases from Authorities Having Jurisdiction permitting Client unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
 - 2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
 - 3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
 - 4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by the Client. Label with manufacturer's name and model number where applicable.
 - a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Architect's signature for receipt of submittals.
- C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 working days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.
 - 1. Advise Client of pending insurance changeover requirements.
 - 2. Make final changeover of permanent locks and deliver keys to Client. Advise Client of changeover in security provisions.
 - 3. Complete startup and testing of systems and equipment.
 - 4. Perform preventive maintenance on equipment used prior to Substantial Completion.
 - 5. Instruct Client's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 - DEMONSTRATION AND TRAINING.
 - 6. Participate with Client in conducting inspection and walkthrough with local emergency responders.
 - 7. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
 - 8. Complete final cleaning requirements, including touchup painting.

- D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of 10 working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect's, that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
 2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
1. Submit a final Application for Payment according to Section 01 29 00 - PAYMENT PROCEDURES.
 2. Certified List of Incomplete Items: Submit certified copy of Contractor's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Contractor. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 4. Submit pest-control final inspection report.
- B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 working days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Contractor will prepare a final Certificate for Payment after inspection or will notify Architect of construction that must be completed or corrected before certificate will be issued.
1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction. Use CSI Form 14.1A or approved similar form.
- B.
1. Include the following information at the top of each page:
 - a. Project name.

- b. Date.
 - c. Name of Client's Representative.
 - d. Name of Architect.
 - e. Page number.
2. Submit list of incomplete items in the following format:
 - a. MS Excel electronic file. Architect will return annotated file.

1.8 SUBMITTAL OF PROJECT WARRANTIES

- A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Client's rights under warranty.
- B. Partial Occupancy: Submit properly executed warranties within 15 working days of completion of designated portions of the Work that are completed and occupied or used by Client during construction period by separate agreement with Architect.
- C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.
 1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, name of Architect, and name of Contractor.
 4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.
- D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces. Refer to section 01 73 00 – EXECUTION for additional cleaning requirements.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

- A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.
 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
 - d. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - e. Remove snow and ice to provide safe access to building.
 - f. Remove labels that are not permanent.
 - g. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - h. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 – LEED CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL.

3.2 REPAIR OF THE WORK

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.
- B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating

components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to the specified condition.

1. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that already show evidence of repair or restoration.
 - a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.
2. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
3. Replace burned-out lamps and starters to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23 – OPERATION AND MAINTENANCE DATA**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:
 - 1. Operation and maintenance documentation directory.
 - 2. Emergency manuals.
 - 3. Operation manuals for systems, subsystems, and equipment.
 - 4. Product maintenance manuals.
 - 5. Systems and equipment maintenance manuals.
- B. Related Requirements:
 - 1. Section 01 33 00 - SUBMITTALS for submitting copies of submittals for operation and maintenance manuals.

1.2 DEFINITIONS

- A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.
- B. Subsystem: A portion of a system with characteristics similar to a system.

1.3 CLOSEOUT SUBMITTALS

- A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
 - 1. Client will comment on whether content of operations and maintenance submittals are acceptable.
 - 2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
- B. Format: Submit operations and maintenance manuals in the following format:
 - 1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Client.
 - a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
 - b. Enable inserted reviewer comments on draft submittals.

- C. Initial Manual Submittal: Submit draft copy of each manual at least 60 calendar days before commencing demonstration and training. Client will comment on whether general scope and content of manual are acceptable.
 - 1. Contractor will make any corrections required and resubmit all copies until Architect and DxA find manuals acceptable.

- D. Final Manual Submittal: Submit five (5) hard copies and one (1) electronic copy of each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Client will return copy with comments.
 - 1. Correct or revise each manual to comply with Client's comments. Submit copies of each corrected manual within 15 working days of receipt of Client's comments and prior to commencing demonstration and training.

1.4 OPERATIONS AND MAINTENANCE MANUALS GENERAL

- A. The commissioning process requires detailed O&M documentation. O&M documentation requirements identified in this section, in Division 01 Section "General Commissioning Requirements" and other Division 21 through 28 sections.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

- A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:
 - 1. List of documents.
 - 2. List of systems.
 - 3. List of equipment.
 - 4. Table of contents.

- B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

- C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

- D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

- E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a

designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

- A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:
1. Title page.
 2. Table of contents.
 3. Manual contents.
- B. Title Page: Include the following information:
1. Subject matter included in manual.
 2. Name and address of Project.
 3. Name and address of Client.
 4. Name of Client
 5. Date of submittal.
 6. Name and contact information for Contractor.
 7. Names and contact information for major consultants to the Contractor that designed the systems contained in the manuals.
 8. Cross-reference to related systems in other operation and maintenance manuals.
- C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.
1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.
- D. Indices for each volume
- E. Specification Section Tab
1. Equipment ID Tag Tab
 - a. Equipment ID Tag Summary
 - b. Contractor: The first page behind the equipment tab shall contain the name, address and telephone number of the manufacturer and installing contractor and the 24-hour number for emergency service for all equipment in this section, identified by equipment.
 - c. Submittal and Product Data: This section shall include all approved submittal data, cut sheets and appropriate shop drawings. If submittal was not required for approval, descriptive product data shall be included.
 - d. Operation and Maintenance Instructions: These shall be the written manufacturer's data with the model and features of this installation clearly

marked and edited to omit reference to products or data not applicable to this installation. This section shall include data on the following:

- 1) Installation, startup and break-in instructions
 - 2) All starting, normal shutdown, emergency shutdown, manual operation, seasonal changeover and normal operating procedures and data, including any special limitations.
 - 3) O&M and installation instructions that were shipped with the unit.
 - 4) Preventative maintenance and service procedures and schedules.
 - 5) Troubleshooting procedures.
 - 6) A parts list, edited to omit reference to items, which do not apply to this installation.
 - 7) A list of any special tools required to service or maintain the equipment.
 - 8) Performance data, ratings and curves.
- e. Warranty, which clearly lists conditions to be maintained to keep warranty in effect and conditions that would affect the validity of the warranty.
 - f. Any service contracts issued.
 - g. Supplemental Data: Prepare written text and/or special drawings to provide necessary information, where manufacturer's standard printed data is not available and information is necessary for a proper understanding and operation and maintenance of equipment or systems, or where it is necessary to provide additional information to supplement data included in the manual or project documents.
 - h. Control Drawings: Include the control drawings for the piece of equipment and its components, including the sequence of operation. This section will be provided by the controls contractor. The drawings will be repeated in the control contractor's O&M submittals.
 - i. Specifications: This section is comprised of the component or system specification section copied and inserted complete with all addenda.
 - j. System Description: This section shall include the individual equipment portion of the overall system Design Documentation Narrative, if available. It will contain simplified professionally drawn single line system diagrams on 8-1/2 x 11 or 11 x 17 sheets, if the system's control drawing is not adequate.
 - k. Preventive Maintenance Instructions: This section shall include condensed typewritten excerpts from the manufacturers written instructions for weekly, monthly, quarterly, annual, etc. maintenance. This summary shall be prepared by the HVAC mechanical contractor with help from the equipment supplier. It shall be prepared for all items listed under condensed operating instructions (below), plus package, window or through the wall AC units and electric unitary heating equipment.
 - l. Condensed Operating Instructions: This section shall include condensed instructions for start-up, shutdown, emergency operation, safety precautions, unusual features and troubleshooting suggestions. Where control is clearly covered in controls description, it is not to be duplicated here. In addition, a copy of these instructions shall be clearly laminated and secured adjacent to the equipment where it can be easily read by operating personnel. These instructions shall be provided for boilers, furnaces, chillers, pumps, heat rejection equipment, large air handling units (greater than 10 tons), heat pump systems, control system, air compressors and dryers.

- F. Controls and Test and Balance (TAB) O&M Manuals: The controls contractor and TAB contractor have special O&M manual preparation requirements in Division 23 Section "Testing, Adjusting, and Balancing for HVAC" that shall be merged with those of this section.
- G. Paper Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem and equipment. If possible, assemble instructions for subsystems, equipment and components of one system into a single binder.
1. Binders: Heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, in thickness necessary to accommodate contents, sized to hold 8-1/2-by-11-inch paper; with clear plastic sleeve on spine to hold label describing contents and with pockets inside covers to hold folded oversize sheets.
 - a. If two or more binders are necessary to accommodate data of a system, organize data in each binder into groupings by subsystem and related components. Cross-reference other binders if necessary to provide essential information for proper operation or maintenance of equipment or system.
 - b. Identify each binder on front and spine, with printed title "OPERATION AND MAINTENANCE MANUAL," Project title or name and subject matter of contents. Indicate volume number for multiple-volume sets.
 2. Dividers: Heavy-paper dividers with plastic-covered tabs for each section. Mark each tab to indicate contents. Include typed list of products and major components of equipment included in the section on each divider, cross-referenced to Specification Section number and title of Project Manual.
 3. Protective Plastic Sleeves: Transparent plastic sleeves designed to enclose diagnostic software diskettes for computerized electronic equipment.
 4. Supplementary Text: Prepared on 8-1/2-by-11-inch, 20-lb/sq. ft. white bond paper.
 5. Supplemental Drawings: Attach reinforced, punched binder tabs on drawings and bind with text.
 6. If oversize drawings are necessary, fold drawings to same size as text pages and use as foldouts.
 - a. If drawings are too large to be used as foldouts, fold and place drawings in labeled envelopes and bind envelopes in rear of manual. At appropriate locations in manual, insert typewritten pages indicating drawing titles, descriptions of contents and drawing locations.
- H. Electronic Manual Contents: Organize into sets of manageable size to ensure files for manual are contained within a single compact disc. Arrange contents alphabetically by file name or bookmarking, for organization to coincide with system, subsystem and equipment. Ensure instructions for subsystems, equipment and components of one system into a single compact disc.
1. DVDs or Solid State Memory Device: All files shall be burned on to and provided in plastic cases. Discs shall be clearly labeled with the same information as required for the manual title page. If more than one manual is present on the disc a listing of the manual contained shall be provided on the label.
 - a. If two or more discs are necessary to accommodate data of a system, organize data in each disc into groupings by subsystem and related components. Cross-reference other discs by bookmarking or annotations in the electronic files contained on the disc if necessary to provide essential information for proper operation or maintenance of equipment or system.

- b. Discs shall be clearly labeled with the same information as required for the manual title page. If more than one manual is present on the disc a listing of the manual contained shall be provided on the label.
2. **Bookmarking:** The O&M manuals shall be fully integrated and navigable. "Fully integrated and navigable", is defined in this context as the ability for users to review and locate information utilizing bookmarks or other file organization methods. Use of folder structures for this purpose will be permitted provided file nomenclature utilized clearly indicates the type of document the file contains and all information pertinent to a given system, sub-system and/or unit is contained within a single folder.
3. **Searching:** All files shall be fully searchable using standard text search functions. If scanned copies of documents are provided, these files shall be converted into OCR recognized text format with original image overlay.
4. **Acceptable Electronic Formats:** Acceptable electronic formats for files provided for manuals shall be as listed below. Contractor shall be responsible to provide free viewers for all formats not listed below for any files provided in their submission. Scanned copies of paper documents must have prior approval from Owner.
 - a. Word, current version
 - b. Excel, current version
 - c. Adobe Acrobat, current version
 - d. WAV
 - e. WMV
 - f. DWF

2.3 EMERGENCY MANUALS

- A. **Content:** Organize manual into a separate section for each of the following:
 1. Type of emergency.
 2. Emergency instructions.
 3. Emergency procedures.
- B. **Type of Emergency:** Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:
 1. Fire.
 2. Flood.
 3. Gas leak.
 4. Water leak.
 5. Power failure.
 6. Water outage.
 7. System, subsystem, or equipment failure.
 8. Chemical release or spill.
- C. **Emergency Instructions:** Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Client's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.
9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

- D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
- E. Piped Systems: Diagram piping as installed and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

- A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
- B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Product Information: Include the following, as applicable:
 - 1. Product name and model number.
 - 2. Manufacturer's name.
 - 3. Color, pattern, and texture.
 - 4. Material and chemical composition.
 - 5. Reordering information for specially manufactured products.
- D. Maintenance Procedures: Include manufacturer's written recommendations and the following:
 - 1. Inspection procedures.
 - 2. Types of cleaning agents to be used and methods of cleaning.
 - 3. List of cleaning agents and methods of cleaning detrimental to product.
 - 4. Schedule for routine cleaning and maintenance.
 - 5. Repair instructions.
- E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
- F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

- A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source

information, maintenance service contracts, and warranty and bond information, as described below.

- B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
- C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:
 - 1. Standard maintenance instructions and bulletins.
 - 2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
 - 3. Identification and nomenclature of parts and components.
 - 4. List of items recommended to be stocked as spare parts.
- D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:
 - 1. Test and inspection instructions.
 - 2. Troubleshooting guide.
 - 3. Precautions against improper maintenance.
 - 4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
 - 5. Aligning, adjusting, and checking instructions.
 - 6. Demonstration and training video recording, if available.
- E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
 - 1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
 - 2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
- F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
- G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
- H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
 - 1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION (Not used)

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for project record documents, including the following:
 - 1. Record Drawings.
 - 2. Record Specifications.
 - 3. Record Product Data.
 - 4. Miscellaneous record submittals.

- B. Related Requirements:
 - 1. Section 01 73 00 - EXECUTION for final property survey.
 - 2. Section 01 77 00 - CLOSEOUT PROCEDURES for general closeout procedures.
 - 3. Section 01 78 23 - OPERATION AND MAINTENANCE DATA for operation and maintenance manual requirements.

1.2 CLOSEOUT SUBMITTALS

- A. Record Drawings: Comply with the following:
 - 1. Number of Copies:
 - a. Initial Submittal:
 - 1) Submit record digital data files reflecting changes from the Contract Documents; changes shall be clouded.
 - 2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
 - b. Final Submittal:
 - 1) Submit PDF electronic files of scanned record prints.
 - 2) Print each drawing, whether or not changes and additional information were recorded.

- B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

- C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.
 - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

- D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.
- E. Reports: Submit written report weekly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

- A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.
 - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, contractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
 - a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
 - b. Accurately record information in an acceptable drawing technique.
 - c. Record data as soon as possible after obtaining it.
 - d. Record and check the markup before enclosing concealed installations.
 - e. Cross-reference record prints to corresponding archive photographic documentation.
 - 2. Content: Types of items requiring marking include, but are not limited to, the following:
 - a. Dimensional changes to Drawings.
 - b. Revisions to details shown on Drawings.
 - c. Depths of foundations below first floor.
 - d. Locations and depths of underground utilities.
 - e. Revisions to routing of piping and conduits.
 - f. Revisions to electrical circuitry.
 - g. Actual equipment locations.
 - h. Duct size and routing.
 - i. Locations of concealed internal utilities.
 - j. Changes made by Change Order or Construction Change Directive.
 - k. Changes made following Architect's written orders.
 - l. Details not on the original Contract Drawings.
 - m. Field records for variable and concealed conditions.
 - n. Record information on the Work that is shown only schematically.
 - 3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.

4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
 5. Mark important additional information that was either shown schematically or omitted from original Drawings.
 6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:
1. Format: Annotated PDF electronic file.
 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
 3. Refer instances of uncertainty to Architect for resolution.
 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
 - a. See Section 01 33 00 - SUBMITTAL PROCEDURES for requirements related to use of Architect's digital data files.
 - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.
 2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
 2. Format: Annotated PDF electronic file.
 3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
 4. Identification: As follows:
 - a. Project name.
 - b. Date.
 - c. Designation "PROJECT RECORD DRAWINGS."
 - d. Name of Architect.

2.2 RECORD SPECIFICATIONS

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
 - 3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
 - 4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
 - 5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
 - 1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
 - 2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
 - 3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file.
 - 1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

- A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.
- B. Format: Submit miscellaneous record submittals as PDF electronic file.
 - 1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION**3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect and construction contractors reference during normal working hours.

END OF SECTION 01 78 39

SECTION 01 79 00 - DEMONSTRATION AND TRAINING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes administrative and procedural requirements for instructing Client's personnel, including the following:
 - 1. Demonstration of operation of systems, subsystems, and equipment.
 - 2. Training in operation and maintenance of systems, subsystems, and equipment.

1.2 INFORMATIONAL SUBMITTALS

- A. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
- B. Attendance Record: For each training module, submit list of participants and length of instruction time.
- C. Evaluations: For each participant and for each training module, submit results and documentation of performance-based test.

1.3 CLOSEOUT SUBMITTALS

- A. Draft Training Session Matrix: Client will designate personnel to be trained; tailor training to needs and skill-level of attendees. Matrix shall be used to confirm scheduling of all required training sessions with the designated personnel. The Contractor shall be responsible to submit a formal training program to be utilized for each respective system at 50% of construction completion milestone to the Architect, Owner, and CxA. It is the Contractor's responsibility to work with Owner and other contractors to develop a cohesive training session schedule that complies with Owner's personnel availability, scheduling requirements of other contractor's sessions, and specifies completion of all training sessions prior to substantial completion. The training program shall include at a minimum the following:
 - 1. Submit not less than four weeks prior to Preliminary Acceptance.
 - 2. Revise and resubmit until acceptable.
 - 3. Provide an overall schedule showing all training sessions.
 - a. Coordinate instruction schedule with the Client's operations and schedule through the Client's Representative. Adjust schedule as required to minimize disrupting the Client's operations and to ensure attendance by designated personnel.

4. Include at least the following for each training session:
 - a. Identification.
 - b. Proposed date, time, and duration.
 - c. Description of products and/or systems to be covered.
 - d. Name of firm and person conducting training; include qualifications.
 - e. Intended audience, such as job description.
 - f. Objectives of training and suggested methods of ensuring adequate training.
 - g. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - h. Media to be used, such a slides, hand-outs, etc.
 - i. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

- B. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 1. Coordinate content of training sessions with content of emergency, operation, and maintenance manuals.
 2. Include applicable portion of O&M manuals.
 3. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 4. Provide one extra copy of each training manual to be included with operation and maintenance data.

- C. Sign-off sheets: Submit copies of proposed sign-off sheets for each training session not less than 10 days prior to the scheduled training. Sign-off sheets are to include the following information:
 1. Name of training session
 2. Date of training
 3. Beginning/Ending time
 4. Detailed, itemized summary listing all areas of training for that session.
 5. Listing of hand-out materials distributed at the session.

6. Signature lines for Trainer, Contractor, and Client's Personnel being trained.
 - a. Signature by Client's personnel evidences training received only to the extent listed on the sign-off sheet summary.

- D. Video Recordings: Submit digital video recording of each demonstration and training session for Client's subsequent use.
 1. Format: DVD Disc. Provide three (3) copies.
 2. Label each disc and container with session identification and date.

- E. Compiled training schedule: To be submitted to A/E, CxA and Client 60 days after approval of draft training program.

1.4 QUALITY ASSURANCE

- A. Facilitator Qualifications: A firm or individual experienced in training or educating maintenance personnel in a training program similar in content and extent to that indicated for this Project, and whose work has resulted in training or education with a record of successful learning performance.

- B. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where applicable, training is to be provided by a factory-authorized service representative experienced in the operation and maintenance procedures and training of the specified product/system.

- C. Preinstruction Conference: Conduct a conference at Project site to comply with requirements in Section 01 31 00 - PROJECT MANAGEMENT AND COORDINATION. Review methods and procedures related to demonstration and training including, but not limited to, the following:
 1. Inspect and discuss locations and other facilities required for instruction.
 2. Review and finalize instruction schedule and verify availability of educational materials, instructors' personnel, audiovisual equipment, and facilities needed to avoid delays.
 3. Review required content of instruction.
 4. For instruction that must occur outside, review weather and forecasted weather conditions and procedures to follow if conditions are unfavorable.

1.5 COORDINATION

- A. Coordinate instruction schedule with Client's operations. Adjust schedule as required to minimize disrupting Client's operations and to ensure availability of Client's personnel.

- B. Coordinate instructors, including providing notification of dates, times, length of instruction time, and course content.
- C. Coordinate content of training modules with content of approved emergency, operation, and maintenance manuals. Do not submit instruction program until operation and maintenance data has been reviewed and approved by Client.

PART 2 - PRODUCTS

2.1 INSTRUCTION PROGRAM

- A. Program Structure: Develop an instruction program that includes individual training modules for each system and for equipment not part of a system, as required by individual Specification Sections and/or listed below.
 - 1. Motorized doors, including overhead doors and automated gates.
 - 2. Equipment, including residential appliances, simulation software/equipment, A/V system.
 - 3. Fire-protection systems, including fire alarm, graphic annunciators, and fire-extinguishing systems.
 - 4. Conveying systems, including elevators.
 - 5. Heat generation, including boilers, feedwater equipment, pumps, distribution piping.
 - 6. Refrigeration systems, including chillers, pumps, and distribution piping.
 - 7. HVAC systems, including air-handling equipment, air distribution systems, and terminal equipment and devices.
 - 8. HVAC instrumentation and controls including building automation systems.
 - 9. Electrical service and distribution, including transformers, switchboards, panelboards, UPS, and motor controls.
 - 10. Lighting equipment and controls.
 - 11. Communication systems, including [intercommunication] [surveillance] [clocks and programming] [voice and data] [and] [television] equipment.
- B. Training Modules: Develop a learning objective and teaching outline for each module. Include a description of specific skills and knowledge that participant is expected to master. For each module, include instruction for the following as applicable to the system, equipment, or component:
 - 1. Basis of System Design, Operational Requirements, and Criteria: Include the following:
 - a. System, subsystem, and equipment descriptions.
 - b. Performance and design criteria if Contractor is delegated design responsibility.
 - c. Operating standards.
 - d. Regulatory requirements.
 - e. Equipment function.
 - f. Operating characteristics.
 - g. Limiting conditions.
 - h. Performance curves.
 - 2. Documentation: Review the following items in detail:
 - a. Emergency manuals.

- b. Operations manuals.
 - c. Maintenance manuals.
 - d. Project record documents.
 - e. Identification systems.
 - f. Warranties and bonds.
 - g. Maintenance service agreements and similar continuing commitments.
3. Emergencies: Include the following, as applicable:
 - a. Instructions on meaning of warnings, trouble indications, and error messages.
 - b. Instructions on stopping.
 - c. Shutdown instructions for each type of emergency.
 - d. Operating instructions for conditions outside of normal operating limits.
 - e. Sequences for electric or electronic systems.
 - f. Special operating instructions and procedures.
4. Operations: Include the following, as applicable:
 - a. Startup procedures.
 - b. Equipment or system break-in procedures.
 - c. Routine and normal operating instructions.
 - d. Regulation and control procedures.
 - e. Control sequences.
 - f. Safety procedures.
 - g. Instructions on stopping.
 - h. Normal shutdown instructions.
 - i. Operating procedures for emergencies.
 - j. Operating procedures for system, subsystem, or equipment failure.
 - k. Seasonal and weekend operating instructions.
 - l. Required sequences for electric or electronic systems.
 - m. Special operating instructions and procedures.
5. Adjustments: Include the following:
 - a. Alignments.
 - b. Checking adjustments.
 - c. Noise and vibration adjustments.
 - d. Economy and efficiency adjustments.
6. Troubleshooting: Include the following:
 - a. Diagnostic instructions.
 - b. Test and inspection procedures.
7. Maintenance: Include the following:
 - a. Inspection procedures.
 - b. Types of cleaning agents to be used and methods of cleaning.
 - c. List of cleaning agents and methods of cleaning detrimental to product.
 - d. Procedures for routine cleaning
 - e. Procedures for preventive maintenance.
 - f. Procedures for routine maintenance.
 - g. Instruction on use of special tools.
8. Repairs: Include the following:

- a. Diagnosis instructions.
- b. Repair instructions.
- c. Disassembly; component removal, repair, and replacement; and reassembly instructions.
- d. Instructions for identifying parts and components.
- e. Review of spare parts needed for operation and maintenance.

PART 3 - EXECUTION

3.1 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Client.
- B. Demonstration may be combined with Client personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Client will provide room and seating at no cost to Contractor.
 1. Contractor to set up instructional equipment at instruction location.
- C. Assemble educational materials necessary for instruction, including documentation and training module. Assemble training modules into a combined training manual.
- D. Provide instruction at mutually agreed on times as approved in the training schedule matrix. For equipment that requires seasonal operation, provide similar instruction at start of each season.
- E. Create and provide training video. Record each training module separately. Include classroom instructions and demonstrations, Client diagrams, and other visual aids, but not student practice.
 1. At beginning of each training module video, record each chart containing learning objective and lesson outline.
- F. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

- G. At the conclusion of each training module obtain sign-offs using the approved sign-off sheets. Executed sign-off sheets are to be submitted as part of the closeout documentation evidencing compliance with training requirements.
- H. Collect used and leftover educational materials and return to Client. Remove instructional equipment. Restore systems and equipment to condition existing before initial training use.

END OF SECTION 01 79 00

SECTION 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS**PART 1 - GENERAL****1.1 PROJECT GOALS**

- A. This project has been designed to achieve the LEED Silver (minimum 50 points) rating as defined by USGBC LEED v4 BD+C.

1.2 WORK INCLUDES

- A. Section includes general requirements and procedures for compliance with certain prerequisites and credits needed for Project to obtain "LEED® Version 4 for Building Design and Construction" (LEED v4 BD+C) certification based on USGBC's LEED v4 BD+C.
 - 1. Specific requirements for LEED are also included in other Sections.
 - 2. Some LEED prerequisites and credits needed to obtain LEED certification depend on product selections and may not be specifically identified as LEED requirements. Compliance with requirements needed to obtain LEED prerequisites and credits may be used as one criterion to evaluate substitution requests and comparable product requests.
 - 3. A copy of the LEED Project checklist is attached at the end of this Section for information only.
 - a. Some LEED prerequisites and credits needed to obtain the indicated LEED certification depend on aspects of Project that are not part of the Work of the Contract.
 - 4. Definitions included in the "LEED Version 4 for Building Design and Construction" (LEED v4 BD+C) Reference Guide and online amendments apply to this Section.
 - 5. The LEED v4.1 MR credits and pilot credits are acceptable.

1.3 LEED Green Building Rating System Overview

- A. The LEED Green Building Rating System is a priority program of the US Green Building Council. It is a voluntary, consensus-based, market-driven building rating system based on existing proven technology. It evaluates environmental performance from a "whole building" perspective over a building's life cycle, providing a definitive standard for what constitutes a "green building."
- B. LEED is based on accepted energy and environmental principles and strikes a balance between known effective practices and emerging concepts. Unlike other rating systems currently in existence, the development of LEED Green Building Rating System™ was instigated by the US Green Building Council Membership, representing all segments of the building industry, and has been open to public scrutiny.
- C. LEED is a feature-oriented system where credits are earned for satisfying each criterion. Compliance with all prerequisites, however, is required for

certification. Different levels of green building certification are awarded based on the total credits earned. The system is designed to be comprehensive in scope, yet simple in operation.

1.4 RELATED WORK

A. Specified elsewhere:

1. Section 01 74 19, "Construction Waste Management and Disposal."
2. Section 01 01 40, "Erosion and Sedimentation Control."
3. Divisions 02 through 49 Sections for LEED requirements specific to the work of each of these Sections. Requirements may or may not include reference to LEED.

1.5 DEFINITIONS

- A. LEED: Leadership in Energy & Environmental Design
- B. Bio-Based Materials: Materials that meet the Sustainable Agriculture Network's Sustainable Agriculture Standard. Bio-based raw materials (other than wood) shall be tested using ASTM D 6866 and be legally harvested, as defined by the exporting and receiving country.
- C. CASRN: Chemical Abstract Service Registration Number
- D. CDPH Standard Method v1.2: California Department of Public Health (CDPH) Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers, v. 1.2–2017, for the emissions testing and requirements of products and materials.
- E. Chain-of-Custody (COC): A procedure that tracks a product from the point of harvest or extraction to its end use, including all successive stage of processing, transformation, manufacturing, a distribution.
- F. Chain-of-Custody Certificates: Certificates signed by manufacturers and fabricators certifying that wood used to make products was obtained from forests certified by an FSC-accredited certification body to comply with FSC STD-01-001.
- G. Composite Wood and Agrifiber: Products made of wood particles and/or plant material pressed and bonded with adhesive or resin such as particleboard, medium density fiberboard (MDF), plywood, wheatboard, strawboard, panel substrates, and door cores.
- H. Corporate Sustainability Report: A third-party verified report that outlines the environmental impacts of extraction operations and activities associated with the manufacturer's product and the product's supply chain.
- I. Cradle to Cradle: A system for certifying building products. Products recognized at Bronze level or higher,
- J. Declare product label: with Declare label designated as Red List Free or Declared or LBC Compliant

- K. Environmental Product Declaration (EPD): An independently verified report based on life-cycle assessment studies that have been conducted according to a set of common rules for each product category and peer-reviewed.
 - 1. Product-Specific Declaration: A product with a publicly available, critically reviewed life-cycle assessment conforming to ISO 14044 that has at least a cradle to gate scope.
 - 2. Product-specific Type III EPD -- Internally Reviewed. Products with an internally critically reviewed LCA in accordance with ISO 14071. Products with product-specific internal EPDs which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope
 - 3. Industry-wide Type III EPD -- Products with third-party certification (Type III), including external verification, in which the manufacturer is explicitly recognized as a participant by the program operator. Products with industry-wide EPDs, which conform to ISO 14025, and EN 15804 or ISO 21930 and have at least a cradle to gate scope.
 - 4. Product-specific Type III EPD -- Products with third-party certification (Type III), including external verification and external critical review in which the manufacturer is explicitly recognized as the participant by the program operator are valued as 1.5 products for the purposes of credit achievement calculation.
- L. Extended Producer Responsibility (EPR): Measures undertaken by the maker of a product to accept its own and sometimes other manufacturers' products as postconsumer waste at the end of the products' useful life.
- M. Health Product Declaration Open Standard (HPD): A standard format for reporting product content and associated health information for building products and materials.
- N. Indoor Air Quality (IAQ) Management Plan: Plan developed by the Contractor to provide a healthy indoor environment for workers and building occupants during construction. Plan must meet or exceed the recommendations of the Sheet Metal and Air Conditioning Contractors National Association (SMACNA) "IAQ Guidelines for Occupied Buildings Under Construction, 2nd Edition, 2007."
- O. Inherently non-emitting sources of VOCs: stone, ceramic, powder-coated metals, plated or anodized metals, glass, concrete, clay brick and unfinished or untreated solid wood with no integral organic-based surface coatings, binders or sealants.
- P. Leadership Extraction Practices: Products that meet at least one of the responsible extraction criteria, which include: extended producer responsibility; bio-based materials; FSC wood products; materials reuse; recycled content; and other USGBC approved programs.
- Q. Material Cost: The dollar value of materials being provided to the site, after Contractor mark-ups, including transportation costs, taxes, fees, and shop labor, but excluding field equipment and field labor costs.

- R. Materials Reuse: Reuse includes salvaged, refurbished, or reused products.
- S. Material Stream (construction waste management): Each source separated material sent to an individual recycler who processes that single material is considered one material stream; materials sent to commingled facilities for mixed-recyclable processing are considered one stream.
- T. Multi-Attribute Optimization: Third party certified products that demonstrate impact reduction below industry average in at least three of the following six categories: global warming potential; stratospheric ozone depletion; acidification; eutrophication; tropospheric ozone creation; nonrenewable resource depletion.
- U. Recycled Content: Recycled content is the sum of post-consumer recycled content plus one-half the pre-consumer recycled content, based on cost.
 - 1. "Post-consumer" material is defined as waste material generated by households or by commercial, industrial, and institutional facilities in their role as end users of the product, which can no longer be used for its intended purpose.
 - 2. "Pre-consumer" material is defined as material diverted from the waste stream during the manufacturing process. Excluded is reutilization of materials, such as rework, regrind, or scrap, generated in a process and capable of being reclaimed within the same process that generated it.
- V. Regional Materials: Materials that are extracted, harvested, recovered, and manufactured within a radius of 100 miles from the Project site. If only a fraction of a product or material is extracted/harvested/recovered and manufactured locally, then only that percentage (by weight) shall contribute to the regional value.
- W. Salvaged and reused materials: Products more than one year old at time of use.
- X. Volatile Organic Compounds (VOC) Emissions Test: Refer to CDPH Standard Method v1.2 definition.

1.6 ADMINISTRATIVE REQUIREMENTS

- A. Work of this project includes completed building and application for LEED certification. Work is not complete until Owner has accepted USGBC's final review of LEED certification.
 - 1. Provide documentation required by LEED and LEED reviewer.
- B. Provide materials and procedures necessary to obtain LEED prerequisites and credits required in this Section. Other Sections may specify requirements that contribute to LEED prerequisites and credits. Refer to other sections for additional materials and procedures necessary to obtain LEED prerequisites and credits.
- C. Respond to questions and requests for additional information from Architect and the USGBC regarding LEED credits until the USGBC/GBCI has made its determination on the project's LEED certification application.

- D. LEED Online Submittals: Upload LEED documentation submittal data directly to USGBC project "LEED Online" website. Complete online forms at least monthly and as necessary to document LEED credits for submittals required in this Section.
 - E. LEED Conference: Schedule and conduct a conference at a time convenient to Owner and Architect within 21 days prior to commencement of the work. Advise Architect, Owner's Commissioning Authority, and Owner's Project Manager of scheduled meeting dates.
 - 1. Attendees: Authorized representatives of Owner, Owner's Commissioning Authority, Owner's Project Manager, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
 - 2. Agenda: LEED goals for the project, Contractor's action plans, and discussion of targeted LEED Prerequisites and Credits.
 - 3. Minutes: Record and distribute minutes to attendees and other entities with responsibilities for obtaining LEED Credits.
- 1.7 ACTION SUBMITTALS: See Section 01 33 00, "Submittal Procedures".
- A. General: Submit additional LEED submittals required by other Specification Sections.
 - 1. Submit each LEED submittal simultaneously with applicable product submittal.
 - B. LEED Documentation Submittals
 - 1. Submit under provisions of Division 01 Section 01 33 00 "SUBMITTALS."
 - 2. General, Sustainable Materials Attributes Form: Project submittals must be accompanied by a completed LEED Materials Submittal Form. Submittal packages must also include highlighted documentation supporting the sustainability claims made on the LEED Materials Submittal Form.
 - a. Provide location and distance from Project of material manufacturer and point of extraction, harvest, or recovery for each raw material if 100 miles or fewer.
 - 3. MRp2/MRc5, Construction and Demolition Waste Management: Comply with submittal requirements of Section 01 74 19 "Construction Waste Management and Disposal."
 - 4. MRc2 v4.1, Environmental Product Declarations complying with LEED requirements.
 - 5. MRc4 v4.1, Material Ingredients: Option 1, Material Ingredient Reporting.
 - a. Material ingredient reports for products that comply with LEED requirements for material ingredient reporting, including but not limited

to the following:

- 1) Manufacturer Inventory.
 - 2) Health Product Declaration.
 - 3) Cradle to Cradle certifications.
 - 4) Declare product labels.
 - 5) ANSI/BIFMA e3 Furniture Sustainability Standard.
6. MRc4 v4.1, Material Ingredients: Option 2, Material Ingredient Optimization.
- a. Documentation for products that comply with LEED requirements for material ingredient optimization, including but not limited to the following:
 - 1) GreenScreen Benchmarks.
 - 2) Cradle to Cradle certifications.
 - 3) REACH optimizations.
7. EQc2, Low-Emitting Materials: Product data, indicating VOC content and emissions testing documents showing compliance with requirements for low-emitting materials, for the following materials:
- a. Paints and coatings.
 - b. Flooring.
 - c. Products containing composite wood or agrifiber products or wood glues.
 - d. Ceilings.
 - e. Insulation: thermal, and acoustic.
8. EQc2, Low-Emitting Materials: Project Materials Cost Data: Provide statement indicating total cost for permanently installed materials used for Project. Costs exclude labor, overhead, and profit. Include breakout of costs for the following categories of items:
- a. Paints and coatings.
 - b. Flooring.
 - c. Products containing composite wood or agrifiber products or wood glues.
 - d. Ceilings.
 - e. Insulation: thermal, and acoustic.

1.8 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For LEED coordinator.

- B. LEED Action Plan Components: Provide preliminary submittals within fifteen days of date established for the Notice to Proceed indicating how the following requirements will be met:
1. MRp2/MRc5, Waste management plan, complying with Section 01 74 19 "Construction Waste Management and Disposal."
 2. EQp2/EQ3/EQ4, Indoor air quality plan. Comply with article 3.3
 3. Erosion and Sedimentation Control plan that meets the requirements of the 2012 U.S. Environmental Protection Agency (EPA) Construction General Permit (CGP) or local equivalent, whichever is more stringent. The plan must describe the measures implemented. Sign a declaration that this plan will be followed either directly on the Erosion and Sedimentation Control plan or company letterhead.
- C. LEED Progress Reports: Concurrent with each Application for Payment (at minimum, monthly), submit reports comparing actual construction and purchasing activities with LEED action plans for the following:
1. SSp1, Construction Activity Pollution plan, logs and photos.
 2. MRp2/MRc5, Waste reduction progress reports complying with Section 01 74 19 "Construction Waste Management and Disposal."
 3. MRc2, Environmental Product Declarations. Documentation shall be compiled on the LEEDv4.1 BPDO Calculator.
 4. MRc3, Sourcing of Raw Materials. Documentation shall be compiled on the LEEDv4.1 BPDO Calculator.
 - a. General: Manufacturing locations.
 - b. Option 1: Corporate sustainability reports.
 - c. Option 2:
 - 1) Extended producer responsibility.
 - 2) Bio-based materials.
 - 3) Certified wood products.
 - 4) Materials reuse.
 - 5) Recycled content.
- D. MRc4, Material Ingredients. Documentation shall be compiled on the LEEDv4.1 BPDO Calculator.
- E. EQc2, Low emitting materials.
1. Low Emitting Materials Tracking Sheet monitoring the project's progress towards targeted LEED Indoor Environmental Quality Credits and noting any proposed product substitutions.
 2. Documentation shall be compiled on the LEED v4.1 Low-Emitting

Materials Calculator to be presented at construction meetings.

F. EQc3, Indoor air quality, during construction, complying with Section 01 73 00, "Execution" and SMACNA standards for indoor air quality during construction, photos.

G. EQc4, Indoor air quality assessment, comply with article 3.3

1.9 QUALITY ASSURANCE

A. LEED Coordinator: Engage an experienced LEED-Accredited Professional to coordinate LEED requirements. Experienced professional shall have completed at least one LEEDv4/4.1 project. LEED coordinator may also serve as waste management coordinator.

B. LEED Preconstruction Meeting: Architect (or Architect's LEED consultant) to conduct meeting at project site as part of the Pre-Construction Conference to comply with requirements of this section.

1. The General Contractor shall require all major subcontractors to attend meeting.

2. Review methods and procedures related to managing the LEED construction process and to include, but are not limited to the following:

a. Understanding LEED process and terminology.

b. Understanding contractor responsibilities and LEED submittal process.

c. Maintaining proper meeting minutes, records, and tracking mechanisms related to LEED credit responsibilities.

d. Understanding LEED certification process and filling out LEED Online submittal forms.

2. PRODUCTS

2.1 MATERIALS, GENERAL

A. Provide products and procedures necessary to obtain LEED credits required in this Section. Although other Sections may specify some requirements that contribute to LEED credits, the Contractor shall determine additional materials and procedures necessary to obtain LEED credits indicated. Contractor to determine a combination of credit options best suited for achieving credits required.

1. Exclusions: Special equipment, such as elevators, escalators, process equipment, and fire suppression systems, is excluded from the credit calculations. Also excluded are products purchased for temporary use on the project, like formwork for concrete.

2.2 BUILDING PRODUCT DISCLOSURE AND OPTIMIZATION

A. MRc2, Environmental Product Declarations (EPD):

1. Option 1. Provide at least 20 permanently installed products (sourced from at least 5 different manufacturers) which meet one of the disclosure criteria:
 - a. Life Cycle Assessment and EPD with publicly available critically reviewed life-cycle assessment conforming to ISO 14044 that have at least a cradle to gate scope. Valued as one whole product.
 - b. Product-Specific Type III EPD with internally critically reviewed LCA in accordance with ISO 14071 and which conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope: Valued as one whole product.
 - c. Industry-Wide Type III EPD with third party verification which conform to ISO 14025 and EN 15804 or ISO 21930 and have at least a cradle to gate scope: Valued as one whole product.
 - 1) Manufacturers of Products must be explicitly recognized as participants in the EPD for industry-wide and product-specific EPDs.
 - d. Product-Specific Type III EPD with third-party certification including external verification and external critical review: Valued as 1.5 products.
2. Option 2. Use products that comply with one of the criteria below for embodied carbon optimization report or action plan separate from the LCA or EPD. Provide at least 5 permanently installed products sourced from at least three different manufacturers.
 - a. Embodied Carbon/LCA Action Plan (½ product).
 - b. Reductions in Embodied Carbon: less than 10% reduction in GWP relative to baseline (1 product)
 - c. Reductions in Embodied Carbon: 10%+ reduction in GWP relative to baseline (1.5 products)
 - d. Reductions in Embodied Carbon: 20%+ reduction in GWP and 5%+ reduction in two additional impact categories, relative to baseline (2 products)
3. For industry-wide (generic) declarations and product-specific Type III declarations, the project team must provide the following:
 - a. Declaration holder (the company, usually the manufacturer, that the EPD is attributed to)
 - b. LCA verifier (the third-party entity that verifies the life-cycle assessment)
 - c. PCR reviewer (the third-party entity that has reviewed the product category rules)
4. Product Specific EPD's require that the following be provided:

- a. Name (declaration holder or producer, typically the manufacturer)
 - b. Contact information
 - c. Product type
 - d. Product name
 - e. Product description
 - f. Summary of impact categories measured and overall values
 - g. Functional unit
 - h. Standards met
 - i. Independent review entity's name and statement
 - j. USGBC approved program – Products that comply with other USGBC approved environmental product declaration frameworks.
- B. MRc3, Sourcing of Raw Materials: Use products sourced from at least three different manufacturers for at least 15% by cost of the total value of permanently installed building products in the project or products sourced from at least five different manufacturers for at least 30% by cost of the total value of permanently installed building products in the project, which meet one of the disclosure criteria:
1. Extended producer responsibility program.
 2. Bio-based materials.
 3. FSC Certified Wood: Wood-based materials include, but are not limited to, the following materials when made from wood, engineered wood products, or wood-based panel products:
 - a. Rough carpentry.
 - b. Miscellaneous carpentry.
 - c. Structural glued-laminated timber.
 - d. Finish carpentry.
 - e. Architectural woodwork.
 - f. Wood paneling.
 - g. Wood veneer wall covering.
 - h. Wood flooring.
 - i. Wood cabinets.
 4. Materials Reuse: Includes salvaged, refurbished and reused products and are valued at 200% of their cost for the purposes of credit achievement.
 5. Recycled content.

- a. Exceptions: Do not include fire protection, operational plumbing, operational mechanical, and operational electrical components, and specialty items, such as elevators and equipment, in the calculation.
- C. MRc4, Material Ingredients: Option 1, Material Ingredient Reporting.
1. Use at least 20 different permanently installed products from at least five different manufacturers that use any of the following programs to demonstrate the chemical inventory of the product to at least 0.1% (1000 ppm), which meet one of the following disclosure criteria:
 - a. Manufacturer Inventory. The manufacturer has published complete content inventory for the product following these guidelines:
 - 1) A publicly available inventory of all ingredients identified by name and Chemical Abstract Service Registration Number (CASRN)
 - 2) Materials defined as trade secret or intellectual property may withhold the name and/or CASRN but must disclose role, amount and GreenScreen benchmark, as defined in GreenScreen v1.2.
 - b. Health Product Declarations (HPDs). The end use product has a published, complete Health Product Declaration with full disclosure of known hazards in compliance with the Health Product Declaration Open Standard.
 - c. Cradle to Cradle (C2C) certifications. Product has Material Health Certificate or is Cradle to Cradle Certified™ under standard version 3 or later with a Material Health achievement level at the Bronze level or higher.
 - d. Declare product labels. The Declare product label must meet the following requirements: Declare labels designated as Red List Free, LBC Red List Free, or Declared. Declare labels designated as LBC Red List Approved or LBC Compliant that demonstrate content inventory to 0.1% (1000 ppm).
- D. MRc4, Building Product Disclosure and Optimization, Material Ingredients: Option 2, Material Ingredient Optimization.
1. Use products from at least three different manufacturers that document their material ingredient optimization using the paths below for at least 5 compliant products, which meet one of the following disclosure criteria:
 - a. Material Ingredient Screening Optimization Action Plan (value at ½ product). See LEED criteria.
 - b. Advanced Inventory and Assessment (value at 1 product). Inventory to at least 0.01% by weight (100 ppm) and no GreenScreen LT-1 hazards or GHS Category 1 hazards are present.
 - c. Inventory to at least 0.01% by weight (100ppm) and at least 75% by weight of product is assessed using GreenScreen. The remaining 25% by weight of product has been inventoried and the GreenScreen assessment is publicly available.

- d. Material Ingredient Optimization (value at 1.5 products). Inventory to at least 0.01% by weight (100 ppm) and at least 95% by weight of product is assessed using GreenScreen. No BM-1 hazards are present. The remaining 5% not assessed has been inventoried and screened using GreenScreen List Translator and no GreenScreen LT-1 hazards are present.
- E. Products sourced (extracted, manufactured, purchased) within 100 miles of the project site are valued at twice their based contributing cost (or number of products) up to a maximum of 200% of their cost or 2 products.

2.3 LOW-EMITTING MATERIALS

- A. EQc2, Low-Emitting Materials, General Emissions Requirements: Products must demonstrate they have been tested and determined compliant in accordance with California Department of Public Health, (CDHP), Standard Method v1.2-2017, using the applicable exposure scenario. Manufacturer’s documentation demonstrating compliance must state the range of total VOCs (tVOC) after 14 days measured as specified in the CDPH Standard Method v1.2 as follows:
 - 1. 0.5mg/m3 or less,
 - 2. between 0.5 and 5.0 mg/m3 or,
 - 3. 0.50 mg/m3 or more.
- B. EQc2, Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, use paints and coatings that comply with the limits for VOC content when calculated according to the California Air Resources Board (CARB) 2007, Suggested Control Measure (SCM) for Architectural Coatings, or the South Coast Air Quality Management District (SCAQMD) Rule 1113, amended February 5, 2016, effective date 1/1/19.

	Allowable VOC Content (g/L):
Bond breakers	350
Building Envelope Coating	50
Colorant added to architectural coatings, excluding IM coatings	50
Colorant added to solvent-based IM	600
Colorant added to waterborne IM	50
Concrete curing compounds	100
Concrete surface retarder	50
Default	50
Driveway sealers	50
Dry-fog coatings	50
Faux finishing coatings	
Clear topcoat	100
Decorative coatings	350

Glazes	350
Japan	350
Trowel applied coatings	50
Fire-proofing coatings	150
Flats	50
Floor coatings	50
Form-release compounds	100
Graphic arts (sign) coatings	200
Industrial maintenance coatings	
Color indicating safety coatings	480
High temperature IM coatings	420
Non-sacrificial anti-graffiti coatings	100
Zinc-rich IM Primers	100
Low-solids coating	120
Magnesite cement coatings	450
Mastic coatings	100
Metallic pigmented coatings	150
Multi-color coatings	250
Nonflat coatings	50
Pre-treatment wash primers	420
Primers, sealers, and undercoaters	100
Reactive penetrating sealers	350
Recycled coatings	250
Roof coatings	50
Roof coatings, aluminum	100
Roof primers, bituminous	350
Rust preventative coatings	100
Sacrificial anti-graffiti coatings	50
Shellac - Clear	730
Shellac – Pigmented	550
Specialty primers	100
Stains, interior	250
Stone consolidants	450
Swimming pool coatings	340
Tile and stone sealers	100
Traffic marking coatings	100
Tub and tile refinish coatings	420
Waterproofing sealers	100
Waterproofing concrete/masonry sealers	100
Wood coatings (varnish, sanding sealers, lacquer)	275
Wood conditioners	100

Wood preservatives	350
--------------------	-----

- C. EQc2, Low-Emitting Materials, Paints and Coatings: For field applications that are inside the weatherproofing system, 75 percent of paints and coatings by volume or surface area shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." 100% shall meet the VOC content evaluation.
- D. EQc2, Low-Emitting Materials, Flooring: At least 90% of all flooring by cost or surface area shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Or it shall be inherently non-emitting or meet salvaged/reused criteria.
- E. EQc2, Low-Emitting Materials, Composite Wood: At least 75% of all Composite wood, agrifiber products, and adhesives by cost or surface area shall be made using ultra-low-emitting formaldehyde (ULEF) resins as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products" or shall be made with no added formaldehyde.
- F. EQc2, Low-Emitting Materials, Ceilings: At least 90% of all ceilings, by cost or surface area, shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Or be inherently non-emitting. Ceilings include ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems such as canopies or clouds, and glazed skylights.
- G. EQc2. Low-Emitting Materials, Thermal, and Acoustic Insulation: At least 75% of all insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers." Insulation includes thermal and acoustic boards, batts, rolls, blankets, sound attenuation fire blankets, foamed-in-place, loose-fill blown, and sprayed insulation.
- H. Additional Low-Emitting Requirements:
 - 1. If the applicable regulation requires subtraction of exempt compounds, any content of intentionally added exempt compounds larger than 1% weight by mass (total exempt compounds) must be disclosed.
 - 2. If a product cannot reasonably be tested as specified above, testing of VOC content must comply with ASTM D2369-10; ISO 11890, part 1; ASTM D6886-03; or ISO 11890-2.

3. Methylene chloride and perchloroethylene may not be intentionally added in paints, coatings, adhesives, or sealants.

2.4 INDOOR WATER USE REDUCTION

- A. WEp2, Indoor Water Use Reduction, Appliances: Provide ENERGY STAR or performance equivalent appliances.
 1. All newly installed toilets, urinals, private lavatory faucets and showerheads that are eligible for labeling must be WaterSense labeled. Cutsheets shall be provided showing the WaterSense label.
- B. WEp2/WEc2, Indoor Water Use Reduction, Plumbing Fixtures: Do not exceed water flow requirements indicated in Division 22 - PLUMBING.

3. EXECUTION

3.1 NON-SMOKING BUILDING

- A. EQp2, Environmental Tobacco Smoke Control: Smoking is not permitted within the building or within 25 feet of entrances, operable windows, or outdoor-air intakes.

3.2 CONSTRUCTION WASTE MANAGEMENT

- A. MRp2 / MRc5, Construction and Demolition Waste Management: Comply with Section 01 74 19 "Construction Waste Management and Disposal."

3.3 CONSTRUCTION INDOOR-AIR-QUALITY MANAGEMENT

- A. EQc3/EQc4, Construction Indoor Air Quality Management Plan:
 1. Air-Quality Testing: Engage testing agency to perform the following:
 - a. Conduct baseline IAQ testing, after construction ends and prior to occupancy, using testing protocols consistent with the EPA's "Compendium of Methods for the Determination of Air Pollutants in Indoor Air," and as additionally detailed in the USGBC's "LEED Reference Guide for Building Design and Construction."
 - b. Demonstrate that the contaminant maximum concentrations listed below are not exceeded:
 - 1) Formaldehyde: 16 ppb.
 - 2) Particulates (PM10): 50 micrograms/cu. m.
 - 3) Particulates (PM2.5): 12 micrograms/cu.m.
 - 4) Ozone: 0.07 ppm, according to ASTM D 5149.
 - 5) Total Volatile Organic Compounds: 500 micrograms/cu. m.
 - 6) Carbon Monoxide: 9 ppm and no greater than 2 ppm above

outdoor levels.

- 7) Acetaldehyde: 140 micrograms/cu.m.
 - 8) Benzene: 3 micrograms/cu.m.
 - 9) Hexane: 7000 micrograms/cu.m.
 - 10) Naphthalene: 9 micrograms/cu.m.
 - 11) Phenol: 200 micrograms/cu.m.
 - 12) Styrene: 900 micrograms/cu.m.
 - 13) Tetrachloroethylene: 35 micrograms/cu.m.
 - 14) Toluene: 300 micrograms/cu.m.
 - 15) Vinyl acetate: 200 micrograms/cu.m.
 - 16) Dichlorobenzene: 800 micrograms/cu.m.
 - 17) Xylenes - total: 700 micrograms/cu.m.
 - 18) Target Chemicals in California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," Table 4-1 (except formaldehyde): Allowable concentrations in California Department of Public Health "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers," Table 4-1.
- c. For each sampling point where the maximum concentration limits are exceeded, take corrective action until requirements have been met.
- d. Air-sample testing shall be conducted as follows:
- 1) All measurements shall be conducted prior to occupancy but during normal occupied hours, and with building ventilation system starting at the normal daily start time and operated at the minimum outside-air flow rate for the occupied mode throughout the duration of the air testing.
 - 2) Building shall have all interior finishes installed, including, but not limited to, millwork, doors, paint, carpet, and acoustic tiles. Nonfixed furnishings, such as workstations and partitions, are encouraged, but not required, to be in place for the testing.
 - 3) Number of sampling locations varies depending on the size of building and number of ventilation systems. For each portion of building served by a separate ventilation system, the number of sampling points shall not be less than one per 5000 sq. ft.. For

large open spaces, one sampling point per 50,000 sq. ft. may be used.

- 4) Air samples shall be collected between 3 and 6 feet from the floor to represent the breathing zone of occupants, and over a minimum four-hour period.

END OF SECTION 01 81 13



LEED v4 for BD+C: New Construction and Major Renovation

Project Checklist

Project Name: EMS Addition
Date: 4/4/2024

Y ?+ ?- N

1				Credit	Integrative Process v4.1	1
12	0	0	4	Location and Transportation		16
			16	Credit	LEED for Neighborhood Development Location	16
1				Credit	Sensitive Land Protection	1
2				Credit	High Priority Site	2
5				Credit	Surrounding Density and Diverse Uses v4.1	5
3			2	Credit	Access to Quality Transit	5
			1	Credit	Bicycle Facilities	1
			1	Credit	Reduced Parking Footprint v4.1	1
1				Credit	Green Vehicles/Electric Vehicles v4.1	1
2	1	0	7	Sustainable Sites		10
Y				Prereq	Construction Activity Pollution Prevention	Required
1				Credit	Site Assessment	1
	1		1	Credit	Site Development - Protect or Restore Habitat v4.1	2
			1	Credit	Open Space v4.1	1
			3	Credit	Rainwater Management v4.1	3
			2	Credit	Heat Island Reduction	2
1				Credit	Light Pollution Reduction	1
5	0	0	6	Water Efficiency		11
Y				Prereq	Outdoor Water Use Reduction	Required
Y				Prereq	Indoor Water Use Reduction	Required
Y				Prereq	Building-Level Water Metering	Required
2				Credit	Outdoor Water Use Reduction	2
2			4	Credit	Indoor Water Use Reduction	6
			2	Credit	Optimize Process Water Use v4.1	2
1				Credit	Water Metering	1
11	3	2	17	Energy and Atmosphere		33
Y				Prereq	Fundamental Commissioning and Verification	Required
Y				Prereq	Minimum Energy Performance	Required
Y				Prereq	Building-Level Energy Metering	Required
Y				Prereq	Fundamental Refrigerant Management	Required
3			3	Credit	Enhanced Commissioning	6
7			11	Credit	Optimize Energy Performance	18
1				Credit	Advanced Energy Metering	1
			2	Credit	Grid Harmonization v4.1	2
	3		2	Credit	Renewable Energy v4.1	5
			1	Credit	Enhanced Refrigerant Management	1

4	2	1	6	Materials and Resources		13
Y				Prereq	Storage and Collection of Recyclables	Required
Y				Prereq	Construction and Demolition Waste Management Planning	Required
			1 4	Credit	Building Life-Cycle Impact Reduction	5
1	1			Credit	Building Product Disclosure and Optimization - Environmental Product Declarations v4.1	2
			2	Credit	Building Product Disclosure and Optimization - Sourcing of Raw Materials v4.1	2
1	1			Credit	Building Product Disclosure and Optimization - Material Ingredients v4.1	2
2				Credit	Construction and Demolition Waste Management	2

9	0	0	7	Indoor Environmental Quality		16
Y				Prereq	Minimum Indoor Air Quality Performance	Required
Y				Prereq	Environmental Tobacco Smoke Control	Required
2				Credit	Enhanced Indoor Air Quality Strategies	2
3				Credit	Low-Emitting Materials v4.1	3
1				Credit	Construction Indoor Air Quality Management Plan	1
2				Credit	Indoor Air Quality Assessment	2
			1	Credit	Thermal Comfort	1
1			1	Credit	Interior Lighting v4.1	2
			3	Credit	Daylight v4.1	3
			1	Credit	Quality Views v4.1	1
			1	Credit	Acoustic Performance v4.1	1

6	0	0	0	Innovation		6
1				Credit	Innovation: Low-Hg Lighting	1
1				Credit	Innovation: O&M Starter Kit Part 1	1
1				Credit	Innovation: O&M Starter Kit Part 2	1
1				Credit	Innovation: Bird Collision Deterrence	1
1				Credit	Innovation: Choose a pilot	1
1				Credit	LEED Accredited Professional	1

3	0	0	1	Regional Priority		4
1				Credit	Regional Priority: Advanced Energy Metering	1
1				Credit	Regional Priority: Enhanced IAQ Strategies	1
				Credit	Regional Priority: High-Priority Site Brownfield	1
			1	Credit	Regional Priority: Protect & Restore Habitat	1

53	6	3	48	TOTALS		110
-----------	----------	----------	-----------	---------------	--	------------

Certified: 40 to 49 points, Silver: 50 to 59 points, Gold: 60 to 79 points, Platinum: 80 to 110

LEED v4.1 MATERIAL COVER SHEET



Provide the following product data for each product.

PROJECT NAME: _____

SUBMITTAL NUMBER: _____

MATERIAL INFORMATION

Manufacturer: _____

Product Name _____

Subcontractor: _____

Material Cost (excludes labor and installation costs): _____

***PLEASE PROVIDE THE BACKUP DOCUMENTATION FOR THE SELECTIONS CHOSEN BELOW.**

Environmental Product Declaration (EPD)

DOCUMENT PROVIDED

Internal EPD, External EPD, Industry Wide EPD, or Product Specific LCA

Sourcing of Raw Materials:

DOCUMENT PROVIDED

- Extended Producer Responsibility
- Bio-Based Materials
- FSC Certified Wood (Forest Stewardship Council). Provide Chain of Custody # for each line item and provide invoice.
- Material Reuse/Estimated Cost for reused materials \$ _____
- Recycled Content / Pre-Consumer Content _____ Post- Consumer Content _____
- Local (extracted, manufactured, and purchased within 100 miles). Location: _____

Material Ingredient Reporting:

DOCUMENT PROVIDED

Health Product Declaration, Cradle to Cradle, DECLARE, Manufacturer Inventory, Other

Low Emitting Materials:

Is the product used in the interior of the building (within the waterproofing membrane)? Yes No

PAINTS AND COATINGS (WET APPLIED ONSITE)

DOCUMENT PROVIDED

VOC Content (g/l) _____

Volume of Installed Product (Estimated or Actual) in Gallons: _____

VOC Emission Evaluation

GREENGUARD GOLD CDPH 1.2-2017 Other Not Compliant

Select Paint and Coating Type and verify VOC content is below the allowable threshold.

<input type="checkbox"/> Bond Breakers 350g/l	<input type="checkbox"/> Colorant - Architectural coatings, excluding IM coatings 50g/l	<input type="checkbox"/> Colorant - Solvent-based IM 600g/l
<input type="checkbox"/> Colorant - Waterborne IM 50g/l	<input type="checkbox"/> Concrete - Curing compounds 100g/l	<input type="checkbox"/> Concrete - Curing compounds for roadways and bridges 350g/l
<input type="checkbox"/> Concrete surface retarder 50g/l	<input type="checkbox"/> Driveway sealer 50g/l	<input type="checkbox"/> Dry-fog coatings 50g/l
<input type="checkbox"/> Faux finishing coatings - Clear topcoat 100g/l	<input type="checkbox"/> Faux finishing coatings - Decorative coatings 350g/l	<input type="checkbox"/> Faux finishing coatings - Glazes 350g/l
<input type="checkbox"/> Faux finishing coatings - Japan 350g/l	<input type="checkbox"/> Faux finishing coatings - Trowel applied coatings 50g/l	<input type="checkbox"/> Fire-proofing coatings 150g/l
<input type="checkbox"/> Flats 50g/l	<input type="checkbox"/> Floor coatings 50g/l	<input type="checkbox"/> Form release compound 100g/l
<input type="checkbox"/> Graphic arts (sign) coatings 200g/l	<input type="checkbox"/> Industrial maintenance coatings 100g/l	<input type="checkbox"/> Industrial maintenance coatings - color indicating safety coatings 480g/l
<input type="checkbox"/> Industrial maintenance coatings - High temperature IM coatings 420g/l	<input type="checkbox"/> Industrial maintenance coatings - non-sacrificial anti-graffiti coatings 100g/l	<input type="checkbox"/> Industrial maintenance coatings - Zinc-rich IM primers 100g/l
<input type="checkbox"/> Magnesite cement coatings 450g/l	<input type="checkbox"/> Mastic coatings 100g/l	<input type="checkbox"/> Metallic pigmented coatings 150g/l
<input type="checkbox"/> Multi-Color coatings 250g/l	<input type="checkbox"/> Nonflat coatings 50g/l	<input type="checkbox"/> Pre-treatment wash primers 420g/l
<input type="checkbox"/> Primers, sealers, and under coats 100g/l	<input type="checkbox"/> Reactive penetrating sealers 350g/l	<input type="checkbox"/> Recycled coatings 250g/l
<input type="checkbox"/> Rust preventative coatings 100g/l	<input type="checkbox"/> Shellac - Clear 730g/l	<input type="checkbox"/> Shellac - Pigmented 550g/l
<input type="checkbox"/> Specialty primers 100g/l	<input type="checkbox"/> Stains 100g/l	<input type="checkbox"/> Stains, interior 250g/l
<input type="checkbox"/> Stone consolidants 450g/l	<input type="checkbox"/> Tile and stone sealers 100g/l	<input type="checkbox"/> Traffic coatings 100g/l
<input type="checkbox"/> Waterproofing sealers 100g/l	<input type="checkbox"/> Waterproofing concrete/masonry sealers 100g/l	<input type="checkbox"/> Wood coatings - varnish 275g/l
<input type="checkbox"/> Wood coatings - sanding sealers 275g/l	<input type="checkbox"/> Wood coatings - lacquer 275g/l	<input type="checkbox"/> Wood conditioners 100g/l
<input type="checkbox"/> Wood preservatives 350g/l	<input type="checkbox"/> Low solids coatings 120g/l	

ADHESIVES & SEALANTS (INTERIOR ADHESIVES AND WET APPLIED ONSITE) **DOCUMENT PROVIDED**

VOC Content (g/l)

Volume of Installed Product (Estimated or Actual) in Gallons:

VOC Emission Evaluation GREENGUARD GOLD CDPH 1.2-2017 Other Not Compliant**FLOORING** **DOCUMENT PROVIDED**

(Includes all types of hard and soft surface flooring (carpet, ceramic, vinyl, rubber, engineered, solid wood, laminates), raised flooring, wall base, underlayment, and other floor coverings)

VOC Emission Evaluation GREENGUARD GOLD CDPH 1.2-2017 Inherently Non-Emitting Other Not Compliant**WALLS** **DOCUMENT PROVIDED**

(Includes all finish wall treatments (wall coverings, wall paneling, wall tile), gypsum or plater surface wall structures, cubicle /curtain/ partition walls, trim, interior and exterior doors, wall frames, interior and exterior windows, and window treatments)

VOC Emission Evaluation GREENGUARD GOLD CDPH 1.2-2017 Inherently Non-Emitting Other Not Compliant**CEILINGS** **DOCUMENT PROVIDED**

(Includes all ceiling panels, ceiling tile, surface ceiling structures such as gypsum or plaster, suspended systems, and glazed skylights)

VOC Emission Evaluation GREENGUARD GOLD CDPH 1.2-2017 Inherently Non-Emitting Other Not Compliant**INSULATION** **DOCUMENT PROVIDED**

(Includes all thermal and acoustic boards, batts, rolls, blankets, sound attention fire blankets, foamed-in place, loose-fill, blown, and sprayed insulation)

VOC Emission Evaluation GREENGUARD GOLD CDPH 1.2-2017 Inherently Non-Emitting Other Not Compliant**COMPOSITE WOOD** **DOCUMENT PROVIDED**

(Includes all particleboard, medium density fiberboard, hardwood plywood with veneer, composite or combination core, and wood structural panels or structural wood products)

- VOC Emission Evaluation
- Ultra-low-emitting formaldehyde (ULEF) product under EPA TSCA Title VI
 - Ultra-low-emitting formaldehyde (ULEF) product under CARB ATCM
 - No added formaldehyde resins (NAF) product under EPA TSCA Title VI
 - No added formaldehyde resins (NAF) product under CARB ATCM
 - Wood structural panel manufactured according to PS 1-09 or PS 2-10
 - Structural wood product manufactured according to ASTM D 5456 (for structural composite lumber), ANSI A190.1 (for glued laminated timber), ASTM D 5055 (for I-joists), ANSI PRG 320 (for cross-laminated timber), or PS 20-15 (for finger-jointed lumber).
 - Salvaged or reused material
 - Does not meet criteria

SECTION 01 91 13 - GENERAL COMMISSIONING REQUIREMENTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Commissioning: Commissioning (Cx) is a systematic documented process of verifying that building systems perform interactively according to the design intent and the Owner's operational needs. Commissioning during the construction phase is intended to achieve the following specific objectives:
 - 1. Review of the Engineer's drawings and specifications during design development and construction document phases.
 - 2. Review of submittals related to the building equipment and systems forwarded to the CxP by the General Contractor (GC).
 - 3. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - 4. Verify that systems are installed in accordance with the Owner's Project Requirements (OPR).
 - 5. Verify and document proper performance of equipment and systems.
 - 6. Verify that operating and maintenance (O&M) documentation is complete.
 - 7. Verify that the Owner's operating personnel are adequately trained.
 - 8. Verify and complete appropriate initial performance tests and documentation, and schedule seasonal tests. Verify seasonal testing and deferred testing is complete.
 - 9. Review building operations 10 months after substantial completion.
 - 10. Develop an ongoing commissioning plan.
- B. Commissioning shall comply with and follow ASHRAE Guideline 0 and 1.
- C. This project is pursuing a LEED Certification.
- D. Systems to be commissioned: Refer to related sections for a listing of the commissioned systems.
- E. Commissioning requires the participation of affected Division contractors (Subs) to ensure that all systems are operating in a manner consistent with the Contract Documents. All affected Division contractors shall be familiar with:
 - 1. All parts of the commissioning plan issued by the Commissioning Provider (CxP)

2. The Owner's Project Requirements (OPR)
- F. Commissioning Team: The members of the commissioning team consist of the following:
1. Commissioning Provider (CxP)
 2. The designated representative of the Owner
 3. The General Contractor (GC)
 4. The Subcontractor (Sub)
 5. The Architect of Record (AOR)
 6. The design engineers or Engineer of Record (EOR), particularly the mechanical engineer
 7. The Mechanical Contractor (MC)
 8. The Electrical Contractor (EC)
 9. The Testing, Adjusting and Balancing (TAB) representative.
 10. The Controls Contractor (CC) installing the Direct Digital Control (DDC) System
 11. Any other installing subcontractors or suppliers of equipment
 12. The Owner's building or plant operator/engineer

1.3 RELATED SECTIONS

- A. The Work of this section applies to all commissioning Work listed in all divisions of these specifications and particularly to the following:
1. 22 08 00 – Commissioning of Plumbing
 2. 23 05 93 – Testing, Adjusting and Balancing for HVAC
 3. 23 08 00 – Commissioning of HVAC
 4. 23 09 23 – Direct Digital Control (DDC) System for HVAC & Associated Sections
 5. 26 08 00 – Commissioning of Electrical Systems

1.4 DEFINITIONS AND ABBREVIATIONS

- A. Terms used in this section shall have the following meanings:
1. "As Built" drawings – Fully dimensioned, to-scale, drawings that present an accurate representation of the components and assemblies as they exist in the built Work; where allowed by other Division 1 specification sections these can be legible hand marks on hard copies of drawings kept on the job site.
 2. "Basis of Design" (BOD) – A document developed by the design team that details all assumptions made during the creation of the construction documents to meet the Owner's Project Requirements (OPR).
 3. "Commissioning" – A quality assurance process to provide documented verification that the building equipment and systems function in compliance with criteria established in the project documents to satisfy the Owner's operational needs. Commissioning begins prior to the design phase and is continuous through the life of the facility.
 4. "Equipment" or "Systems" – Collectively or separately these are part of the Work consisting of materials, systems, components, and assemblies intended or

- designed to be part of the building and include any labor or process required by the Contract Documents related to that part.
5. “Contractor’s Equipment” – All or any apparatus, machinery, equipment, vehicles, materials, plant tools and all other items required for the Work, design services, procurement activities, or the remedying of defects but not to become part of the finished Work.
 6. “Contractor Start-up” – The original check by the contractor and/or manufacturer’s representative of the installation and operation of a component or system. This is often completed with the aid of checklists provided by the installing contractor or manufacturer.
 7. “Corrective Action” – An activity intended to correct a non-conforming item or action, or to prevent further recurrences of non-conformities.
 8. “Functional Performance Testing” – Tests to confirm the proper operation of a fully installed system for operation. Tests verify operation both individually and in conjunction with other systems.
 9. “Inspection” – Any activity taken in accordance with project documents to formally or officially view, examine, measure, test, or gauge one or more characteristics of an approved material, procedure, product, or service against the specified requirements.
 10. “Material Test Certificate” – An approved test result document from either the source of materials or directly from the manufacturer or an independent agency.
 11. “Non-Destructive Test” means any test whereby the integrity or conformity of a material item can be assessed without resorting to a destructive procedure for analysis.
 12. “Owners Project Requirements” (OPR) – A document developed by the Owner design team that details all assumptions made during the creation of the construction documents to meet the Owner Requirements.
 13. “Pre-Functional Checklist (Construction Checklist)” – On-site verification of the existence and installation of equipment, materials, and or systems as required in the contract documents. The checklists serve as written notification from the contractor to the CxP that the related piece of equipment is ready for functional testing.
 14. “Review” – Verification of documents, reports, work, or any item submitted for approval in accordance with Technical Specifications Schedule 6 [Review Procedure] as called for in the Contract or as Owner’s Representative may require.
 15. “Sampling Rate” – The percentage or quantity of components, equipment, or systems to be witnessed by the Owner and or Commissioning Provider to ensure compliance with the Owner’s Project Requirements and contract documents.
 16. “Short-Term Diagnostic Testing” – The use of short term or temporary testing to verifying system operation through sampling a systems ability to perform as designed.
 17. “Third Party Inspection” – A service provided by a recognized independent agency employed by the Owner or project team to oversee inspections and tests of materials, as required by the customer or his representative.
 18. “Witness” – The authorized and/or nominated personnel from the Subcontractor, Contractor, Owner, Third Party Inspector, or vendor representative who observes or participates in the inspection and/or testing of an item to determine acceptability, in accordance with the Accepted and Endorsed Inspection & Test Procedure (ITP).

- B. The following is a list of abbreviations:
1. BOD: Basis of Design
 2. CxP: Commissioning Provider
 3. GC: General Contractor
 4. Cx: Commissioning
 5. EOR: Engineer of Record
 6. FPT: Functional Performance Test
 7. FTS: Functional (Performance) Test Script
 8. O&M: Operations and Maintenance
 9. OPR: Owner's Project Requirements
 10. PFC: Pre-Functional Checklist
 11. SOR: Site Observation Report
 12. TAB: Testing, Adjusting, and Balancing
 13. TS: Technical Specifications
- 1.5 REFERENCE STANDARDS: The referenced sections of the following publications form a part of these Specifications; comply with provisions of these publications except as otherwise indicated or specified:
- A. ASHRAE Guideline 0 and Guideline 1
 - B. Green Building Design and Construction; LEED Reference Guide for Green Building Design and Construction, published by the U.S. Green Building Council.
- 1.6 COMMISSIONING PROVIDER (CxP)
- A. The commissioning provider and/or agency is selected and employed by the building owner. The commissioning provider shall not be associated with or employed by the Architect, the GC, or a sub-contractor.
 - B. The Commissioning Provider for this project is dbHMS.
 - C. The CxP will create the following deliverables:
 1. A Commissioning Plan
 2. Pre-functional Checklists for specific systems and equipment
 3. Function Performance Test Procedures for specific systems and equipment.
 4. Issues Log in on-line or other form
 5. Final Commissioning Report
 - D. The primary role of the CxP is to write a commissioning plan and coordinate the execution of it. In doing so the CxP will observe and document equipment installation and performance and note when systems are not functioning in accordance with the OPR and Contract Documents.
 - E. The CxP is not responsible for design concepts, design criteria, compliance with codes, design or general construction scheduling, cost estimating, or construction management.

- F. The CxP may assist with problem solving, non-conformance or deficiencies, but ultimately the responsibility to clarify the design intent lies with the EOR. The responsibility to solve deficiencies or non-conformance with the Contract Documents resides with the GC.
- G. The CxP shall attend and record results for up to two (2) FPTs for any given system or piece of equipment. The cost for the CxP's time for attending and recording results for tests beyond two tests shall be charged to the GC by Change Order when those costs meet the criteria set forth in Part 3 of this specification under "Cost of Re-testing".
- H. Limits to the responsibility of the CxP:
 - 1. Nothing stated in this section shall be construed to transfer responsibility for the design of the building to the CxP nor to relieve the EOR of responsibility for the design.
 - 2. Nothing stated in this section shall be construed to relieve the General Contractor of responsibility for the means and methods of construction, scheduling and coordination of construction activities, and on-the-job safety.

1.7 COMMISSIONING PLAN:

- A. The commissioning plan is prepared by CxP and expands and makes more specific the information contained here. The commissioning plan is issued by the CxP prior to or at the Kickoff Meeting. Contractors and sub-contractors shall comply with the provisions of the Commission Plan. In the event of a conflict between the Commissioning Plan and these specifications, the Specifications shall govern.
- B. Schedule dates provided in the Commissioning Plan are tentative and shall be confirmed by the General Contractor and the responsible sub-contractors by inclusion in the project master schedule.

1.8 SUBMITTALS

- A. Comply with the Division One Submittals section of these specifications.
- B. Obtain from the CxP a list of submittals required by the CxP for review.
- C. Maintain a submittal log and copy the CxP on the log at least once every two weeks.
- D. Provide submittals that are specific to this Work and that are marked to show actual materials, methods, options, dimensions, formulas, and other characteristics to be provided. "Generic" web-based PDF files without the appropriate marks and un-edited sales brochures, etc. will be returned by the CxP with the recommendation that they be rejected.
- E. Ensure concurrent submittals for related equipment; that is, equipment that relies on controls or interaction with other equipment shall be submitted for review at the same time as that equipment. In that way, the CxP and the EOR can review each component

while having access to information for related systems. The CxP requires a minimum of 5 days for submittal reviews.

- F. For re-submittals comply with the following. (Re-Submittals that do not comply will be returned by the CxP with the recommendation that they be rejected.):
 - 1. "Bubble" or "cloud" changes from the previous submittal to clearly indicate what has changed.
 - 2. Keep sheet numbers the same.
 - 3. It is permitted to omit sheets that have not changed but do not re-number sheets.
 - 4. Keep drawings, schedules, and detail numbers the same.
 - 5. Keep drawings and details on the same sheet as they were originally issued.
- G. Submit installation instructions and maintenance manuals. (These can inform the installation and performance of systems and are necessary for the CxP to get a complete picture.)
- H. The CxP will review submittals related to the commissioned systems, in accordance with the following aspects:
 - 1. Conformance to the contract Documents as they relate to the commissioning process.
 - 2. The functional performance of the systems as they relate to the OPR.
 - 3. The adequacy of the components and arrangements for developing test procedures for the commissioning process.
- I. The review by the CxP of submittals is intended only to aid in verifying compliance with the OPR and for the development of functional testing procedures. The review by the CxP does not verify compliance with the EOR's design intent, the specifications, or Contract Documents. The CxP will not stamp, sign or return hard copies of submittals but will mark submittals showing any items missing, any issues found, or areas that are not adequate for commission purposes and which require resubmission and will return electronic copies through the established channels.
- J. Submit Installation Instructions and O & M manuals for the commissioned components within 60 days of their acceptance by the EOR, not at the end of the project. (These are necessary for system commissioning) Provide the following:
 - 1. Full warranty information, including clear identification of the Owner's responsibilities to keep the warranty in force.
 - 2. The installation instructions and safety sheets that are shipped with the equipment or systems.
 - 3. O&M manual requirements for Cx do not replace O&M manual documentation requirements listed elsewhere in these specifications.

PART 2 - EQUIPMENT

2.1 TEST EQUIPMENT

- A. All standard testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the Division contractor for the equipment being tested.
- B. Special equipment, material samples (including gaseous), tools and instruments (only available from the vendor, specific to a piece of equipment) required for testing, according to these Contract Documents shall be included in the base bid price to the Contractor and left on site.
- C. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance within the tolerances specified in the Owner's Project Requirements document. If not otherwise noted, the following minimum requirements apply: Temperature sensors and digital thermometers shall have resolution of 0.1 degrees F and calibration within 6 months of use to an accuracy of ± 0.5 degrees F. Pressure sensors shall have been calibrated within 6 months of use to an accuracy of $\pm 3.0\%$ of the value being measured (not full range of device).
 - 1. All calibration shall be to NIST traceable standards. (National Institute of Standards and Technology - www.nist.gov, 301-975-6478).
 - 2. All equipment shall be calibrated according to the manufacturer's recommended intervals and immediately after being dropped or damaged.
 - 3. Calibration tags shall be affixed or certificates readily available.
- D. Access to the buildings Wi-Fi connection for functional testing and documentation download/upload (if available).

2.2 ACCESS TO EQUIPMENT

- A. Provide means for the CxP to access, observe, touch, and visually confirm proper operation of all equipment and systems. These means shall follow all OSHA and job-site safety regulations.

PART 3 - EXECUTION

3.1 GENERAL

- A. Execute the Work of this section and allocate work to GC, sub-contractors, and suppliers as appropriate and at the discretion of the GC, understanding that ultimate responsibility lies with the GC.
- B. Provide coordination between all construction and supply entities so as to provide a complete and functional commissioning as required here and in conformance with the referenced standards.
- C. Any References to "sub-contractor" or "supplier" responsibilities are for convenience in dividing and organizing language and are not intended to allocate Work and shall not remove ultimate responsibility from the GC.

3.2 SCHEDULING COMMISSIONING

- A. Maintain a master project schedule as specified in other Division One sections and ensure, in coordination with the Cx Plan and CxP, that Cx activities are included in detail. Inform the CxP of discrepancies between the project schedule and the Cx Plan.
- B. Integrate all commissioning activities into the master schedule. Obtain sufficient notice of schedule changes from the CxP to update the commissioning activities schedule.
- C. At least once a month, publish an overall project schedule with the commissioning milestones included.
 - 1. Ensure that the schedule includes the steps that must proceed and follow the system installation.
 - 2. Ensure that all systems tests are included in the schedule.
- D. Notify the CxP when commissioning activities, not yet performed or scheduled, will delay construction.
- E. Inform the CxP in writing on a weekly basis of the status of activities that affect the commissioning process; this may be accomplished by copying the CxP on job meeting minutes – provided they have the necessary details.

3.3 RESPONSIBILITIES

- A. General Contractor (GC)
 - 1. Include the cost of commissioning in the contract price.
 - 2. Ensure that sub-contractors perform their commissioning responsibilities.
 - 3. Furnish a copy of all construction documents, addenda, change orders and approved submittals and shop drawings, related to commissioned equipment, to the CxP.
 - 4. Attend commissioning meetings as required by the CxP.
 - 5. In each purchase order or subcontract written, include the requirements for submittal data, O&M data, commissioning tasks and training.
 - 6. Responsible for ensuring that all Subcontractors, suppliers, and manufacturers execute their commissioning responsibilities, according to the Contract Documents and schedule.
 - 7. Prepare O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions.
 - 8. Submit O&M manuals to the CxP for review **within 60 days** of acceptance of equipment submittals by EOR.
 - 9. Designate a representative who shall attend a commissioning kickoff meeting and other necessary meetings scheduled by the CxP to facilitate the Commissioning process.
 - 10. Verify that Test and Balance has been completed in accordance with Division 23 specifications and submit a test and balance report to the EOR and CxP for review.
 - 11. Coordinate the training of Owner operations and User personnel.

Warranty Period

12. Ensure that Subs correct items of non-compliance and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing or the 10-month review, and as noted by LEED criteria.

Change Orders for Commissioning Costs

13. Prepare a deduct Change Order to the Owner for the cost incurred by the CxP for attending and recording results of field testing when those costs meet the criteria set forth in Part 3 of this specification under "Cost of Re-testing".

B. Sub-Contractors

1. The commissioning responsibilities applicable to each of the subcontractors are generally as follows (below references apply to commissioned equipment only). Specific requirements may be shown in the appropriate Divisions.
2. Construction and Acceptance Phases
 - a. Include the cost of commissioning work in the contract price.
 - b. In each purchase order or subcontract written, include requirements for submittal data, commissioning documentation, O&M data, and training.
 - c. Attend a commissioning kickoff meeting and other meetings necessary to facilitate the Commissioning process.
 - d. Subcontractors shall provide the GC with shop submittals of commissioned equipment, as part of the normal submittal process, for distribution to the CxP as specified in Part 1 of this section.
 - e. Deliver O & M manuals within 60 days of acceptance of equipment by the EOR in accordance with the submittal requirements in Part 1 of this section.
 - f. Provide further documentation necessary for the commissioning process when requested by the CxP.
 - g. Subcontractors shall assist, along with the EOR, in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation are not sufficient for writing detailed testing procedures.
 - h. Assist the CxP in preparing the specific functional performance test procedures.
 - i. Review test procedures prepared by the CxP to ensure feasibility, safety, and equipment protection and provide necessary written alarm limits to be used during the tests.
 - j. Develop a full start-up and initial checkout plan using manufacturer's start-up procedures and the pre-functional checklists from the CxP for all commissioned equipment. Submit the plan to CxP for review prior to startup.
 - k. During the startup and initial checkout process, execute the pre-functional checklists for all commissioned equipment. Submit Construction (Pre-functional) checklists a minimum of five days prior to the start of functional performance testing. Note: If for whatever reason, Pre-functional checklists

are not complete, written verification that equipment is ready for functional performance testing is required.

- l. Perform and clearly document the completed startup and system operational checkout procedures, providing a copy to the CxP.
 - m. Address current AOR/EOR punch list items before functional testing.
 - n. Provide skilled technicians to execute starting the equipment and to execute the functional performance tests. Ensure that the individuals are available and present during the agreed-upon schedules and for sufficient duration to complete the necessary tests, adjustments and problem solving.
 - o. Provide all tools or the use of tools to start, checkout and functionally test equipment and systems, except for testing equipment supplied and installed by the CxP.
 - p. Perform functional performance testing under the direction of the CxP for specified equipment. Assist the CxP in interpreting the monitoring data, as necessary.
 - q. Correct deficiencies, differences between specified, and observed performance, as reported by the CxP to the AOR/EOR and as directed by the Owner's representative. Retest the equipment.
 - r. Update O&M manuals, according to the Contract Documents, including clarifying and updating the original sequences of operation to as-built conditions. Submit a copy of the complete O&M manual to the CxP for review and approval prior to the final submission to the owner.
 - s. Prepare redline as-built drawings for all design drawings and final as-builds for contractor-generated coordination drawings.
 - t. Prepare a training outline and submit to CxP for comment and approval as described in division 01. Provide training of the Owner's operating personnel as specified in division 01.
 - u. Coordinate with equipment manufacturers to determine specific requirements to maintain the validity of the warranty.
 - v. Be physically present for onsite test activities. Video conferences or phone conversations are not acceptable.
3. Warranty Period
- a. Execute seasonal or deferred functional performance testing, witnessed by the CxP, when specified as part of the commissioning process or called for in the Commissioning Plan.
 - b. Correct issues of non-compliance and make necessary adjustments to O&M manuals and as-built drawings for applicable issues identified in any seasonal testing.

C. Equipment Suppliers

1. Provide all requested submittal data, including detailed start-up procedures and specific responsibilities of the Owner to keep warranties in force.
2. Assist in equipment testing per agreements with Subs.
3. Include all special tools and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment according to these Contract Documents in the base bid price to the Contractor, except for stand-alone data logging equipment that may be used by the CxP.

4. Provide information requested by CxP regarding equipment sequence of operation and testing procedures.
5. Review test procedures provided by factory representatives and deliver to CxP.
6. Deliver factory representative test result reports to the CxP.

3.4 TEST AND BALANCE VERIFICATION

- A. Provide the labor and test equipment necessary to demonstrate to the CxP that the air and water systems have been properly balanced. This is required prior to the start of functional performance testing of balanced equipment.
- B. The CxP will randomly select devices, equipment, and systems for verification purposes.
- C. The GC shall regard this verification process as a functional performance test for purposes of time allowed to correct deficiencies and requirements regarding retesting if major problems are discovered

3.5 START-UP AND PRE-FUNCTIONAL CHECK LISTS

- A. Prepare a start-up plan for each piece of equipment including the following:
 1. The manufacturer's standard start-up and check out procedures copied from the installation instructions.
 2. The subcontractor's standard start-up and check out procedures.
 3. Construction (Pre-functional) checklists provided by the CxP.
 4. Checklists and procedures with specific spaces for recording and documenting the inspection of each procedure and a summary block for deficiencies and explanations.
- B. Submit startup plan to CxP for review and obtain approval before proceeding. Include final startup report signature block provided by CxP.
- C. Incorporate this equipment's start-up date in the overall start-up schedule for the project.
- D. Perform start-up testing for each piece of equipment to ensure that the equipment and systems are properly installed and ready for turnover to the Owner.
- E. The CxP and/or Owner may be present for the start-up of the equipment. For lower-level components of equipment or for similar equipment present in large quantities, the CxP may observe a sampling of the pre-functional and start-up procedures. The sampling procedures are identified in the commissioning plan.
- F. Identify individuals that have direct knowledge of, and have witnessed, that a line-item task on the pre-functional checklist was performed. Ensure that these individuals, and only these individuals, are the ones to initial or check-off that item on the pre-functional checklist.

- G. Ensure that start-up and pre-functional checklists are completed on the job-site concurrent with the activities being documented. Checklists that are found to have undergone remedial documentation either off-site or after the procedures have been completed will be rejected by the CxP.
- H. Ensure that checklists are complete, accurate, and fully legible to the CxP's satisfaction.
- I. Where checklists are rejected by the CxP due to non-compliance with "G" and "H" above, repeat the procedure or test and prepare new checklists at no additional cost to the Owner.
- J. Submit the completed start-up checklists, reports, and equipment pre-functional checklists to the CxP for review. Note all noncompliance items on these checklists. Notify the CxP when outstanding items have been corrected.
- K. Submit satisfactory completed start-up checklists to the CxP a minimum of five working days prior to the start of functional performance testing.

3.6 FUNCTIONAL TESTING PREPARATION

- A. GC's signature on the final start-up checklists signature block shall constitute certification by the GC that:
 - 1. The commissioned systems, subsystems, and equipment have been installed, calibrated, started and are operating according to the Contract Documents.
 - 2. The commissioned instrumentation and control systems have been completed and calibrated, are operating according to the Contract Documents, and pretest set points have been recorded.
 - 3. Testing, adjusting, and balancing procedures have been completed and reports of same have been submitted, discrepancies corrected, and corrective work approved.
 - 4. GC agrees to a deduct change order as follows:
 - a. If the CxP arrives on site and determines that equipment and systems are not in the condition certified, the CxP shall inform the Owner of a wasted trip and provide an itemized list of expenses associated with the trip. The Owner shall prepare a deduct Change Order to the Contract for costs incurred by the CxP and execute it under the provisions of other Division One sections.
 - 5. GC agrees to commencement of procedures listed below under "Cost of Retesting."

3.7 FUNCTIONAL PERFORMANCE TESTING

- A. Provide all documentation as requested to the CxP for development of functional performance testing procedures. This documentation shall include, at a minimum, the

manufacturer's installation, start-up, operation and maintenance procedures. The CxP may request further documentation as necessary for the development of functional performance tests.

- B. Review the functional performance test scripts developed by the CxP.
 - 1. Respond in writing to the CxP regarding the acceptability of the proposed test scripts.
 - 2. Note any necessary modifications to the scripts due to the actual equipment/systems or safety concerns and submit these to the CxP for consideration.
- C. Place equipment and systems into operation and continue the operation as required during each working day of the testing activities.
- D. Accomplish the functional performance testing of equipment based on scripts developed by the CxP and as reviewed by the GC.
 - 1. Provide access to the equipment in compliance with OSHA regulations.
 - 2. Provide, to the CxP, access to The Building Automation System by way of passwords, web-based access, and access on site via temporary or permanent front-end computer and equipment.
 - 3. Provide skilled technicians to operate the systems during functional performance testing. The CxP reserves the right to determine if the technician is not suitable for testing and has the authority to request a more experienced technician.
 - 4. Correct any deficiencies identified during testing and retest equipment as required.
 - 5. For lower-level components of equipment or for similar equipment present in large quantities, the CxP may perform functional testing on a sampling of equipment. The sampling procedures are identified in the commissioning plan.
- E. Functional performance testing is intended to begin upon completion and proper startup (dictated by the manufacturer) of a system. Functional testing may proceed prior to the completion of the system at the discretion of the CxP only.
- F. Verify all sequences of operation defined in the Contract Documents for the commissioned equipment and systems.
 - 1. Perform testing by overriding set points or sensor readings at the DDC System or by other means mutually agreed to by the Contractor, the CxP and the owner, to initiate sequences of operation and verifying the response of the system.
- G. Upon successful completion of all functional performance tests, perform Integrated Systems Testing. The testing shall document and verify the proper response of the overall HVAC systems.
- H. Provide technicians, instrumentation, and tools to perform commissioning tests at the direction of the CxP.
- I. The scope of HVAC&R testing shall include entire HVAC&R installation, from central equipment for heat generation and refrigeration through distribution systems to each

conditioned space. Testing shall include measuring capacities and effectiveness of operational and control functions.

- J. Test all operating modes, interlocks, control responses, and responses to abnormal or emergency conditions, and verify proper response of building automation system controllers and sensors.
- K. The CxP along with the Contractors, Testing Adjusting and Balancing Subcontractor, and Controls Subcontractor shall prepare detailed testing plans, procedures, and checklists for HVAC&R systems, subsystems, and equipment.
- L. Tests are to be performed using design conditions whenever possible.
- M. Simulated conditions may need to be imposed using an artificial load when it is not practical to test under design conditions. Before simulating conditions, calibrate testing instruments. Provide equipment to simulate loads. Set simulated conditions as directed by the CxP and document simulated conditions and methods of simulation. After tests, return settings to normal operating conditions.
- N. The CxP may direct that set points be altered when simulating conditions is not practical.
- O. The CxP may direct that sensor values be altered with a signal generator when design or simulating conditions and altering set points are not practical.
- P. If tests cannot be completed because of a deficiency outside the scope of the HVAC&R system, document the deficiency and report it to the Owner. After deficiencies are resolved, reschedule tests.
- Q. If the testing plan indicates specific seasonal testing, complete appropriate initial performance tests and documentation and schedule seasonal tests.

3.8 DOCUMENTATION, NON-CONFORMANCE, AND APPROVAL OF TESTS

- A. Documentation. The CxP shall witness and document the results of functional tests using the specific Functional Test Scripts (FTS) developed for that purpose. Prior to testing, these scripts are provided to the GC for review and approval and to the Subs for review. The CxP will include the filled-out scripts in the Commissioning Report.
- B. Non-Conformance.
 - 1. The CxP will record the results of the functional test on the FTS form. Issues of non-conformance shall be noted.
 - 2. Corrections of minor issues of non-conformance identified may be made during the tests at the discretion of the CxP. In such cases the issues of non-conformance and resolution will be documented on the FTS form.
 - 3. Make every effort to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
 - 4. As tests progress and non-conformance issues are identified, the CxP will discuss and log issues.

- a. When there is no dispute on the non-conformance issue and the Sub accepts responsibility to correct it:
 - 1) The CxP documents the deficiency and the Sub's response and intentions, then go on to another test or sequence.
 - b. If there is a dispute about a non-conformance issue, regarding whether it is a non-conformance issue or who is responsible:
 - 1) The non-conformance issue shall be documented as an issue and assigned to an assumed responsible party.
 - 2) Resolutions shall be made at the lowest management level possible. Other parties are brought into the discussions as needed. Final interpretive authority is with the A/E. Final acceptance authority is with the Owner.
 - 3) The CxP documents the resolution process in the Issues Log.
 - 4) Once the interpretation and resolution have been decided, the appropriate party corrects the deficiency and provides a written response in the Issues Log documenting the resolution. The CxP reschedules the test, and the test is repeated until satisfactory performance is achieved.
 5. Provide a written response to each issue recorded in the Issue Log provided by the CxP. Update these responses at least as often as commissioning meetings are scheduled. Outline the status of each apparent outstanding discrepancy identified during commissioning. Discussion shall cover explanations of any disagreements and proposals for their resolution.
 6. The CxP retains the original FTS forms until the end of the project.
- C. Failure Due to Manufacturer Defect. If 10%, or three, whichever is greater, of identical pieces (size alone does not constitute a difference) of equipment fail to perform to the Contract Documents (mechanically or substantively) due to manufacturing defect, not allowing it to meet its submitted performance spec, all identical units may be considered unacceptable. In such case, the GC shall provide the Owner with the following:
1. Within one week of notification, the GC or manufacturer's representative shall examine all other identical units making a record of the findings. The findings shall be provided within two weeks of the original notice.
 2. Within two weeks of the original notification, the GC or manufacturer shall provide a signed and dated, written explanation of the problem, cause of failures, etc. and all proposed solutions which shall include full equipment submittals. The proposed solutions shall not significantly differ from the specification requirements of the original installation.
 3. The Owner is to determine whether a replacement of all identical units or a repair is acceptable.
 4. Upon acceptance, the GC and/or manufacturer shall replace or repair all identical items, at their expense and extend the warranty accordingly, if the original equipment warranty has begun. The replacement/repair work shall proceed with reasonable speed beginning within one week from when parts can be obtained.

- D. Approval. The CxP notes each satisfactorily demonstrated function and recommends acceptance of each test on the FTS form. The Owner gives final approval on each test using the same form, providing a signed copy to the CxP and the Contractor.

3.9 TRACKING OF ISSUES – ISSUES LOG

- A. The CxP will create and maintain a log of issues related to the building systems in an on-line web site or other means that allows members of the team to:
 - 1. View the issues and related photos and documents.
 - 2. Read any responses.
 - 3. Write responses when the issue is assigned.
- B. Issues are to be assigned to a member (or members) of the team by the CxP, in a way that allows for response in writing to the issue and provide photos and documents as part of their response.
- C. For those issues assigned to the GC, sub-contractor or supplier:
 - 1. Respond in writing to the issue, as a minimum, within 10 working days of its published date or the date of any subsequent comment by the CxP.
 - 2. If work on resolving an issue is in progress, indicate this in writing.
 - 3. Ensure the subcontractors provide information required to solve the issue.
- D. Periodically, all issues open and not responded to within 10 working days will be submitted to the Owner as delinquent. The CxP reserves sole discretion in determining the status of issues, e.g. “open”, “ready for verification”, or “closed”.
- E. The Owner may increase the retainage percentage for sub-contractors with an unacceptable number of open issues where written responses are not up to date.
- F. The final Cx Report contains a copy of the issues log identifying the status of issues.

3.10 COST OF RETESTING

- A. The cost for the Subcontractor to retest a pre-functional or functional test, if they are responsible for the non-conformance issue, shall be theirs.
- B. First two functional tests: The CxP shall attend and record results for up to two (2) functional tests for any given piece of equipment as part of the CxP's normal scope.
- C. Beyond two tests: The cost for the CxP's time for attending and recording results for tests beyond two tests shall be charged to the General Contractor by Change Order when:
 - 1. The deficiency is due to deficient work by responsible contractors and
 - 2. That work has been recorded as deficient by the CxP and
 - 3. That work remains uncorrected, or the contractor has failed to adequately respond to commissioning comments after the first two tests.

3.11 OPERATION AND MAINTENANCE (O&M) MANUALS

- A. The following O&M manual requirements do not replace O&M manual documentation requirements elsewhere in these specifications.
- B. Each Division shall compile and prepare documentation for all equipment and systems covered in that Division and deliver this documentation to the GC for inclusion in the O&M manuals.
 - 1. Field checkout sheets and logs should be provided to the CxP.
 - 2. All documentation shall be made specific to this project by permanently marking "generic" manufacturer's O&M manuals to indicate exactly which models and options are included in the Work of this project.
- C. Deliver the O&M manuals to the CxP for review within 60 days of final review of the submittals of the equipment.
- D. Review and Approvals. Review of the commissioning-related sections of the O&M manuals shall be made by the A/E and by the CxP.

3.12 TRAINING OF OWNER PERSONNEL

- A. Coordinate and schedule training and ensure that training is completed.
- B. The CxP shall be responsible for overseeing and approving the content and adequacy of the training of Owner personnel for commissioned equipment.
- C. Prepare a training outline and submit it to the CxP for comments and approval. Provide training of the Owner's operating personnel.

3.13 DEFERRED FUNCTIONAL PERFORMANCE TESTING

- A. Perform any deferred testing as required to properly demonstrate successful operation to the owner.
 - 1. Some test conditions may not be able to be simulated and thus require the actual conditions to be present, to implement and test.
 - 2. A mutually convenient time for the owner, CxP, and Contractor will be scheduled when these test conditions will be present, to conduct this deferred testing.
 - 3. Perform these tests as indicated in the functional performance test procedures.
- B. Correct any deficiencies or failures identified in the process of performing these tests.

END OF SECTION 01 91 13

SECTION 02 41 19 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

- A. Selective demolition of building elements indicated and specified, and as required for installation of new work required for the completion of the project.
- B. Related Requirements:
- C. Section 01 10 00 "Summary".
- D. Sections 01 73 00 "Execution".
- E. Section 31 23 16 "Excavation".
- F. Section 31 23 17 "Excavating, Backfilling, and Compacting for Utilities".
- G. Section 02 86 13 - Hazardous and Universal Waste Management.
- H. Section 01 74 19 - LEED Construction Waste Management and Disposal.
- I. Section 31 22 00 - Grading: Topsoil removal.
- J. Section 31 23 23.01 - Fill: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

1.2 REFERENCE STANDARDS

- A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.
- B. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

1.3 DEFINITIONS

- A. Remove: Detach items from existing construction and legally dispose of them in accordance with Division 31 Sections, unless indicated to be removed and salvaged or removed and reinstalled.
- B. Remove and Salvage: Detach items from existing construction, where indicated, and deliver them to Owner ready for reuse.
- C. Remove and Reinstall: Detach items from existing construction, prepare them for reuse, and reinstall them where indicated.

- D. Existing to Remain: Existing items of construction that are not to be removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Contractor to confirm abatement of hazardous materials and asbestos containing materials prior to demolition activities.

- B. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section.

- 1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.

- 2. Review the detailed requirements for the work of this section and to review the drawings and specifications for this work

- a. Require attendance by all affected installers including but not limited to

- 1) Contractor's Superintendent
 - 2) Installer
 - 3) Manufacturer/Fabricator Representative
 - 4) Other affected Subcontractors
 - 5) Architect
 - 6) Owner's Representative

- 3. Review the scope of work, inspect and discuss condition of construction areas to be selectively demolished.

- 4. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.

- 5. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.

- 6. Review areas where existing construction is to remain and requires protection.

- 7. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner and those affected by decisions made.

- C. Materials Ownership: Historic items indicated and historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be encountered during selective demolition remain Owner's property. Carefully remove

and salvage each item or object in a manner to prevent damage and deliver promptly to Owner.

- a. Coordinate with Owner who will establish special procedures for removal and salvage.

1.5 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. See Section 01 81 13 - LEED Sustainable Design Requirements, when required.
- C. Schedule of Selective Demolition Activities: Indicate the following:
 1. For purposes of Owner's information only, sequence of selective demolition and removal work, with starting and ending dates for each activity as well as shift starting and ending times. Ensure Owner's on-site operations are uninterrupted.
 2. Interruption of utility services. Indicate how long utility services will be interrupted.
 3. Coordination for shutoff, capping, and continuation of utility services.
 4. Use of elevator and stairs if acceptable to the Owner.
 5. Locations of proposed dust- and noise-control temporary partitions and means of egress.
 6. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
 7. Means of protection for items to remain in the building and items in path of waste removal from building.
 8. Path of waste removal from building and locations of waste containers.
- D. Predemolition Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, that might be misconstrued as damage caused by building demolition operations. Submit before beginning work on this section.
- E. Liquid Materials Handling Plan: Prior to commencing work, the Contractor shall provide a liquid material handling plan. The plan shall stipulate provisions for dewatering, pumping, collection, temporary storage, and discharge or disposal of storm water, perched water and other liquids, contained and /or uncontained, at the site so as to facilitate removal of materials from the site and minimize disposal costs for contained materials.
- F. Landfill Records: Provide disposal receipts and acceptance of wastes from the permitted Subtitle D Landfill to Owner's Representative.

1.6 QUALITY ASSURANCE

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
- B. Regulatory Requirements: Comply with all governing environmental regulations prior to and during demolition. Comply with requirements of authorities having local, state and federal jurisdiction and the City of Chicago. Comply with all requirements related to lead paint; asbestos containing materials; PCB's; universal and hazardous materials; environmental dust control; health related hazards; and air, water, and ground quality. Comply with requirements for the management and legal disposal of waste materials.
- C. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

1.7 FIELD CONDITIONS

- A. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 GENERAL PROCEDURES AND PROJECT CONDITIONS

- A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
 - 1. Obtain required permits.
 - 2. Comply with applicable requirements of NFPA 241.
 - 3. Use of explosives is not permitted.
 - 4. Verify that area to be demolished is vacated and use discontinued prior to the start of the Work.
- B. Take precautions to prevent catastrophic or uncontrolled collapse of existing construction being removed and to remain do not allow worker or public access within range of potential collapse of unstable construction.
 - 1. Engage a demolition engineer to perform an engineering survey of existing conditions of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.
 - 2. Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction and finishes to remain. Strengthen or add new supports when required during progress of demolition

- C. Owner will occupy portions of the building immediately adjacent to selective demolition area(s). Conduct operations to minimize effects on and interference with adjacent structures and occupants.
 - 1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
 - 2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
 - 3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
 - 4. Cover and protect furniture, furnishings, and equipment that have not been removed.
- D. Provide, erect, and maintain temporary barriers and security devices necessary for execution of the work and to protect Owner's property and operations. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 - Temporary Facilities and Controls and Section 01 56 11 – General Dust, Fume, and Odor Controls.
- E. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
 - 1. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- F. Start work under this section only after asbestos and/or hazardous materials have been removed in accordance with Related Sections.
- G. If hazardous materials are discovered during removal operations, notify Owner's Representative. Start of operations will be evidence of acceptance that environmental conditions have been remedied in accordance with applicable Division 2 and Division 31 Sections, and Environmental Manual.
- H. Perform demolition in a manner that maximizes salvage and recycling of materials.

3.2 EXISTING UTILITIES

- A. Maintain existing utilities required to remain in service and protect them against damage during selective demolition operations.
- B. Maintain existing fire-protection facilities in service during selective demolition operations.
- C. Inspect the facility for the presence of special systems that must be maintained operational during demolition in the presence of the Owner. Such systems include

security systems, access control systems, fire and smoke detection and alarm systems and communication systems.

1. Develop a strategy with the Owner to maintain such systems operational during alterations including temporary re-working, unavoidable downtime, acceptable discontinuation of service intervals and contingencies for notification of involved agencies.
 2. Instruct every Subcontractor as to the procedures to be followed and supervise the process to ensure implementation.
 3. Restore such systems and extend them into the altered area.
 4. Include all services and materials necessary to maintain special systems in the Contract Sum.
- D. Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
1. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.
 2. If services/systems are required to be removed, relocated, or abandoned, before proceeding with selective demolition provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to other parts of building.
 3. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing.

3.3 EXAMINATION

- A. Verify that utilities have been disconnected and capped.
- B. Survey existing conditions and coordinate with requirements indicated to determine extent of selective demolition required.
- C. Inventory and record the condition of items to be removed and reinstalled and items to be removed and salvaged.
- D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.
- E. Record existing conditions by use of preconstruction photographs and preconstruction videotapes.
 1. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction

- F. Perform surveys as the Work progresses to detect hazards resulting from selective demolition activities.

3.4 SELECTIVE DEMOLITION

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as indicated.
 - 2. Report discrepancies to Architect before disturbing existing installation.
 - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Remove existing work as indicated on drawings and as required to accomplish new work. Remove existing construction only to the extent required by new construction.
- C. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
 - 4. Patch as specified for patching new work.
 - 5. Where possible Items may be removed to a suitable, protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete
- D. Use methods required to complete the selective demolition work within limitations of governing regulations and as follows:
 - 1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
 - 2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering, and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
 - 3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
 - 4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents

of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.

- a. Maintain adequate ventilation when using cutting torches.
5. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site at a permitted Subtitle D landfill facility.
6. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
7. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
8. Dispose of demolished items and materials at a permitted Subtitle D landfill promptly.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

- A. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals, using power-driven saw, then remove concrete between saw cuts.
- B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.
- C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.
- D. Resilient Floor Coverings: Remove floor coverings and adhesive according to recommendations in RFCI (RWP).
 1. Remove residual adhesive and prepare substrate for new floor coverings by one of the methods recommended by RFCI (RWP).
- E. Air-Conditioning Equipment: Remove equipment without releasing refrigerants.

3.6 MANAGEMENT OF DEMOLISHED MATERIALS

- A. Separate recyclable demolished materials from other demolished materials to the maximum extent possible. Separate recyclable materials by type.
 1. Provide containers or other storage method for controlling recyclable materials until they are removed from Project site.
 2. Stockpile processed material on-site without intermixing with other materials. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 3. Stockpile materials away from demolition area. Do not store within drip line of existing trees to remain.

4. Store recyclable and salvaged components off the ground and protect from the weather.
- B. For items indicated to be Removed and Salvaged:
1. Clean salvaged items.
 2. Pack or crate items after cleaning. Identify contents of containers.
 3. Store items in a secure area until delivery to Owner.
 4. Transport items to storage area designated by Owner.
 5. Protect items from damage during transport and storage.
- C. For items indicated to be Removed and Reinstalled:
1. Clean and repair items to functional condition adequate for intended reuse. Paint equipment to match new equipment.
 2. Pack or crate items after cleaning and repairing. Identify contents of containers.
 3. Protect items from damage during transport and storage.
 4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.7 DEBRIS AND WASTE REMOVAL

- A. Remove debris, junk, and trash from site immediately. Legally dispose of non-recyclable debris, and other materials resulting from demolition operations in accordance with Section 31 23 18.13 - Soil, Fill, Backfill, CU Structural Soil & Construction & Demolition Debris Removal.
- B. Burning of removed materials will not be permitted on the site.
- C. Sale of removed materials will not be permitted on the site.
- D. Remove from site all materials not to be reused on site; do not burn or bury. Comply with requirements in Division 31.
- E. Leave site in clean condition, ready for subsequent work.
- F. Clean up spillage and wind-blown debris from public and private lands.
- G. Clean adjacent structures and improvements of dust, dirt, and debris caused by building demolition operations. Return adjacent areas to condition existing before building demolition operations began.

END OF SECTION 02 41 19

SECTION 03 30 00 – CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcement, concrete materials, mix design, placement procedures, and finishes.
- B. Related Requirements:
 - 1. Division 31 Section "Earth Moving" for drainage fill under slabs-on-ground.
 - 2. Division 32 Section "Concrete Paving" for concrete pavement and walks.

1.3 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement, fly ash and other pozzolans, slag cement, and silica fume; subject to compliance with requirements.
- B. Water/Cement Ratio (w/cm): The ratio by weight of water to cementitious materials.
- C. Form-Facing Material: Temporary structure or mold for the support of concrete while the concrete is setting and gaining sufficient strength to be self-supporting.
- D. Formwork: The total system of support of freshly placed concrete, including the mold or sheathing that contacts the concrete, as well as supporting members, hardware, and necessary bracing.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Meetings." Minutes of the meeting shall be recorded, typed, and printed out by the Contractor and distributed by the Contractor to all parties concerned within 5 days of the meeting.
 - 1. Require representatives of each entity directly concerned with cast-in-place concrete to attend, including the following:
 - a. Contractor's superintendent.
 - b. Independent testing agency responsible for concrete design mixtures.
 - c. Ready-mix concrete manufacturer.

- d. Concrete Subcontractor.
 - e. Laboratory responsible for field quality control.
 - f. Admixture manufacturer.
 - g. Concrete pumping equipment operator.
 - h. Owner's representative (attendance at Owner's option).
 - i. AECOM representative (attendance at Owner's option)
2. Review the following:
- a. Special inspection and testing and inspecting agency procedures for field quality control.
 - b. Construction joints, contraction joints, isolation joints, and joint-filler strips.
 - c. Semirigid joint fillers.
 - d. Vapor-retarder installation.
 - e. Anchor rod and anchorage device installation tolerances.
 - f. Cold and hot weather concreting procedures.
 - g. Concrete finishes and finishing.
 - h. Curing procedures.
 - i. Forms and form-removal limitations.
 - j. Methods for achieving specified floor and slab flatness and levelness.
 - k. Floor and slab flatness and levelness measurements.
 - l. Concrete repair procedures.
 - m. Concrete protection.
 - n. Initial curing and field curing of field test cylinders (ASTM C31).
 - o. Steel reinforcement installation.

1.5 ACTION SUBMITTALS

A. Product Data: For each of the following:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:
 - a. Include limitations of use, including restrictions on cementitious materials, supplementary cementitious materials, air entrainment, aggregates, temperature at time of concrete placement, relative humidity at time of concrete placement, curing conditions, and use of other admixtures.
6. Color pigments.
7. Fiber reinforcement.
8. Vapor retarders.
9. Floor and slab treatments.
10. Liquid floor treatments.
11. Curing materials.
 - a. Include documentation from color pigment manufacturer, indicating that proposed methods of curing are recommended by color pigment manufacturer.

12. Joint fillers.
 13. Repair materials.
- B. Design Mixtures: For each concrete mixture, include the following:
1. Mixture identification.
 2. Minimum 28-day compressive strength.
 3. Durability exposure class.
 4. Maximum w/cm.
 5. Slump limit.
 6. Air content.
 7. Nominal maximum aggregate size.
 8. Sieve analysis reports.
 9. Designation, type, quality, and source of fine and coarse aggregates.
 10. Synthetic fiber content.
 11. Indicate amounts of mixing water to be withheld for later addition at Project site if permitted.
 12. Intended placement method.
 13. Include certification test indicating compliance with any specified chloride ion content limits.
 14. Include testing indicating compliance with any specified shrinkage limits.
 15. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Shop Drawings: Comply with ACI SP-066:
1. Include placing drawings that detail fabrication, bending, and placement.
 2. Include bar sizes, lengths, materials, grades, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, location of splices, lengths of lap splices, details of mechanical splice couplers, details of welding splices, tie spacing, hoop spacing, and supports for concrete reinforcement.
 3. Detailing and orientation of Shop Drawing Plans and Schedules shall be consistent with the Construction Drawings. The reviewer reserves the right to reject and order redrawn any Shop Drawings that could cause field placement problems due to crowding, illegibility, or lack of detailing. Complicated structures shall have each level of reinforcing detailed individually. All resubmitted Shop Drawings shall have changes clouded.
- D. Construction Joint Layout: Indicate proposed construction joints required to build the structure.
1. Location of construction joints is subject to approval of the A/E.
- E. Concrete Schedule: For each location of each Class of concrete indicated in "Concrete Mixtures" Article, including the following:
1. Concrete Class designation.
 2. Location within Project.
 3. Exposure Class designation.
 4. Formed Surface Finish designation and final finish.
 5. Final finish for floors.
 6. Curing process.
 7. Floor treatment if any.

1.6 INFORMATIONAL SUBMITTALS**A. Qualification Data: For the following:**

1. Installer: Include copies of applicable ACI certificates.
2. Ready-mixed concrete manufacturer.
3. Testing agency: Include copies of applicable ACI certificates.

B. Material Certificates/Product Data: For each of the following, signed by manufacturers:

1. Cementitious materials.
2. Admixtures.
3. Fiber reinforcement.
4. Each type of steel reinforcement
5. Mechanical splice couplers
6. Form materials and release agents
7. Form ties
8. Waterstops
9. Curing compounds.
10. Floor and slab treatments.
11. Bonding agents.
12. Adhesives.
13. Vapor retarders.
14. Semirigid joint filler.
15. Joint-filler strips.
16. Repair materials.
17. Statement from supplier stating if aggregate is possibly alkali-reactive, based on tests and past service. Include service record data indicating absence of deleterious expansion of concrete due to alkali-aggregate reactivity.
18. Statement from supplier stating if aggregate can possibly cause pop-outs, "D" cracking or other disruptions due to moisture gain, freezing or other mechanisms based on tests and past service.

C. Material Test Reports of In-Place Construction: For the following, from a qualified testing agency:

1. Portland cement.
2. Fly ash.
3. Slag cement.
4. Aggregates.
5. Admixtures:
 - a. Permeability-Reducing Admixture: Include independent test reports, indicating compliance with specified requirements, including dosage rate used in test.

D. Floor surface flatness and levelness measurements report, indicating compliance with specified tolerances.**E. Research Reports:**

1. For concrete admixtures in accordance with ICC's Acceptance Criteria AC198.
 2. For sheet vapor retarder/termite barrier, showing compliance with ICC AC380.
- F. Preconstruction Test Reports: For each mix design.
- G. Field quality-control reports.
- H. Vertical hoistway tolerances for plumbness and clearance within elevator shafts shall be coordinated with equipment manufacturer.
- I. Minutes of preinstallation conference.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: A qualified installer who employs Project personnel qualified as an ACI-certified Flatwork Technician and Finisher and a supervisor who is a certified ACI Flatwork Concrete Finisher/Technician or an ACI Concrete Flatwork Technician with experience installing and finishing concrete and incorporating permeability-reducing admixtures.
- B. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for formwork and shoring and reshoring installations that are similar to those indicated for this Project in material, design, and extent.
- C. Ready-Mixed Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C94 requirements for production facilities and equipment.
1. Manufacturer certified in accordance with NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- D. Laboratory Testing Agency Qualifications: A testing agency qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated and employing an ACI-certified Concrete Quality Control Technical Manager.
1. Personnel performing laboratory tests shall be an ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.
- E. Field Quality Control Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified in accordance with ASTM C1077 and ASTM E329 for testing indicated.
1. Personnel conducting field tests shall be qualified as an ACI Concrete Field Testing Technician, Grade 1, in accordance with ACI CPP 610.1 or an equivalent certification program.

- F. Mock-Ups: Cast concrete wall mockup of the 7-inch perimeter concrete wall at the base of the building to demonstrate typical joints, surface finish, texture, tolerances, and standard of workmanship. Mock-up shall be 80 SF, and should contain a construction joint.
1. Notify A/E seven days in advance of dates and times when mock-ups will be constructed.
 2. Obtain A/E's approval of mock-ups before starting construction.
 3. If A/E determines that mock-ups do not meet requirements, demolish and remove them from the site and cast another until the mockup is approved.
 4. Maintain mock-ups during construction in an undisturbed condition as a standard for judging the completed Work.
 5. Demolish and remove mock-ups when directed.
- G. References: Comply with the edition in effect per governing building code or the latest of the following, unless more stringent provisions are indicated. Maintain one copy of the publications in the Project field office at all times during concrete work. Contractor's supervisory personnel shall be familiar with the publications as they apply to this Project.
1. ACI 301, "Specification for Structural Concrete."
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials and Commentary."
 3. ACI 311.7, "Specification for Inspection of Concrete Construction."
 4. ACI 318, "Building Code Requirements for Structural Concrete and Commentary."
 5. ACI 306.1, "Standard Specification for Cold Weather Concreting."
 6. ACI 305.1, "Specification for Hot Weather Concreting."
 7. ACI 308.1, "Specification for Curing Concrete."
 8. ACI 350, "Code Requirements for Environmental Engineering Concrete Structures and Commentary."
 9. SP-66, "ACI Detailing Manual."
 10. CRSI "Manual of Standard Practice."
 11. CRSI "Recommended Practice for Placing Reinforcing Bars."

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with ASTM C94 and ACI301.
- B. Deliver, store, and handle steel reinforcement to prevent bending and damage.
- C. Waterstops shall be stored under cover to protect from moisture, sunlight, dirt, oil, and other contaminants.

1.9 FIELD CONDITIONS

- A. Cold-Weather Placement: Comply with ACI 301 and ACI 306.1 and as follows.
 1. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

2. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 3. Do not use frozen materials or materials containing ice or snow.
 4. Do not place concrete in contact with surfaces less than 35 deg F, other than reinforcing steel.
 5. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- B. Hot-Weather Placement: Comply with ACI 301 and ACI 305.1, and as follows:
1. Cool ingredients before mixing to maintain concrete temperature at time of discharge to less than 90 deg F. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Cover steel reinforcement with water-soaked burlap so steel temperature will not exceed ambient air temperature immediately before embedding in concrete.
 3. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. ACI Publications: Comply with ACI 301 unless modified by requirements in the Contract Documents.

2.2 PERFORMANCE REQUIREMENTS

- A. Concrete Formwork: Design, engineer, erect, shore, brace, and maintain formwork, shores, and reshores in accordance with ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads, so that resulting concrete conforms to the required shapes, lines, and dimensions.
1. Design wood panel forms in accordance with APA's "Concrete Forming Design/Construction Guide."
 2. Design formwork to limit deflection of form-facing material to 1/240 of center-to-center spacing of supports.
 - a. For concrete exposed to view when construction is complete, limit deflection of form-facing material, studs, and walers to 0.0025 times their respective clear spans (L/400).

2.3 FORM-FACING MATERIALS

- A. Provide form materials compatible with finish surface indicated and achieving the specified finish quality and tolerances.
- B. As-Cast Surface Form-Facing Material:
 - 1. Provide continuous, true, and smooth concrete surfaces.
 - 2. Furnish in largest practicable sizes to minimize number of joints.
 - 3. Acceptable Materials: As required to comply with Surface Finish designations specified, and as follows:
 - a. Plywood, metal, or other approved panel materials.
- C. Concealed Surface Form-Facing Material: Lumber, plywood, metal, plastic, or another approved material.
 - 1. Provide lumber dressed on at least two edges and one side for tight fit.

2.4 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615, Grade 60, deformed.
- B. Low-Alloy-Steel Reinforcing Bars: ASTM A 706, deformed.
- C. Steel Bar Mats: ASTM A 184, assembled with clips.
 - 1. Steel Reinforcement: ASTM A 615, Grade 60, deformed bars.
 - 2. Steel Reinforcement: ASTM A 706, deformed bars.
- D. Plain-Steel Welded-Wire Reinforcement: ASTM A1064, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.

2.5 REINFORCEMENT ACCESSORIES

- A. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire fabric in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports. Stainless steel supports shall be used if concrete is to be rubbed or sand-blasted after form removal.
 - 2. Reinforcement chaired off earth such as in slabs on ground and footings shall utilize chairs that will not sink into the earth. Cast concrete cubes may be used, but clay brick chairs are not permitted.
- B. Joint Dowel Bars: Plain-steel bars, ASTM A 615, Grade 60. Cut bars true to length with ends square and free of burrs.

- C. Deformed Bar Anchors (DBA): Conforming to ASTM A496 with a minimum yield strength of 75,000 psi. All bar anchors shall be arc stud welded to steel members.
- D. Mechanical Reinforcing Splicing Systems: conforming with ACI 318, Type 1 and Type 2.
 - 1. Unless specified, provide Type 1 couplers with tension and compression capacity of 125% of the specified yield strength (F_y) for the bar intended.
 - 2. Where indicated, provide Type 2 couplers with tension and compression capacity equal to the specified tensile strength (f_u) for the bar intended.
 - 3. Provide standard transition couplers with tapered thread for creation of mechanical butt splice of two different diameter sections of reinforcing steel. Reinforcing bars will require special end-preparation to engage with the couplers. See manufacturer for details.
 - 4. Mechanical lock-couplers with coupler sleeve and interlocking bolts may not be used without special request and acceptance on a case-by-case basis, due to the over-size of the system.
- E. Mechanically Anchored Deformed Bars in Tension: conforming with ACI 318-19, Section 25.4.5.1.
- F. Steel Tie Wire: ASTM A1064, annealed steel, not less than 0.0508 inch in diameter.
 - 1. Finish: Plain.

2.6 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.7 CONCRETE MATERIALS

- A. Source Limitations:
 - 1. Obtain all concrete mixtures from a single ready-mixed concrete manufacturer for entire Project.
 - 2. Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant.
 - 3. Obtain aggregate from single source.
 - 4. Obtain each type of admixture from single source from single manufacturer.
- B. Cementitious Materials:
 - 1. Portland Cement: ASTM C 150, Type I
 - 2. Portland Cement: ASTM C 150, Type I/II.
 - 3. Fly Ash: ASTM C 618, Class C or F.
 - 4. Slag Cement: ASTM C 989, Grade 100 or 120.
- C. Normal-Weight Aggregates: ASTM C33, Severe weathering region, Class 4S or 5S coarse aggregate, graded. Provide aggregates from a single source.
 - 1. Maximum Coarse-Aggregate Size: 1-1/2 inches for drilled shafts and 1 inch nominal, typical.
 - 2. Coarse-Aggregate Type: Limestone.
 - 3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

4. For concrete exposed to view, provide coarse aggregate from sources that do not contain amounts of deleterious substances, as determined by the following limits:
 - a. Staining (**Test Method ASTM C641**)—An aggregate producing a stain index of 60 or higher shall be rejected when the deposited stain is found upon chemical analysis to contain an iron content, expressed as Fe_2O_3 equal to or greater than 1.5mg/200 g of sample.
5. For concrete in slabs on ground: Total coarse and fine aggregate combined gradation shall result in between 8% to 18% retained on each sieve, except largest sieve shall have 1% to 4% retained and No. 100 sieve shall have 2% to 5% retained. Total of No. 100 and No. 200 sieves plus pan is to be 3% to 8%.
6. Alkali Silica Reaction: Comply with one of the following:
 - a. Expansion Result of Aggregate: Not more than 0.04 percent at one-year when tested in accordance with ASTM C1293.
 - b. Expansion Results of Aggregate and Cementitious Materials in Combination: Not more than 0.10 percent at an age of 16 days when tested in accordance with ASTM C1567.
 - c. Alkali Content in Concrete: Not more than 4 lb./cu. yd. for moderately reactive aggregate or 3 lb./cu. yd. for highly reactive aggregate, when tested in accordance with ASTM C1293 and categorized in accordance with ASTM C1778, based on alkali content being calculated in accordance with ACI 301.

D. Water: Potable and complying with ASTM C 94.

E. Air-Entraining Admixture: ASTM C 260.

F. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Admixtures used in concrete in contact with potable water shall meet the requirements of ANSI/NSF Standard 61.

G. Water-Reducing Admixture: ASTM C 494, Type A.

H. High-Range, Water-Reducing Admixture: ASTM C 494, Type F

I. Shrinkage-Reducing Admixture, ASTM C494, Type S.

2.8 FIBER REINFORCEMENT

A. Synthetic Macro-Fiber: Polyolefin macro-fibers engineered and designed for use in concrete, complying with ASTM C 1116, Type III, 1 to 2-1/4 inches long.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Euclid Chemical Company (The), an RPM company; Tuf-Strand SF.
 - b. GCP Applied Technologies; Strux 90/40.
 - c. Master Builders Solutions US LLC; MasterFiber MAC Series
 - d. Nycon, Inc.; XL.
 - e. Sika Corporation; SikaFiber Force 650.

2.9 WATERSTOPS

- A. Self-Expanding Rubber Strip Waterstops: Manufactured rectangular or trapezoidal strip, bentonite-free hydrophilic polymer-modified chloroprene rubber, for adhesive bonding to concrete, 3/8 by 3/4 inch.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Adeka Ultra Seal/OCM, Inc.; Adeka Ultra Seal.
 - b. Greenstreak; Hydrotite.
 - c. Vinylex Corp.; Duroseal Gasket.
 - d. Synko-Flex Plastic Adhesive Waterstop; Synko-Flex Products.
 - e. JP Specialties, Inc.; Type 20.

2.10 VAPOR RETARDERS

- A. Sheet Vapor Retarder: ASTM E 1745, Class A with a maximum perm rating of .01 and a minimum thickness of 15 mils. Include manufacturer's recommended adhesive or pressure-sensitive tape.
 - 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fortifiber Building Systems Group; Moistop Ultra 15.
 - b. Insulation Solutions; Viper VaporCheck II 15 mil "Class A".
 - c. Stego Industries, LLC; Stego Wrap 15 mil Class A.
- B. Fine-Graded Granular Material: Clean mixture of crushed stone, crushed gravel, and manufactured or natural sand; ASTM D 448, Size 10, with 100 percent passing a No. 4 sieve and 10 to 30 percent passing a No. 100 sieve, and at least 5 percent passing No. 200 sieve; meeting deleterious substance limits of ASTM C 33 for fine aggregates.
- C. Granular Fill: Clean mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448, Size 57, with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

2.11 FLOOR AND SLAB TREATMENTS

- A. Slip-Resistive Emery Aggregate Finish: Factory-graded, packaged, rustproof, non-glazing, abrasive crushed emery aggregate containing not less than 50 percent aluminum oxide and not less than 20 percent ferric oxide; unaffected by freezing, moisture, and cleaning materials with 100 percent passing No. 8 sieve.
- B. Penetrating Liquid Floor Treatment: Chemically reactive, waterborne solution of inorganic silicate or silicate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.
- C. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, the following:
- D. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Slip-Resistive Emery Aggregate Finish:
 - a. Emery Non-Slip, Dayton Superior Corporation, Oregon, IL.
 - b. EMAG-20, Lambert Corporation, Orlando, FL.

- c. Grip It, L&M Construction Chemicals, Inc., Omaha, NE.
 - d. MasterTop 120SR, Master Builders Solutions US LLC, Shakopee, MN
 - e. Metco Anti-Skid Aggregate, Metalcrete Industries, Cleveland, OH.
2. Penetrating Liquid Floor Treatment:
- a. Basis of Design: Seal Hard; L&M Construction Chemicals, Inc., Omaha, NE
 - b. Titan Hard; Burke Group, LLC (The), Long Beach, CA
 - c. Chemisil Plus; ChemMasters, Madison, OH
 - d. Intraseal; Conspec Marketing & Manufacturing Co., Inc., Kansas City, KS
 - e. Ashford Formula; Curecrete Chemical Co., Inc., Springville, UT
 - f. Day-Chem Sure Hard; Dayton Superior Corporation, Oregon, IL
 - g. Euco Diamond Hard; Euclid Chemical Co., Cleveland, OH
 - h. MasterProtect HD Series, Master Builder Solutions US LLC, Shakopee, MN
 - i. Vexcon Starseal PS; Vexcon Chemicals, Inc., Philadelphia, PA

2.12 CURING MATERIALS

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz. per sq. yd. dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Curing Paper: Eight-foot-wide paper, consisting of two layers of fibered kraft paper laminated with double coating of asphalt.
- E. Water: Potable.
- F. Clear, Waterborne, Membrane-Forming Dissipating Curing Compound: ASTM C 309, Type 1, Class B, certified by curing compound manufacturer to not interfere with bonding of floor covering.
- G. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Evaporation Retarder:
 - a. Spray-Film; ChemMasters, Madison, OH.
 - b. Aquafilm; Conspec Marketing & Manufacturing Co., Inc., Kansas City, KS.
 - c. Sure Film; Dayton Superior Corporation, Oregon, IL.
 - d. Eucobar; Euclid Chemical Co., Cleveland, OH.
 - e. MasterKure ER 50; Master Builders Solutions US LLC, Shakopee, MN.
 - 2. Clear, Waterborne, Membrane-Forming Curing Compound:
 - a. Safe-Cure Clear; ChemMasters, Madison, OH.
 - b. Day-Chem Rez Cure; Dayton Superior Corporation, Oregon, IL.
 - c. Kurez W VOX; Euclid Chemical Co., Cleveland, OH.
 - d. MasterKure CC 180WB; Master Builders Solutions US LLC, Shakopee, MN.
 - e. 1100-CLEAR; W. R. Meadows, Inc., Elgin, IL.

2.13 RELATED MATERIALS

- A. Expansion and Isolation Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.
- B. Semirigid Joint Filler: Two-component, semirigid, 100 percent solids, epoxy resin with a Type A shore durometer hardness of 80 per ASTM D 2240.
- C. Bonding Agent: ASTM C 1059, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- D. Epoxy-Bonding Adhesive: ASTM C 881, two-component epoxy resin, capable of humid curing and bonding to damp surfaces, of class suitable for application temperature and grade to suit requirements, and as follows:
 - 1. Types I and II, non-load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
 - 2. Types IV and V, load bearing, for bonding hardened or freshly mixed concrete to hardened concrete.
- E. Floor Slab Protective Covering: Eight-foot-wide cellulose fabric.
- F. Reglets: Fabricate reglets of not less than 0.022-inch- thick galvanized steel sheet. Temporarily fill or cover face opening of reglet to prevent intrusion of concrete or debris.
- G. Dovetail Anchor Slots: Hot-dip galvanized steel sheet, not less than 0.034 inch thick, with bent tab anchors. Temporarily fill or cover face opening of slots to prevent intrusion of concrete or debris.
- H. Chamfer Strips: Wood, metal, PVC, or rubber strips, 3/4 by 3/4 inch, minimum.
- I. Rustication Strips: Wood, metal, PVC, or rubber strips, kerfed for ease of form removal.
- J. Form Release Agent: Commercially formulated form release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
 - 1. Formulate form release agent with rust inhibitor for steel form-facing materials
 - 2. Form release agent for form liners shall be acceptable to form liner manufacturer.
 - 3. Surfaces in contact with potable water shall use a form release agent in conformance with ANSI/NSF Standard 61.
- K. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
 - 1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of the exposed concrete surface.

2.14 REPAIR MATERIALS

- A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
 - 4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109.

- B. Repair Overlayment: Traffic-bearing, cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch, and that can be filled in over a scarified surface to match adjacent floor elevations.
 - 1. Cement Binder: ASTM C 150, Portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
 - 2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
 - 3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
 - 4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109.

2.15 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixes for each type and strength of concrete determined by either laboratory trial mix or field test data bases, as follows:
 - 1. Proportion normal-weight concrete according to ACI 211.1 and ACI 301.

- B. Use a qualified independent testing agency for preparing and reporting proposed mix designs for the laboratory trial mix basis.

- C. Proposed concrete proportions and mixes must be submitted to the A/E and may be reviewed by the A/E. However, the Contractor is solely responsible for producing concrete of the quality, durability and strength so stated in the Specifications and on the Drawings.

- D. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than Portland cement in concrete as follows (unless specifically noted otherwise):
 - 1. Fly Ash: 20 percent.
 - 2. Slag Cement: 25 percent.
 - a. Combined percentage of fly ash and slag cement shall not exceed 30 percent.

- E. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing admixture or high-range water-reducing admixture (superplasticizer) in concrete, as required, for placement and workability.

2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 4. Do not air entrain normal-weight concrete for trowel-finished interior floors and suspended slabs. Do not allow entrapped air content to exceed 3 percent.
 5. Calcium chloride and admixtures containing calcium chloride shall not be used. Water soluble chloride ions in the total concrete mix shall not exceed specified limits.
 - a. Per ASTM C 1281, submit a minimum of one test of the chloride content for each concrete mix with a specified maximum chloride limit. Mixture shall be tested at an age of between 28 and 42 days.
- F. Shrinkage (Length Change): When maximum shrinkage is specified, determine length change of hardened concrete test specimens in accordance with ASTM C 157, except as noted in paragraphs below. Existing test data from previous projects is acceptable.
1. Test specimens shall be moist cured, including period in molds for 7 days. Then store specimens in air for period of 28 days.
 2. Use the same concrete materials and design mix proportions submitted for use on this Project.
 3. Report length change of specimens after periods of air drying after curing of 4, 7, 14, 21, and 28 days

2.16 CONCRETE MIXTURES

- A. Class F0: Normal-weight concrete for footings, deep foundations, grade beams, and tie beams not exposed to weather.
1. Exposure Class: ACI 318 F0, S0, W0, C1.
 2. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 3. Cementitious Material Type: Per ACI 318 Table 19.3.2.1
 4. Maximum w/cm: 0.64
 5. Slump Limit:
 - a. 5 inches, plus or minus 1 inch
 - b. 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
 6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- B. Class F1: Normal-weight concrete for mat foundations exposed to weather and light water
1. Exposure Class: ACI 318 F1, S1, W0, C1
 1. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 2. Cementitious Material Type: Per ACI 318 Table 19.3.2.1
 3. Maximum w/cm: 0.50.
 4. Slump Limit:
 - a. 5 inches, plus or minus 1 inch

- b. 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
 5. Air Content:
 - a. 4.5 percent, plus or minus 1.5 percent at point of delivery
 6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
- C. Class EX: Normal-weight concrete exposed to weather and de-icing salts, including foundation walls and grade beams that are fully or partially exposed to the exterior of the building.
1. Exposure Class: ACI 318 F2, S1, W0, C1
 2. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 3. Cementitious Material Type: Per ACI 318 Table 19.3.2.1
 4. Maximum w/cm: 0.40.
 5. Slump Limit:
 - a. 4 inches, plus or minus 1 inch
 - b. 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
 6. Air Content:
 - a. 6 percent, plus or minus 1.5 percent at point of delivery
 7. Limit water-soluble, chloride-ion content in hardened concrete to 0.10 percent by weight of cement.
- D. Class NWT: Typical normal-weight concrete unless noted otherwise.
1. Exposure Class: ACI 318 F0, S0, W0, C0
 2. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 3. Cementitious Material Type: Per ACI 318 Table 19.3.2.1
 4. Maximum w/cm: 0.53.
 5. Slump Limit:
 - a. 4 inches, plus or minus 1 inch
 - b. 8 inches, plus or minus 1 inch for concrete with verified slump of 3 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
 6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
 7. Fiber reinforcement: Uniformly disperse in concrete mixture per manufacturer's recommendations. Dosage rate shall be as indicated on the Drawings.
- E. Class NWS: Normal-weight concrete over metal deck.
1. Exposure Class: ACI 318 F0, S0, W0, C0
 2. Minimum Compressive Strength: As indicated on Drawings at 28 days.
 3. Cementitious Material Type: Per ACI 318 Table 19.3.2.1

4. Maximum w/cm: 0.53.
5. Slump Limit:
 - a. 4 inches, plus or minus 1 inch
 - b. 8 inches, plus or minus 1 inch for concrete with verified slump of 6 inches plus or minus 1 inch before adding high-range water-reducing admixture or plasticizing admixture at Project site
6. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.
7. Fiber reinforcement: Uniformly disperse in concrete mixture per manufacturer's recommendations. Dosage rate shall be as indicated on the Drawings.

F. Class LC: Lean Concrete.

1. Exposure Class: Not Applicable
2. Minimum Compressive Strength: As indicated on Drawings at 28 days.
3. Maximum w/cm: 0.70.
4. 3/8" aggregate.
5. Fly ash and slag cement content not to exceed 30 percent of cementitious material weight
6. Slump Limit:
 - a. 8 inches, plus or minus 1 inch

2.17 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94, and furnish batch ticket information. Mixing of concrete with fibers shall comply with ASTM C1116.
 1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to ASTM C 94. Mix concrete materials in appropriate drum-type batch machine mixer.
 1. For mixer capacity of 1 cu. yd. or smaller, continue mixing at least one and one-half minutes, but not more than five minutes after ingredients are in mixer, before any part of batch is released.
 2. For mixer capacity larger than 1 cu. yd., increase mixing time by 15 seconds for each additional 1 cu. yd.
 3. Provide batch ticket for each batch discharged and used in the Work, indicating Project identification name and number, date, mix type, mix time, quantity, and amount of water added. Record approximate location of final deposit in structure.

2.18 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.19 EMBEDDED ITEMS

- A. It is solely the Contractor's responsibility to coordinate with all Trades for the setting of sleeves, anchors, dovetail slots, inserts, frames, flashing reglets, and other items to be embedded and to provide all openings required for the installation of other work.
 - 1. Such coordination shall include, but not be limited to, review of all Contract Documents and the various subcontractors' Shop Drawings.
 - 2. No insert shall be allowed to displace reinforcement.
 - 3. All inserts embedded in concrete exposed to the environment shall be hot-dipped galvanized.

- B. Continuous concrete inserts shall be "Unistrut" type.
 - 1. The anchors of the insert shall not be allowed to project past the body of the insert.
 - 2. The maximum height of the insert body shall be as follows:
 - a. Inserts placed in slabs and joists: 7/8 inch.
 - b. Inserts placed in beams: 1-3/8 inch.

- C. Embedment of conduits and pipes shall be in accordance with ACI 318, "Conduits and Pipes Embedded in Concrete," except that;
 - 1. No conduits shall be embedded in concrete slabs, beams, girders, walls and columns unless specifically detailed on the Structural Drawings.
 - 2. Aluminum shall not be embedded in concrete.

- D. Structural Integrity: Do not provide any sleeves or openings in structural members unless shown on the Structural Drawings.

- E. Anchor Bolts: The Contractor shall be responsible for the correct orientation and exact center line location of anchor bolts.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Before placing concrete, verify that installation of concrete forms, accessories, and reinforcement, and embedded items is complete and that required inspections have been performed.
 - 2. Do not proceed until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide reasonable auxiliary services to accommodate field testing and inspections, acceptable to testing agency, including the following:
 - 1. Daily access to the Work.
 - 2. Incidental labor and facilities necessary to facilitate tests and inspections.

3. Secure space for storage, initial curing, and field curing of test samples, including source of water and continuous electrical power at Project site during site curing period for test samples.
4. Security and protection for test samples and for testing and inspection equipment at Project site.

3.3 FORMWORK

- A. Comply with ACI 301.
- B. Construct formwork, so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117 and to comply with the surface finish designations specified.
- C. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until concrete structure can support such loads.
 1. Wall or column footings may be trenched (excavated neat) and cast without formwork if the soil is suitable and the size of footing does not increase by more than 2 inches in any direction.
- D. Limit concrete surface irregularities, designated by ACI 347R as abrupt or gradual, as follows:
 1. Class A, 1/8 inch, for smooth formed surfaces.
 2. Class C, 1/2 inch, for rough formed surfaces.
- E. Construct forms tight enough to prevent loss of concrete mortar.
 1. Minimize joints.
 2. Exposed Concrete: Symmetrically align joints in forms.
- F. Construct removable forms for easy removal without hammering or prying against concrete surfaces.
 1. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces.
 2. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
 3. Install keyways, reglets, recesses, and other accessories, for easy removal.
- G. Do not use rust-stained, steel, form-facing material.
- H. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces.
 1. Provide and secure units to support screed strips
 2. Use strike-off templates or compacting-type screeds.
 3. The new floor construction must meet and match the existing floor line and elevation where tie-ins to adjacent structures are made.
- I. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible.

1. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar.
 2. Locate temporary openings in forms at inconspicuous locations.
 3. Locate ports and openings in bottom of vertical forms, in inconspicuous location, to allow flushing water to drain.
 4. Close temporary ports and openings with tight-fitting panels, flush with inside face of form, and neatly fitted, so joints will not be apparent in exposed concrete surfaces.
- J. Chamfer exterior corners and edges of permanently exposed concrete.
- K. At construction joints, overlap forms onto previously placed concrete not less than 12 inches.
- L. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work.
1. Determine sizes and locations from trades providing such items.
 2. Obtain written approval of A/E prior to forming openings not indicated on Drawings.
- M. Construction and Movement Joints:
1. Construct joints true to line with faces perpendicular to surface plane of concrete.
 2. Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
 3. Place joints perpendicular to main reinforcement.
 4. Locate joints for beams, slabs, joists, and girders in the middle third of spans.
 - a. Offset joints in girders a minimum distance of twice the beam width from a beam-girder intersection.
 5. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 6. Space vertical joints in walls as indicated on Drawings.
 - a. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
- N. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- O. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.
- P. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.4 INSTALLATION OF EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining Work that is attached to or supported by cast-in-place concrete.
 - 1. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of ANSI/AISC 303.
 - 3. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 4. Install dovetail anchor slots in concrete structures as indicated
 - 5. Clean embedded items immediately prior to concrete placement.

3.5 REMOVING AND REUSING FORMS

- A. It shall be solely the responsibility of the Contractor to remove the forms in a manner which will ensure complete safety of the structure.
- B. Formwork, for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete must also be hard enough to not be damaged by form-removal operations and curing and protection operations must be maintained.
- C. Leave formwork, for beam soffits, joists, slabs, and other structural elements, that supports weight of concrete in place until concrete has achieved the following:
 - 1. At least 70 percent of 28-day design compressive strength.
 - 2. Determine compressive strength of in-place concrete by testing representative field- or laboratory-cured test specimens according to ACI 301.
 - 3. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.
- D. Clean and repair surfaces of forms to be reused in the Work.
 - 1. Split, frayed, delaminated, or otherwise damaged form-facing material are unacceptable for exposed surfaces.
 - 2. Apply new form-release agent.
- E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints.
 - 1. Align and secure joints to avoid offsets.
 - 2. Do not use patched forms for exposed concrete surfaces unless approved by A/E.

3.6 SHORES AND RESHORES

- A. Comply with ACI 318, ACI 301, and recommendations in ACI 347R for design, installation, and removal of shoring and reshoring. Reshoring design and execution is the responsibility of the Contractor.
 - 1. Do not remove shoring or reshoring until measurement of slab tolerances is complete.
- B. In multistory construction, extend shoring or reshoring over a sufficient number of stories to distribute loads in such a manner that no floor or member will be excessively loaded or will induce tensile stress in concrete members without sufficient steel reinforcement. The design live loads indicated on the Drawings shall not be exceeded at any time.
- C. Plan sequence of removal of shores and reshore to avoid damage to concrete. Locate and provide adequate reshoring to support construction without excessive stress or deflection.

3.7 INSTALLATION OF VAPOR RETARDER

- A. Sheet Vapor Retarders: Place, protect, and repair sheet vapor retarder in accordance with ASTM E1643 and manufacturer's written instructions.
 - 1. Choke top layer of granular base with fine graded material to elevation tolerances of +0 inches or -3/4 inch. Place the vapor barrier over fine graded material.
 - 2. Install vapor retarder with longest dimension parallel with direction of concrete pour.
 - 3. Face laps away from exposed direction of concrete pour.
 - 4. Lap vapor retarder over footings and grade beams not less than 6 inches, sealing vapor retarder to concrete.
 - 5. Lap joints 6 inches and seal with manufacturer's recommended tape.
 - 6. Terminate vapor retarder at the top of floor slabs, grade beams, and pile caps, sealing entire perimeter to floor slabs, grade beams, foundation walls, or pile caps.
 - 7. Turn vapor barrier up at walls to top of slab.
 - 8. Seal penetrations in accordance with vapor retarder manufacturer's instructions.
 - 9. Protect vapor retarder during placement of reinforcement and concrete.
 - a. Repair damaged areas by patching with vapor retarder material, overlapping damaged area by 6 inches on all sides, and sealing to vapor retarder.

3.8 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement.
 - 1. Locate and support reinforcement with bar supports to maintain minimum concrete cover.
 - 2. Do not tack weld crossing reinforcing bars.
- D. Shop- or field-weld reinforcement according to AWS D1.4, where indicated.
- E. Preserve clearance between bars of not less than 1 inch, not less than one bar diameter, or not less than 1-1/3 times size of large aggregate, whichever is greater.
- F. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.
- G. Splices: Lap splices as indicated on Drawings.
 - 1. Bars indicated to be continuous, and all vertical bars shall be lapped as indicated on Drawings.
 - 2. Stagger splices in accordance with ACI 318.
 - 3. Mechanical Splice Couplers: Install in accordance with manufacturer's instructions.
 - 4. Weld reinforcing bars in accordance with AWS D1.4, where indicated on Drawings.
- H. Install welded-wire reinforcement in longest practicable lengths.
 - 1. Support welded-wire reinforcement in accordance with CRSI "Manual of Standard Practice."
 - a. For reinforcement less than W4.0 or D4.0, continuous support spacing shall not exceed 12 inches.
 - 2. Lap edges and ends of adjoining sheets at least one wire spacing plus 2 inches for plain wire and 8 inches for deformed wire.
 - 3. Offset laps of adjoining sheet widths to prevent continuous laps in either direction.
 - 4. Lace overlaps with wire.

3.9 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by A/E.
 - 1. Place joints perpendicular to main reinforcement.
 - 2. Continue reinforcement across construction joints unless otherwise indicated.
 - 3. Do not continue reinforcement through sides of strip placements of floors and slabs.
 - 4. Form from preformed galvanized steel, plastic keyway-section forms, or bulkhead forms with keys, unless otherwise indicated. Embed keys at least 1-1/2 inches into concrete. Provide keys in all construction joints, including footings, unless specifically noted otherwise in the Contract Documents.
 - 5. Locate joints for beams, slabs, joists, and girders in the middle third of spans. Offset joints in girders a minimum distance of twice the beam width from a beam-

- girder intersection. Locate joints in strip footings in the middle third of the distance between columns.
6. Locate horizontal joints in walls and columns at underside of floors, slabs, beams, and girders and at the top of footings or floor slabs.
 7. Space vertical joints in walls at a maximum of 40'-0" unless otherwise indicated on the Drawings. Space vertical joints in walls at a maximum of 20'-0" from corners unless otherwise indicated on Drawings. Locate joints beside piers integral with walls, near corners, and in concealed locations where possible.
 8. Space joints in footings at a maximum of 100'-0" unless otherwise indicated on the Drawings.
 9. In foundation mat slabs and tank base slabs, space joints at a maximum of 40'-0" on center unless noted otherwise on the Drawings. Align joints in slabs and walls where possible.
 10. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
 11. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.
- C. Contraction Joints in Slabs-on-Ground: Form weakened-plane contraction joints, sectioning concrete into areas as indicated. Contraction joints shall be spaced in each direction at no more than 3 times the slab thickness in feet, unless otherwise indicated on the Drawings. For example, a 5-inch thick slab shall have a maximum joint spacing of 15 feet. Construct contraction joints for a depth equal to at least one-fourth of concrete thickness, as follows:
1. Sawed Joints: Form contraction joints with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut 1/8-inch- wide joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks.
 - a. All sawn contraction joints shall be made using the "Soff-Cut" type of equipment with operating vacuum attached to saw. Saw joints immediately following the final finishing operation in accordance with recommendations of Soff-Cut. Replace saw blades at first sign of raveling at the joint. Skid plate shall be replaced each time a saw blade is replaced. Use "joint saver" inserts, provided by the saw manufacturer, at all intersecting joints and at location where front wheel crosses perpendicular to the previously cut joint.
- D. Isolation Joints in Slabs-on-Ground: After removing formwork, install joint-filler strips at slab junctions with vertical surfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
1. Extend joint-filler strips full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
 2. Terminate full-width joint-filler strips not less than 1/2 inch or more than 1 inch below finished concrete surface where joint sealants, specified in Division 07 Section "Joint Sealants," are indicated.
 3. Install joint-filler strips in lengths as long as practicable. Where more than one length is required, lace or clip sections together.
- E. Doweled Joints: Install dowel sleeves and dowels or dowel bar and support assemblies at joints where indicated.
1. Use dowel sleeves or lubricate or asphalt-coat one-half of dowel length to prevent concrete bonding to one side of joint.

2. For proprietary dowel plate systems, see manufacturers recommendation for placement of sleeve block-out and steel plate dowel.

3.10 INSTALLATION OF WATERSTOPS

- A. Self-Expanding Strip Waterstops: Install in construction joints and at other locations indicated on Drawings, according to manufacturer's written instructions, by adhesive bonding, mechanically fastening, and firmly pressing into place.
 1. Install in longest lengths practicable.
 2. Locate waterstops in center of joint unless otherwise indicated on Drawings.
 3. Protect exposed waterstops during progress of the Work.

3.11 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, embedded items, and vapor retarder is complete and that required inspections are completed.
 1. Immediately prior to concrete placement, inspect vapor retarder for damage and deficient installation, and repair defective areas.
 2. Provide continuous inspection of vapor retarder during concrete placement and make necessary repairs to damaged areas as Work progresses.
- B. Notify A/E and testing and inspection agencies 24 hours prior to commencement of concrete placement.
- C. Do not add water to concrete during delivery, at Project site, or during placement, unless approved by A/E, but not to exceed the amount indicated on the concrete delivery ticket
 1. Do not add water to concrete after adding high range water reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness.
 1. If a section cannot be placed continuously, provide construction joints as indicated.
 2. Deposit concrete to avoid segregation.
 3. If a variation in texture or color is evident, the Contractor shall revise construction procedures until uniformity is maintained.
 4. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.
 5. Consolidate placed concrete with mechanical vibrating equipment in accordance with ACI 301.
 - a. Do not use vibrators to transport concrete inside forms.
 - b. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer.
 - c. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity.

- d. At each insertion, limit duration of vibration to time necessary to consolidate concrete, and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.
 6. In no case shall concrete be allowed to drop freely for more than 3'-0". For drops greater than 3'-0", use a tremie or other approved method for placing.
- E. Deposit and consolidate concrete for floors and slabs in a continuous operation, within limits of construction joints, until placement of a panel or section is complete.
1. Do not place concrete floors and slabs in a checkerboard sequence.
 2. Consolidate concrete during placement operations, so concrete is thoroughly worked around reinforcement and other embedded items and into corners.
 3. Maintain reinforcement in position on chairs during concrete placement.
 4. Screed slab surfaces with a straightedge and strike off to correct elevations.
 5. Level concrete, cut high areas, and fill low areas.
 6. Slope surfaces uniformly to drains where required.
 7. Begin initial floating using bull floats or darbies to form a uniform and open-textured surface plane, before excess bleedwater appears on the surface.
 8. Do not further disturb slab surfaces before starting finishing operations.

3.12 FINISHING FORMED SURFACES

A. As-Cast Surface Finishes:

1. ACI 301 Surface Finish Rough Formed Finish: As-cast concrete texture imparted by form-facing material.
 - a. Patch voids larger than 1-1/2 inches wide or 1/2 inch deep.
 - b. Remove projections larger than 1 inch.
 - c. Tie holes do not require patching.
 - d. Surface Tolerance: ACI 117 Class C.
 - e. Apply to concrete surfaces not exposed to public view.
2. ACI 301 Surface Finish Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams.
 - a. Patch voids larger than 3/4 inch wide or 1/2 inch deep.
 - b. Remove projections larger than 1/8 inch.
 - c. Patch tie holes.
 - d. Surface Tolerance: ACI 117 Class A.
 - e. Locations: Apply to concrete surfaces exposed to public view, to receive a rubbed finish, or to be covered with a coating or covering material applied directly to concrete.

B. Rubbed Finish: Apply after concrete has been smooth-formed finished.

1. Smooth-Rubbed Finish:
 - a. Perform no later than one day after form removal.

- b. Moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture.
- c. If sufficient cement paste cannot be drawn from the concrete by the rubbing process, use a grout made from the same cementitious materials used in the in-place concrete.
- d. Maintain required patterns or variances as shown on Drawings.
- e. Apply finish where indicated on the architectural drawings.

C. Related Unformed Surfaces:

1. At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a color and texture matching adjacent formed surfaces.
2. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.13 FINISHING FLOORS AND SLABS

A. General: Comply with recommendations in ACI 302.1R for screeding, restraighening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Trowel Finish:

1. After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel.
2. Continue troweling passes and restraighen until surface is free of trowel marks and uniform in texture and appearance.
3. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
4. Do not add water to concrete surface.
5. Do not apply hard-troweled finish to concrete which has a total air content greater than 3 percent.
6. Apply a trowel finish to surfaces exposed to view or to be covered with resilient flooring, carpet, ceramic or quarry tile set over a cleavage membrane, paint, or another thin-film-finish coating system.
7. Finish surfaces to the following tolerances, in accordance with ASTM E1155, for a randomly trafficked floor surface:
 - a. Specified overall values of flatness, F(F) 35; and levelness, F(L) 25; with minimum local values of flatness, F(F) 24; and levelness, F(L) 17; for slabs-on-ground.
 - b. Specified overall values of flatness, F(F) 25; with minimum local values of flatness, F(F) 17; for unshored slabs over metal deck. F(L) measurements shall not be taken for unshored slabs, but the entire slab shall fall within plus or minus 3/8 inch of its specified plane. The Contactor will not be compensated for additional concrete placed due to the deflection of the unshored framing.

C. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces indicated on Drawings where ceramic or quarry tile is to be installed by either thickset or thinset

method. While concrete is still plastic, slightly scarify surface with a fine broom perpendicular to main traffic route.

1. Coordinate required final finish with A/E before application.
 2. Comply with flatness and levelness tolerances for trowel-finished floor surfaces.
- D. Broom Finish: Apply a broom finish to exterior concrete platforms, steps, ramps, and locations indicated on Drawings.
1. Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
 2. Coordinate required final finish with A/E before application.
- E. Slip-Resistive Finish: Before final floating, apply slip-resistive aggregate finish to concrete stair treads, platforms, ramps as indicated on Drawings
1. Apply in accordance with manufacturer's written instructions and as follows:
 - a. Uniformly spread 25 lb/100 sq. ft. of dampened slip-resistive aggregate over surface in one or two applications.
 - b. Tamp aggregate flush with surface, but do not force below surface.
 - c. After broadcasting and tamping, apply float finish.
 - d. After curing, lightly work surface with a steel wire brush or an abrasive stone and water to expose slip-resistive aggregate.

3.14 INSTALLATION OF MISCELLANEOUS CONCRETE ITEMS

- A. Filling In:
1. Fill in holes and openings left in concrete structures after Work of other trades is in place unless otherwise indicated.
 2. Mix, place, and cure concrete, as specified, to blend with in-place construction.
 3. Provide other miscellaneous concrete filling indicated or required to complete the Work.
- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.
- C. Equipment Bases and Foundations:
1. Coordinate sizes and locations of concrete bases with actual equipment provided.
 2. Construct concrete bases 4 inches high unless otherwise indicated on Drawings, and extend base not less than 6 inches in each direction beyond the maximum dimensions of supported equipment unless otherwise indicated on Drawings, or unless required for seismic anchor support.
 3. Minimum Compressive Strength: 4000 psi at 28 days.
 4. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.

5. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete substrate.
 6. Prior to pouring concrete, place and secure anchorage devices.
 - a. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - b. Cast anchor-bolt insert into bases.
 - c. Install anchor bolts to elevations required for proper attachment to supported equipment.
- D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items.
1. Cast-in inserts and accessories, as shown on Drawings.
 2. Screed, tamp, and trowel finish concrete surfaces.

3.15 CONCRETE CURING

- A. Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
1. Comply with ACI 301 and ACI 306.1 for cold weather protection during curing.
 2. Comply with ACI 301 and ACI 305.1 for hot-weather protection during curing.
 3. Maintain moisture loss no more than 0.2 lb/sq. ft. x h before and during finishing operations. Apply evaporation retarder according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing if moisture loss exceeds this level.
- B. Curing Formed Surfaces: Comply with ACI 308.1 as follows:
1. Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces.
 2. If forms remain during curing period, moist cure after loosening forms.
 3. If removing forms before end of curing period, continue curing for remainder of curing period, as follows:
 - a. Continuous Fogging: Maintain standing water on concrete surface until final setting of concrete.
 - b. Continuous Sprinkling: Maintain concrete surface continuously wet.
 - c. Absorptive Cover: Pre-dampen absorptive material before application; apply additional water to absorptive material to maintain concrete surface continuously wet.
 - d. Water-Retention Sheeting Materials: Cover exposed concrete surfaces with sheeting material, taping, or lapping seams.
 - e. Membrane-Forming Curing Compound: Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 1) Recoat areas subject to heavy rainfall within three hours after initial application.

- 2) Maintain continuity of coating and repair damage during curing period.

C. Curing Unformed Surfaces: Comply with ACI 308.1 as follows:

1. Begin curing immediately after finishing concrete.
 - a. For Floors to Receive Floor Coverings Specified in Other Sections, Floors to Receive Penetrating Liquid Floor Treatments, Post-Tensioned Concrete, and Concrete used to Contain Liquids: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12-inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive.
 - a) Immediately repair any holes or tears during curing period, using cover material and waterproof tape.
 - b) Cure for not less than seven days.
 - 3) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:
 - a) Water.
 - b) Continuous water-fog spray.
 - b. Floors to Receive Polished Finish: Contractor has option of the following:
 - 1) Absorptive Cover: As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - a) Lap edges and ends of absorptive cover not less than 12 inches.
 - b) Maintain absorptive cover water saturated, and in place, for duration of curing period, but not less than seven days.
 - 2) Ponding or Continuous Sprinkling of Water: Maintain concrete surfaces continuously wet for not less than seven days, utilizing one, or a combination of, the following:

- a) Water.
 - b) Continuous water-fog spray.
- c. Floors to Receive Chemical Stain:
- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install curing paper over entire area of floor.
 - 2) Install curing paper square to building lines, without wrinkles, and in a single length without end joints.
 - 3) Butt sides of curing paper tight; do not overlap sides of curing paper.
 - 4) Leave curing paper in place for duration of curing period, but not less than 28 days.
- d. Floors to Receive Urethane Flooring:
- 1) As soon as concrete has sufficient set to permit application without marring concrete surface, install prewetted absorptive cover over entire area of floor.
 - 2) Rewet absorptive cover, and cover immediately with polyethylene moisture-retaining cover with edges lapped 6 inches and sealed in place.
 - 3) Secure polyethylene moisture-retaining cover in place to prohibit air from circulating under polyethylene moisture-retaining cover.
 - 4) Leave absorptive cover and polyethylene moisture-retaining cover in place for duration of curing period, but not less than 28 days.
- e. Floors to Receive Curing Compound:
- 1) Apply uniformly in continuous operation by power spray or roller in accordance with manufacturer's written instructions.
 - 2) Recoat areas subjected to heavy rainfall within three hours after initial application.
 - 3) Maintain continuity of coating, and repair damage during curing period
 - 4) Curing compounds shall not be used to cure post-tensioned concrete.
 - 5) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

3.16 APPLICATION OF LIQUID FLOOR TREATMENTS

- A. Penetrating Liquid Floor Treatment: Prepare, apply, and finish penetrating liquid floor treatment according to manufacturer's written instructions.
1. Remove curing compounds, sealers, oil, dirt, laitance, and other contaminants and complete surface repairs.
 2. Do not apply to concrete that is less than seven days old.

3. Apply liquid until surface is saturated, scrubbing into surface until a gel forms; rewet; and repeat brooming or scrubbing.
 4. Rinse with water; remove excess material until surface is dry.
 5. Apply a second coat in a similar manner if surface is rough or porous.
- B. Sealing Coat: Uniformly apply a continuous sealing coat of curing and sealing compound to hardened concrete by power spray or roller according to manufacturer's written instructions.

3.17 JOINT FILLING

- A. Prepare, clean, and install joint filler according to manufacturer's written instructions.
1. Defer joint filling until concrete has aged at least six months.
 2. Do not fill joints until construction traffic has permanently ceased.
- B. Remove dirt, debris, saw cuttings, curing compounds, and sealers from joints; leave contact faces of joint clean and dry.
- C. Install semirigid epoxy joint filler full depth in saw-cut joints and at least 2 inches deep in formed joints.
- D. Overfill joint and trim joint filler flush with top of joint after hardening.

3.18 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by A/E. Remove and replace concrete that cannot be repaired and patched to A/E's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part Portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete. It is not required to patch voids less than 1/2 inch in depth unless total area of all voids in any 1-foot by 1-foot square area exceed 15 square inches. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
 2. Repair defects on surfaces exposed to view by blending white Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by A/E.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 2. After concrete has cured at least 14 days, correct high areas by grinding.
 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
 5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
 7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to A/E's approval, using adhesive and patching mortar as specified by the A/E.
- F. Repair materials and installation not specified above may be used, subject to A/E's approval.
- G. All repair procedures and products shall be reviewed and approved by the A/E prior to commencing with the remedial work.

3.19 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a special inspector to perform field tests and inspections and prepare testing and inspection reports.

- B. Testing Agency: Owner will engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
1. Testing agency shall be responsible for providing curing container for composite samples on Site and verifying that field-cured composite samples are cured in accordance with ASTM C31.
 2. Testing agency shall immediately report to A/E, Contractor, and concrete manufacturer any failure of Work to comply with Contract Documents.
 3. Testing agency shall report results of tests and inspections, in writing, to Owner, A/E, Contractor, and concrete manufacturer within 48 hours of inspections and tests.
 - a. Test reports shall include reporting requirements of ASTM C31, ASTM C39, and ACI 301, including the following as applicable to each test and inspection:
 - 1) Project name.
 - 2) Name of testing agency.
 - 3) Names and certification numbers of field and laboratory technicians performing inspections and testing.
 - 4) Name of concrete manufacturer.
 - 5) Date and time of inspection, sampling, and field testing.
 - 6) Date and time of concrete placement.
 - 7) Location in Work of concrete represented by samples.
 - 8) Date and time sample was obtained.
 - 9) Truck and batch ticket numbers.
 - 10) Design compressive strength at 28 days.
 - 11) Concrete mixture designation, proportions, and materials.
 - 12) Field test results.
 - 13) Information on storage and curing of samples before testing, including curing method and maximum and minimum temperatures during initial curing period.
 - 14) Type of fracture and compressive break strengths at seven days and 28 days.
- C. Batch Tickets: For each load delivered, submit three copies of batch delivery ticket to testing agency, indicating quantity, mix identification, admixtures, design strength, aggregate size, design air content, design slump at time of batching, and amount of water that can be added at Project site.
- D. Concrete Tests: Testing of composite samples of fresh concrete obtained in accordance with ASTM C 172 shall be performed in accordance with the following requirements:
1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 50 cu. yd., plus one set for each additional 100 cu. yd. or fraction thereof.
 - a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least

five randomly selected batches or from each batch if fewer than five are used.

2. Slump: ASTM C143:
 - a. One test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. Perform additional tests when concrete consistency appears to change.
 - c. No concrete shall be placed that does not meet specified slump requirements. Slump exceeding the specified maximum, when occurring in 2 consecutive tests made on different portions of the same sample, will be cause for rejection of that truckload and shall be reported to the A/E immediately. The replacement of such concrete shall be done at no additional expense to the Owner
3. Air Content: ASTM C231 pressure method, for normal-weight concrete.
 - a. One test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
 - b. No concrete shall be placed that does not meet specified air content requirements.
4. Concrete Temperature: ASTM C1064:
 - a. One test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
5. Compression Test Specimens: ASTM C31:
 - a. Cast and laboratory cure two sets of two 6-inchby 12-inchor two sets of three 4-inchby 8-inchcylinder specimens for each composite sample.
 - b. Cast, initial cure, and field cure two sets of two standard 6-inch by 12-inch or three 4-inch by 8-inch cylinder specimens for each composite sample.
6. Compressive-Strength Tests: ASTM C39:
 - a. Test one set of laboratory-cured specimens at seven days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of specimens obtained from same composite sample and tested at age indicated.
7. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
8. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength, and no compressive-strength test value falls below specified compressive strength by more than 500 psiif specified compressive strength is less than or equal to 5000 psi, or no compressive strength test value is

- less than 10 percent of specified compressive strength if specified compressive strength is greater than 5000 psi.
9. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by A/E but will not be used as sole basis for approval or rejection of concrete.
 10. If the 28-day test results do not meet the specified strength f'_c , the mix proportions shall be adjusted for the remaining portion of the structure at no additional expense to the Owner.
 11. Additional Tests:
 - a. Where concrete is considered partially deficient, the Owner may require additional testing to be made at no additional expense to the Owner. Any such testing shall be done by an independent testing laboratory. If additional tests do not indicate concrete meets the Project requirements, Contractor shall remove and replace deficient concrete as directed by A/E. In lieu of additional testing, Contractor has option to immediately remove and replace deficient concrete at no additional expense to the Owner or Project Schedule
 - b. Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by A/E.
 - c. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C42 or by other methods as directed by A/E.
 - 1) Acceptance criteria for concrete strength shall be in accordance with ACI 301 section 1.6.6.3.
 12. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
 13. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.
- E. Measure floor and slab flatness and levelness in accordance with ASTM E1155 within 72 hours of completion of floor finishing and promptly report test results to A/E.
- F. Inspection Services: Inspection work shall be performed in accordance with ACI 311 by an independent testing laboratory.
1. The inspecting agency shall perform the following duties:
 - a. Inspect batching and mixing operations of concrete.
 - b. Inspect storage facilities and methods of material handling.
 - c. Inspect formwork for shape, location, and dimensions of the concrete member being formed.
 - d. Inspect placed reinforcing steel, shoring, bracing, embedded items, anchor bolts, joints, etc.
 - e. Inspect concrete handling, placing, consolidating, finishing, curing, protection, and repair or patching.
 - f. Submit certified reports the same day that duties are performed to all those designated by the A/E or the Owner. Any noncompliance with Project requirements shall be reported immediately.

2. The Contractor shall fully cooperate with the inspecting agency in their performance of specified duties and render any necessary physical assistance.
3. The reinforcing steel and embedded item placement must be completed before inspection. Concrete placement shall not commence until the area has been inspected and given final approval by the inspecting agency.

3.20 PROTECTION

A. Protect concrete surfaces as follows:

1. Protect from petroleum stains.
2. Diaper hydraulic equipment used over concrete surfaces.
3. Prohibit use of pipe-cutting machinery over concrete surfaces.
4. Prohibit placement of steel items on concrete surfaces.
5. Prohibit use of acids or acidic detergents over concrete surfaces.
6. Protect liquid floor treatment from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by liquid floor treatments installer.
7. Protect concrete surfaces scheduled to receive surface hardener or polished concrete finish using Floor Slab Protective Covering.

- #### B. Slabs on ground shall not receive any type of loading other than people foot traffic until the concrete has cured for at least seven days and the concrete has reached 80 percent of its required strength.

END OF SECTION 03 30 00

SECTION 04 22 00 – CONCRETE UNIT MASONRY**PART 1 - GENERAL****1.01 SUMMARY**

Section Includes:

Concrete masonry units.

1. Mortar and grout.
2. Steel reinforcing bars.
3. Masonry-joint reinforcement.
4. Miscellaneous masonry accessories.

Related Requirements:

5. Section 07 62 00 "Sheet Metal Flashing and Trim" for exposed sheet metal flashing and for furnishing manufactured reglets installed in masonry joints.

1.02 DEFINITIONS

CMU(s): Concrete masonry unit(s).

- A. Reinforced Masonry: Masonry containing reinforcing steel in grouted cells.

1.03 PREINSTALLATION MEETINGS

Preinstallation Conference: Conduct conference at 4433 W CHICAGO AVE.

1.04 ACTION SUBMITTALS

Product Data: For each type of product.

A. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.

Shop Drawings: For the following:

Masonry Units: Show sizes, profiles, coursing, and locations of special shapes.

2. Reinforcing Steel: Detail bending, lap lengths, and placement of unit masonry reinforcing bars. Comply with ACI 315. Show elevations of reinforced walls.
3. Fabricated Flashing: Detail corner units, end-dam units, and other special applications.

1.05 INFORMATIONAL SUBMITTALS

Qualification Data: For testing agency.

- A. Material Certificates: For each type and size of the following:
Masonry units.

Include data on material properties.

- a. For masonry units, include data and calculations establishing average net-area compressive strength of units.
2. Cementitious materials. Include name of manufacturer, brand name, and type.
3. Mortar admixtures.
4. Preblended, dry mortar mixes. Include description of type and proportions of ingredients.
5. Grout mixes. Include description of type and proportions of ingredients.
6. Reinforcing bars.
7. Joint reinforcement.
8. Anchors, ties, and metal accessories.

Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91/C 91M for air content.

9. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

Statement of Compressive Strength of Masonry: For each combination of masonry unit type and mortar type, provide statement of average net-area compressive strength of masonry units, mortar type, and resulting net-area compressive strength of masonry determined according to TMS 602/ACI 530.1/ASCE 6.

- B. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.06 QUALITY ASSURANCE

Testing Agency Qualifications: Qualified according to ASTM C 1093 for testing indicated.

1.07 DELIVERY, STORAGE, AND HANDLING

Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

- A. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- C. Deliver preblended, dry mortar mix in moisture-resistant containers. Store preblended, dry mortar mix in delivery containers on elevated platforms in a dry location or in covered weatherproof dispensing silos.

- D. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.08 FIELD CONDITIONS

Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

Extend cover a minimum of 24 inches down both sides of walls, and hold cover securely in place.

Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least three days after building masonry walls or columns.

- A. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.

1. Protect sills, ledges, and projections from mortar droppings.
2. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and higher and will remain so until masonry has dried, but not less than seven days after completing cleaning.

Hot-Weather Requirements: Comply with hot-weather construction requirements contained in TMS 602/ACI 530.1/ASCE 6.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, from single source from single manufacturer for each product required.

- A. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

2.02 PERFORMANCE REQUIREMENTS

Provide unit masonry that develops indicated net-area compressive strengths at 28 days.

Determine net-area compressive strength of masonry from average net-area compressive strengths of masonry units and mortar types (unit-strength method) according to TMS 602/ACI 530.1/ASCE 6.

1. Determine net-area compressive strength of masonry by testing masonry prisms according to ASTM C 1314.

2.03 UNIT MASONRY, GENERAL

Masonry Standard: Comply with TMS 602/ACI 530.1/ASCE 6 except as modified by requirements in the Contract Documents.

- A. Defective Units: Referenced masonry unit standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated. Do not use units where such defects are exposed in the completed Work.
- B. Fire-Resistance Ratings: Comply with requirements for fire-resistance-rated assembly designs indicated.
Where fire-resistance-rated construction is indicated, units shall be listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction.

2.04 CONCRETE MASONRY UNITS

Regional Materials: CMUs shall be manufactured within 100 miles of Project site from aggregates[and cement] that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

- A. Shapes: Provide shapes indicated and as follows, with exposed surfaces matching exposed faces of adjacent units unless otherwise indicated.
Provide special shapes for lintels, corners, jambs, sashes, movement joints, headers, bonding, and other special conditions.
 1. Provide bullnose units for outside corners unless otherwise indicated.

CMUs: ASTM C 90.

Unit Compressive Strength: Provide units with minimum average net-area compressive strength of 2000 psi.

2. Density Classification: Normal weight unless otherwise indicated.
3. Size (Width): Manufactured to dimensions 3/8 inch less-than-nominal dimensions.

2.05 MASONRY LINTELS

General: Provide one of the following:

- A. Masonry Lintels: Prefabricated or built-in-place masonry lintels made from bond beam CMUs matching adjacent CMUs in color, texture, and density classification, with reinforcing bars placed as indicated and filled with coarse grout. Cure precast lintels before handling and installing. Temporarily support built-in-place lintels until cured.

2.06 MORTAR AND GROUT MATERIALS

Regional Materials: Aggregate for mortar and grout, cement, and lime shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

- A. Portland Cement: ASTM C 150/C 150M, Type I or II, except Type III may be used for cold-weather construction. Provide natural color or white cement as required to produce mortar color indicated.
Alkali content shall not be more than 0.1 percent when tested according to ASTM C 114.

Hydrated Lime: ASTM C 207, Type S.

- B. Portland Cement-Lime Mix: Packaged blend of portland cement and hydrated lime containing no other ingredients.
- C. Masonry Cement: ASTM C 91/C 91M.
Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
Cemex S.A.B. de C.V.; Brikset, Type N Citadel, Type S Dixie, Type S Kosmortar, Type N Richmortar Victor Plastic Cement.
 - a. Essroc, Italcementi Group; Brixment Flamingo Color Masonry Cement Velvet.
 - b. Holcim (US) Inc.; Mortamix Masonry Cement Rainbow Mortamix Custom Buff Masonry Cement White Mortamix Masonry Cement.
 - c. Lafarge North America Inc.; Magnolia Masonry Cement Lafarge Masonry Cement Trinity White Masonry Cement.
 - d. Lehigh Cement Company.; Lehigh Masonry Cement Lehigh White Masonry Cement.

Mortar Cement: ASTM C 1329/C 1329M.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
Lafarge North America Inc.; Lafarge Mortar Cement Magnolia Superbond Mortar Cement.

Aggregate for Mortar: ASTM C 144.

For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.

- D. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

Products: Subject to compliance with requirements, [provide the following] [provide one of the following] [available products that may be incorporated into the Work include, but are not limited to, the following]:

BASF Corporation Chemicals - Building Systems; Trimix-NCA.

- a. Euclid Chemical Company (The); an RPM company; Accelguard 80.
- b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.

Water: Potable.

2.07 REINFORCEMENT

Uncoated Steel Reinforcing Bars: ASTM A 615/A 615M or ASTM A 996/A 996M, Grade 60.

- A. Reinforcing Bar Positioners: Wire units designed to fit into mortar bed joints spanning masonry unit cells and to hold reinforcing bars in center of cells. Units are formed from 0.148-inch steel wire, hot-dip galvanized after fabrication. Provide units designed for number of bars indicated.

Products: Subject to compliance with requirements, provide one of the following:

Heckmann Building Products Inc.; No. 376 Rebar Positioner.

- a. Hohmann & Barnard, Inc.; #RB or #RB-Twin Rebar Positioner.
- b. Wire-Bond; O-Ring or Double O-Ring Rebar Positioner.

Masonry-Joint Reinforcement, General: Ladder type complying with ASTM A 951/A 951M.

Interior Walls: Mill- galvanized carbon steel.

2. Exterior Walls: Hot-dip galvanized carbon steel.
3. Wire Size for Side Rods: 0.187-inch diameter.
4. Wire Size for Cross Rods: 0.148-inch diameter.
5. Spacing of Cross Rods: Not more than 16 inches o.c.
6. Provide in lengths of not less than 10 feet, with prefabricated corner and tee units.

2.08 TIES AND ANCHORS

General: Ties and anchors shall extend at least 1-1/2 inches into masonry but with at least a 5/8-inch cover on outside face.

- A. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:
- Mill-Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 641/A 641M, Class 1 coating.
1. Hot-Dip Galvanized, Carbon-Steel Wire: ASTM A 82/A 82M, with ASTM A 153/A 153M, Class B-2 coating.
 2. Galvanized-Steel Sheet: ASTM A 653/A 653M, Commercial Steel, G60 zinc coating.
 3. Steel Sheet, Galvanized after Fabrication: ASTM A 1008/A 1008M, Commercial Steel, with ASTM A 153/A 153M, Class B coating.
 4. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

Adjustable Anchors for Connecting to Structural Steel Framing: Provide anchors that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of wall.

Anchor Section for Welding to Steel Frame: Crimped 1/4-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

5. Tie Section: Triangular-shaped wire tie made from 0.187-inch- diameter, hot-dip galvanized steel wire. Mill-galvanized wire may be used at interior walls unless otherwise indicated.

Partition Top Anchors: 0.105-inch- thick metal plate with a 3/8-inch- diameter metal rod 6 inches long welded to plate and with closed-end plastic tube fitted over rod that allows rod to move in and out of tube. Fabricate from steel, hot-dip galvanized after fabrication.

2.09 EMBEDDED FLASHING MATERIALS

Metal Flashing: Provide metal flashing complying with Section 07 62 00 "Sheet Metal Flashing and Trim" and as follows:

Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

1. Fabricate through-wall metal flashing embedded in masonry from , with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.

Fabricate through-wall flashing with snaplock receiver on exterior face where indicated to receive counterflashing.

2. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
3. Fabricate through-wall flashing with sealant stop unless otherwise indicated. Fabricate by bending metal back on itself 3/4 inch at exterior face of wall and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
4. Fabricate metal drip edges and sealant stops for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam sheds water.
5. Fabricate metal drip edges from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.
6. Fabricate metal sealant stops from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.
7. Fabricate metal expansion-joint strips from stainless steel to shapes indicated.
8. Solder metal items at corners.

Application: Unless otherwise indicated, use the following:

Where flashing is indicated to receive counterflashing, use metal flashing.

9. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.

10. Where flashing is partly exposed and is indicated to terminate at the wall face, use metal flashing with a drip edge or flexible flashing with a metal drip edge or elastomeric thermoplastic flashing with a drip edge.
11. Where flashing is fully concealed, use metal flashing or flexible flashing.

Solder and Sealants for Sheet Metal Flashings: As specified in Section 07 62 00 "Sheet Metal Flashing and Trim."

Elastomeric Sealant: ASTM C 920, chemically curing urethane sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and remain watertight.

Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.10 MISCELLANEOUS MASONRY ACCESSORIES

Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene urethane or.

- A. Preformed Control-Joint Gaskets: Made from styrene-butadiene-rubber compound, complying with ASTM D 2000, Designation M2AA-805 or PVC, complying with ASTM D 2287, Type PVC-65406 and designed to fit standard sash block and to maintain lateral stability in masonry wall; size and configuration as indicated.
- B. Bond-Breaker Strips: Asphalt-saturated felt complying with ASTM D 226/D 226M, Type I (No. 15 asphalt felt).

2.11 MORTAR AND GROUT MIXES

General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

Do not use calcium chloride in mortar or grout.

1. Use portland cement-lime masonry cement or mortar unless otherwise indicated.
2. For exterior masonry, use portland cement-lime masonry cement or mortar.
3. For reinforced masonry, use portland cement-lime masonry cement mortar cement mortar.
4. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

- B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide the following types of mortar for applications stated unless another type is indicated or needed to provide required compressive strength of masonry.

For reinforced masonry, use Type S.

1. For interior nonload-bearing partitions, Type O may be used instead of Type N.

Grout for Unit Masonry: Comply with ASTM C 476.

Use grout of type indicated or, if not otherwise indicated, of type coarse that will comply with TMS 602/ACI 530.1/ASCE 6 for dimensions of grout spaces and pour height.

2. Proportion grout in accordance with ASTM C 476, Table 1 or paragraph 4.2.2 for specified 28-day compressive strength indicated, but not less than 3000 psi.
3. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143/C 143M.

PART 3 - EXECUTION

3.01 EXAMINATION

Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

1. Verify that foundations are within tolerances specified.
2. Verify that reinforcing dowels are properly placed.
3. Verify that substrates are free of substances that would impair mortar bond.

Before installation, examine rough-in and built-in construction for piping systems to verify actual locations of piping.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

Build chases and recesses to accommodate items specified in this and other Sections.

- A. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match construction immediately adjacent to opening.
- B. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

3.03 TOLERANCES

Dimensions and Locations of Elements:

For dimensions in cross section or elevation, do not vary by more than plus 1/2 inch or minus 1/4 inch.

1. For location of elements in plan, do not vary from that indicated by more than plus or minus 1/2 inch.
2. For location of elements in elevation, do not vary from that indicated by more than plus or minus 1/4 inch in a story height or 1/2 inch total.

Lines and Levels:

For bed joints and top surfaces of bearing walls, do not vary from level by more than 1/4 inch in 10 feet, or 1/2-inch maximum.

3. For conspicuous horizontal lines, such as lintels, sills, parapets, and reveals, do not vary from level by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
4. For vertical lines and surfaces do not vary from plumb by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
5. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/8 inch in 10 feet, 1/4 inch in 20 feet, or 1/2-inch maximum.
6. For lines and surfaces, do not vary from straight by more than 1/4 inch in 10 feet, 3/8 inch in 20 feet, or 1/2-inch maximum.
7. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10 feet, or 1/2-inch maximum.
8. For faces of adjacent exposed masonry units, do not vary from flush alignment by more than 1/16 inch.

Joints:

For bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch, with a maximum thickness limited to 1/2 inch.

9. For exposed bed joints, do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch.
10. For head and collar joints, do not vary from thickness indicated by more than plus 3/8 inch or minus 1/4 inch.
11. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch.

3.04 LAYING MASONRY WALLS

Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

- A. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.
- B. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than 4 inches. Bond and interlock each course of each wythe at corners. Do not use units with less-than-nominal 4-inch horizontal face dimensions at corners or jambs.

- C. Stopping and Resuming Work: Stop work by stepping back units in each course from those in course below; do not tooth. When resuming work, clean masonry surfaces that are to receive mortar, remove loose masonry units and mortar, and wet brick if required before laying fresh masonry.
- D. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.
- E. Fill space between steel frames and masonry solidly with mortar unless otherwise indicated.
- F. Fill cores in hollow CMUs with grout 24 inches under bearing plates, beams, lintels, posts, and similar items unless otherwise indicated.
- G. Build nonload-bearing interior partitions full height of story to underside of solid floor or roof structure above unless otherwise indicated.
Install compressible filler in joint between top of partition and underside of structure above.
 - 1. Fasten partition top anchors to structure above and build into top of partition. Grout cells of CMUs solidly around plastic tubes of anchors and push tubes down into grout to provide 1/2-inch clearance between end of anchor rod and end of tube. Space anchors 48 inches o.c. unless otherwise indicated.
 - 2. Wedge nonload-bearing partitions against structure above with small pieces of tile, slate, or metal. Fill joint with mortar after dead-load deflection of structure above approaches final position.
 - 3. At fire-rated partitions, treat joint between top of partition and underside of structure above to comply with Section 07 84 43 "Joint Firestopping."

3.05 MORTAR BEDDING AND JOINTING

Rake out mortar joints at pre-faced CMUs to a uniform depth of 1/4 inch and point with epoxy mortar to comply with epoxy-mortar manufacturer's written instructions.

- A. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.
- B. Cut joints flush for masonry walls to receive plaster or other direct-applied finishes (other than paint) unless otherwise indicated.
- C. Cut joints flush where indicated to receive waterproofing unless otherwise indicated.

3.06 MASONRY-JOINT REINFORCEMENT

General: Install entire length of longitudinal side rods in mortar with a minimum cover of 5/8 inch on exterior side of walls, 1/2 inch elsewhere. Lap reinforcement a minimum of 6 inches. Space reinforcement not more than 16 inches o.c.

- 1. Space reinforcement not more than 8 inches o.c. in foundation walls and parapet walls.

2. Provide reinforcement not more than 8 inches above and below wall openings and extending 12 inches beyond openings[in addition to continuous reinforcement].

Interrupt joint reinforcement at control and expansion joints unless otherwise indicated.

- B. Provide continuity at wall intersections by using prefabricated T-shaped units.
- C. Provide continuity at corners by using prefabricated L-shaped units.
- D. Cut and bend reinforcing units as directed by manufacturer for continuity at[corners,] returns, offsets, column fireproofing, pipe enclosures, and other special conditions.

3.07 ANCHORING MASONRY TO STRUCTURAL STEEL AND CONCRETE

Anchor masonry to structural steel and concrete, where masonry abuts or faces structural steel or concrete, to comply with the following:

Provide an open space not less than 1 inch wide between masonry and structural steel or concrete unless otherwise indicated. Keep open space free of mortar and other rigid materials.

1. Anchor masonry with anchors embedded in masonry joints and attached to structure.
2. Space anchors as indicated, but not more than 24 inches o.c. vertically and 36 inches o.c. horizontally.

3.08 CONTROL AND EXPANSION JOINTS

General: Install control- and expansion-joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.

- A. Form control joints in concrete masonry as follows:
Install preformed control-joint gaskets designed to fit standard sash block.

3.09 LINTELS

Provide masonry lintels where shown and where openings of more than 12 inches for brick-size units and 24 inches for block-size units are shown without structural steel or other supporting lintels.

- A. Provide minimum bearing of 8 inches at each jamb unless otherwise indicated.

3.10 FLASHING

General: Install embedded flashing at ledges and other obstructions to downward flow of water in wall where indicated.

- A. Install flashing as follows unless otherwise indicated:

Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.

1. At lintels, extend flashing a minimum of 6 inches into masonry at each end. At heads and sills, extend flashing 6 inches at ends and turn up not less than 2 inches to form end dams.
2. Interlock end joints of ribbed sheet metal flashing by overlapping ribs not less than 1-1/2 inches or as recommended by flashing manufacturer, and seal lap with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
3. Install metal drip edges with ribbed sheet metal flashing by interlocking hemmed edges to form hooked seam. Seal seam with elastomeric sealant complying with requirements in Section 07 92 00 "Joint Sealants" for application indicated.
4. Install metal drip edges beneath flexible flashing at exterior face of wall. Stop flexible flashing 1/2 inch back from outside face of wall, and adhere flexible flashing to top of metal drip edge.

- B. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.11 REINFORCED UNIT MASONRY INSTALLATION

Temporary Formwork and Shores: Construct formwork and shores as needed to support reinforced masonry elements during construction.

Construct formwork to provide shape, line, and dimensions of completed masonry as indicated. Make forms sufficiently tight to prevent leakage of mortar and grout. Brace, tie, and support forms to maintain position and shape during construction and curing of reinforced masonry.

1. Do not remove forms and shores until reinforced masonry members have hardened sufficiently to carry their own weight and other loads that may be placed on them during construction.

Placing Reinforcement: Comply with requirements in TMS 602/ACI 530.1/ASCE 6.

- B. Grouting: Do not place grout until entire height of masonry to be grouted has attained enough strength to resist grout pressure.

Comply with requirements in TMS 602/ACI 530.1/ASCE 6 for cleanouts and for grout placement, including minimum grout space and maximum pour height.

1. Limit height of vertical grout pours to not more than 48 inches.

3.12 FIELD QUALITY CONTROL

Testing and Inspecting: Owner will engage special inspectors to perform tests and inspections and prepare reports. Allow inspectors access to scaffolding and work areas as needed to perform tests and inspections. Retesting of materials that fail to comply with specified requirements shall be done at Contractor's expense.

- A. Inspections: Special inspections according to Level B in TMS 402/ACI 530/ASCE 5.

Begin masonry construction only after inspectors have verified proportions of site-prepared mortar.

1. Place grout only after inspectors have verified compliance of grout spaces and of grades, sizes, and locations of reinforcement.
2. Place grout only after inspectors have verified proportions of site-prepared grout.

Testing Prior to Construction: One set of tests.

- B. Testing Frequency: One set of tests for each 5000 sq. ft. of wall area or portion thereof.
- C. Concrete Masonry Unit Test: For each type of unit provided, according to ASTM C 140 for compressive strength.
- D. Mortar Test (Property Specification): For each mix provided, according to ASTM C 780. Test mortar for mortar air content and compressive strength.
- E. Grout Test (Compressive Strength): For each mix provided, according to ASTM C 1019.
- F. Prism Test: For each type of construction provided, according to ASTM C 1314 at 7 days and at 28 days.

3.13 REPAIRING, POINTING, AND CLEANING

Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

- A. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application, where indicated.
- B. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins and smears before tooling joints.
- C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed masonry as follows:
Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
 1. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
 2. Protect adjacent stone and nonmasonry surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
 3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing surfaces thoroughly with clear water.

4. Clean concrete masonry by applicable cleaning methods indicated in NCMA TEK 8-4A.

3.14 MASONRY WASTE DISPOSAL

Salvageable Materials: Unless otherwise indicated, excess masonry materials are Contractor's property. At completion of unit masonry work, remove from Project site.

- A. Waste Disposal as Fill Material: Dispose of clean masonry waste, including excess or soil-contaminated sand, waste mortar, and broken masonry units, by crushing and mixing with fill material as fill is placed.

Crush masonry waste to less than 4 inches in each dimension.

1. Mix masonry waste with at least two parts of specified fill material for each part of masonry waste. Fill material is specified in Section 31 20 00 "Earth Moving."
2. Do not dispose of masonry waste as fill within 18 inches of finished grade.

Masonry Waste Recycling: Return broken CMUs not used as fill to manufacturer for recycling.

- B. Excess Masonry Waste: Remove excess clean masonry waste that cannot be used as fill, as described above or recycled, and other masonry waste, and legally dispose of off Owner's property.

END OF SECTION 04 22 00

SECTION 05 12 00 – STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes structural steel, as defined in the AISC Manual of Steel Construction, "Code of Standard Practice," and as otherwise indicated.
- B. Related Sections:
 - 1. Division 01 Section "Quality Requirements" for independent testing agency procedures and administrative requirements.
 - 2. Division 05 Section "Architecturally Exposed Structural Steel Framing" for additional requirements for architecturally exposed structural steel.
 - 3. Division 05 Section "Steel Decking" for field installation of shear connectors through deck.
 - 4. Division 05 Section "Metal Fabrications" for steel lintels and shelf angles not attached to structural-steel frame miscellaneous steel fabrications and other metal items not defined as structural steel.
 - 5. Division 05 Section "Metal Stairs."
 - 6. Division 09 painting Sections and Division 09 Section "High-Performance Coatings" for surface-preparation and priming requirements.

1.3 DEFINITIONS

- A. Structural Steel: Elements of structural-steel frame, as classified by AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

1.4 PERFORMANCE REQUIREMENTS

- A. Comply with applicable provisions of the following specifications and documents:
 - 1. ANSI/AISC 303.
 - 2. ANSI/AISC 341.
 - 3. ANSI/AISC 360.
 - 4. RCSC's "Specification for Structural Joints Using High-Strength Bolts."
- B. Connections: Final design of all connections not fully detailed on the Drawings shall be the responsibility of the structural-steel fabricator. Provide details of connections

including comprehensive engineering design by a qualified engineer to withstand loads indicated and comply with other information and restrictions indicated.

1. Select and complete connections using schematic details indicated and AISC 360. Engineer unique connection details as required.
2. Use LRFD; data are given at factored-load level.

C. Moment Connections: Type FR, fully restrained.

D. Construction: Combined system of braced frame and shear walls.

1.5 SUBMITTALS

A. Product Data for each type of product specified.

B. Sustainable Design Submittal:

1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS

C. Shop Drawings detailing fabrication of structural steel components.

1. General

a. All Shop Drawings shall have a revision block that contains all dates of revision and reissuance, as well as all pertinent revision information.

- 1) Changes to Shop Drawings for resubmission shall be “clouded” or “flagged” to clearly indicate all changes (including additions and deletions) from the previous submission. Resubmissions will be reviewed only to verify those items clouded or flagged. All other information will be assumed to be unchanged from the previous submission.

- 2) No changes or substitutions shall be made on the Shop Drawings, unless such changes or substitutions have previously been authorized in writing by the A/E.

b. Erection Drawings: Subject to compliance with requirements, provide Drawings produced by one of the following methods:

- 1) Correctable, translucent prints of the A/E's Drawings may be used for erection drawings. The A/E's title block and profession seals shall not appear on submittals. Documents shall reflect current Construction Documents.
- 2) Electronic copies of CAD Drawings may be available from the A/E. Contractors requiring this service must contact the A/E to verify availability and receive a price quote. The cost of disk copying will be established on an individual basis, relative to the time required to copy and process the information. Requests for copies should be addressed to the A/E's Project Manager.
- 3) The A/E's title block and profession seals shall not appear on submittals. Documents shall reflect current Construction Documents.

c. The entire plan of any floor or roof shall be completely detailed before being submitted for review. The minimum amount of detailing that will be reviewed is half of a plan, or the area between expansion joints.

d. Detailing shall be done on a 24-inch by 36-inch sheet for erection plans and 11-inch by 17-inch for piece marks, minimum, and the sheets shall be filled completely to minimize the number of Shop Drawings.

2. Include details of cuts, connections, splices, camber, holes, and other pertinent data.
 3. Include embedment drawings.
 4. Indicate welds by standard AWS symbols, distinguishing between shop-welds and field-welds, and show size, length, and type of each weld. See backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
 5. Indicate type, size, and length of bolts, distinguishing between shop-bolts and field-bolts. Identify high-strength bolted slip-critical, direct-tension, or tensioned shear/bearing connections.
 6. Provide setting Drawings, templates, and directions for the installation of anchor bolts and other anchorages to be installed by others.
 7. Complete connection calculations, bearing the engineer's seal, shall accompany the appropriate Shop Drawing submittals.
 - a. The Engineer responsible for connection design shall review and provide Shop Drawing Stamp on all structural steel shop drawings prior to submitting to the A/E.
- D. Welding Procedure Specifications (WPSs) and Procedure Qualification Records (PQRs): Provide according to AWS D1.1/D1.1M, "Structural Welding Code - Steel," for each welded joint whether prequalified or qualified by testing, including the following:
1. Power source (constant current or constant voltage).
- E. Qualification Data: For qualified Installer, fabricator, and professional engineer.
- F. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- G. Control Submittals
1. Mill test reports signed by manufacturers, certifying that their products comply with requirements, including the following:
 - a. Structural steel, including chemical and physical properties.
 - b. Bolts, nuts, and washers, including mechanical properties and chemical analysis.
 - c. Direct-tension indicators.
 - d. Shear stud connectors.
 - e. Shop primers.
 - f. Non-shrink grout.
 2. Shop and field inspection reports.
 3. Design calculations for all connections not detailed on Contract Documents. Calculations shall be performed by a qualified professional engineer and shall bear the engineer's seal.
 4. Certifications that welders, both in shop and in field, have satisfactorily passed AWS qualifications within the past 12 months for the type of welds being made.
- 1.6 QUALITY ASSURANCE
- A. Fabricator Qualifications: Engage a firm experienced in fabricating structural steel similar to that indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to fabricate structural steel without delaying the Work.

1. A qualified fabricator that participates in the AISC Quality Certification Program and is designated an AISC-Certified Plant, Category BU or is accredited by the IAS Fabricator Inspection Program for Structural Steel (Acceptance Criteria 172).
 - B. Installer Qualifications: Engage an installer who participates in the AISC certification program and is designated an AISC-certified erector, Category ACSE or CSE.
 - C. Shop-Painting Applicators: Qualified according to AISC's Sophisticated Paint Endorsement P1 or SSPC-QP 3, "Standard Procedure for Evaluating Qualifications of Shop Painting Applicators."
 - D. Comply with applicable provisions of the following specifications and documents:
 1. AISC's "Steel Manual of Construction", LRFD.
 2. AISC's "Code of Standard Practice for Steel Buildings and Bridges.
 3. AISC's "Specification for Allowable Stress Design of Single-Angle Members."
 4. AISC's "Specification for Load and Resistance Factor Design of Single-Angle Members."
 5. AISC's "Seismic Provisions for Structural Steel Buildings."
 6. ASTM A 6 "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural Use."
 7. Research Council on Structural Connections' (RCSC) "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - E. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for projects with structural steel framing that are similar to that indicated for this Project in material, design, and extent.
 - F. Welding Standards: Comply with applicable provisions of AWS D1.1 "Structural Welding Code--Steel."
 1. Present evidence that each welder has satisfactorily passed AWS qualification tests for welding processes involved and, if pertinent, has undergone recertification.
 2. Any welder found producing unsatisfactory work, even though certified, shall be immediately recertified or replaced with a qualified, certified welder.
 3. If recertification of welders is required, retesting and recertification are the Contractor's responsibility.
 4. Welders and welding operators performing work on bottom-flange, demand-critical welds shall pass the supplemental welder qualification testing, as required by AWS D1.8. FCAW-S and FCAW-G shall be considered separate processes for welding personnel qualification.
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Deliver structural steel to Project site in such quantities and at such times to ensure continuity of installation.
 - B. Store materials to permit easy access for inspection and identification. Keep steel members off ground by using pallets, platforms, or other supports. Protect steel members and packaged materials from erosion and deterioration.

1. Store fasteners in a protected place in sealed containers with manufacturer's labels intact. Clean and relubricate bolts and nuts that become dry or rusty before use.
2. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.
3. Comply with manufacturer's written recommendations for cleaning and lubricating ASTM F3125, Grade F1852 bolt assemblies and for retesting bolt assemblies after lubrication.
4. Do not store materials on structure in a manner that might cause distortion or damage to members or supporting structures. Repair or replace damaged materials or structures as directed.

1.8 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' recommendations to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

PART 2 - PRODUCTS

2.1 STRUCTURAL-STEEL MATERIALS

- A. Recycled Content of Steel Products: Provide products with an average recycled content of steel products so postconsumer recycled content plus one-half of preconsumer recycled content is not less than **25** percent.
- B. Rolled Steel Wide Flanges and WT Shapes
 1. Carbon Steel: ASTM A992, unless noted otherwise.
- C. Structural Steel Channels, Plates, Angles, and Bars: As follows:
 1. Carbon Steel: ASTM A36, 36,000 psi yield, unless noted otherwise.
 2. High-Strength, Low-Alloy Columbium-Vanadium Steel: ASTM A572, Grade 50, where noted.
- D. Cold-Formed Hollow Structural Sections: ASTM A500, Grade C.
- E. Steel Pipe: ASTM A53, Type E or S, Grade B.
 1. Weight Class: Standard, unless otherwise noted.
 2. Finish: Galvanized, when pipe is in contact with earth or exposed to weather, and where indicated.
 - a. Color: Black, unless otherwise noted.
- F. Shear Connectors: ASTM A29, Grade 1010 through 1020, headed-stud type, cold-finished carbon steel, AWS D1.1, Type B.
- G. Threaded Rods, Anchor Bolts, and Washers: As follows:
 1. Threaded Rods: ASTM A36.

2. Anchor Bolts: ASTM F-1554, Grade 36, or as indicated on the Drawings.
 3. Washers: ASTM A36.
 4. Nuts: ASTM A563 heavy-hex carbon steel.
- H. Non-High-Strength Bolts, Nuts, and Washers: ASTM A307, Grade A; carbon-steel, hex-head bolts, carbon-steel nuts, and flat, unhardened steel washers ASTM A36.
1. Finish: Hot-dip zinc coating, ASTM A153, Class C, unless noted otherwise.
- I. High-Strength Bolts, Nuts, and Washers: ASTM F3125 Grade A325, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts ASTM A563 Grade DH, and hardened carbon-steel washers ASTM F436 Type 1.
1. Finish: Hot-dip zinc coating, ASTM A153, Class C, unless noted otherwise.
 2. Direct-Tension Indicators: ASTM F 959, Type 325-1, compressible-washer type.
 - a. Finish: Plain, uncoated.
 - b. Finish: Mechanically deposited zinc coating, ASTM B695, Class 50.
- J. High-Strength Bolts, Nuts, and Washers: ASTM F3125 Grade A490, Type 1, heavy hex steel structural bolts, heavy hex carbon-steel nuts ASTM A563 Grade DH, and hardened carbon-steel washers ASTM F436 Type 1.
1. Direct-Tension Indicators: ASTM F 959, Type 490-1, compressible-washer type with plain finish.
- K. Tension-Control, High-Strength Bolt-Nut-Washer Assemblies: ASTM F3125 Grade F1852 Type 1 heavy-hex head assemblies, consisting of steel structural bolts with splined ends; ASTM A563 Grade DH heavy-hex carbon-steel nuts; and ASTM F436 Type 1 hardened carbon-steel washers.
- L. Welding Electrodes: Comply with AWS requirements.
1. Conform to the Specification for Mild Steel-Covered Arc-Welding Electrodes, AWS A5.1, latest edition.
 2. E-70 electrodes shall be used for all welding of structural materials, unless a higher strength electrode is required by Table 4.1.1 of AWS D1.1.
- M. Eye Bolts and Nuts: Made from cold-finished carbon steel bars, ASTM A108, Grade C-1030.

2.2 PRIMER

- A. Primer: Fabricator's standard lead- and chromate-free, nonasphaltic, rust-inhibiting primer complying with MPI No. 79 and compatible with topcoat.
- B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds and repair-painting galvanized steel, with dry film containing not less than 93 percent zinc dust by weight and complying with DOD-P-21035A or SSPC-Paint 20.

2.3 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: Premixed, nonmetallic, noncorrosive, nonstaining grout containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water-reducing agents, complying with ASTM C1107, of consistency suitable for application, and a 30-minute working time.

2.4 FABRICATION

- A. Fabricate and assemble structural steel in shop to greatest extent possible. Fabricate structural steel according to ANSI/AISC 303 and 360 specifications referenced in this Section and in Shop Drawings.
1. Camber structural steel members where indicated.
 2. Fabricate beams with rolling camber up.
 3. Identify high-strength structural steel according to ASTM A6 and maintain markings until steel has been erected.
 4. Mark and match-mark materials for field assembly.
 5. Fabricate for delivery a sequence that will expedite erection and minimize field handling of structural steel.
 6. Complete structural steel assemblies, including welding of units, before starting shop-priming operations.
 7. Comply with fabrication tolerance limits of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for structural steel.
- B. Fabricate architecturally exposed structural steel with exposed surfaces smooth, square, and free of surface blemishes, including pitting, rust and scale seam marks, roller marks, rolled trade names, and roughness.
1. Remove blemishes by filling, grinding, or by welding and grinding, prior to cleaning, treating, and shop priming.
 2. Comply with fabrication requirements, including tolerance limits, of AISC's "Code of Standard Practice for Steel Buildings and Bridges" for architecturally exposed structural steel.
- C. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.
1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1.
- D. Finishing: Accurately mill ends of columns and other members transmitting loads in bearing.
- E. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1 and manufacturer's printed instructions.
- F. Bolt Holes and other Holes: Provide holes required for securing other work to structural steel framing and for passage of other work through steel framing members, as shown on Shop Drawings.
1. Cut, drill, or punch holes perpendicular to metal surfaces. Do not flame-cut holes or enlarge holes by burning. Drill holes in bearing plates.
 2. Weld threaded nuts to framing and other specialty items as indicated to receive other work.
 3. Shop-drill or punch holes in members as required for bolts to secure structural steel, wood blocking, nailers, sash, etc. Burning of holes is not allowed.
 4. Drilling, cutting, or punching in members in the field for fastening of blocking, nailers, sash, etc., is not permitted without written approval from A/E.
 5. Provide holes required for securing other work to structural steel framing, and for the passage of other work through steel framing members, as indicated. Provide

threaded nuts welded to framing, and other specialty items as shown to receive work.

2.5 SHOP CONNECTIONS

- A. General: Connections shall conform to the following requirements:
1. Provide typical detailing of standard connections in accordance with AISC's "Steel Manual of Construction" if not otherwise shown. Connection details which deviate from the AISC Manual standard details, and which are not shown on the Drawings, shall be designed by the fabricator. Additional connections requiring design by the fabricator are also noted on the Drawings. All calculations performed by the fabricator shall be performed by an Engineer. The Engineer shall be registered in the state where the steel is to be erected. Complete calculations, bearing the Engineer's seal, shall accompany the appropriate Shop Drawing submittals.
 2. The minimum length of connection angles shall be equal to one-half the depth of the member to be supported. The maximum spacing between two rows of bolts shall be 3 inches, unless noted otherwise.
 3. One-sided connections will not be permitted unless specifically detailed on the Drawings.
 4. The minimum number of bolts in bolted connections shall be 2 bolts per angle leg.
- B. Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.
- C. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
 2. Bolts: ASTM A490 high-strength bolts, unless otherwise indicated.
 3. Connection Type: Snug-tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
 4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.
- D. Weld Connections: Comply with AWS D1.1 for procedures, tolerance, appearance and quality of welds, and methods used in correcting welding work.
1. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Do not exceed tolerances in AISC 303 for mill material.
 2. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of backside welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.
- E. Headed Stud-Type Shear Connectors: All headed studs shall be end-stud-welded to steel members in accordance with the manufacturer's printed instructions.

2.6 MISCELLANEOUS FABRICATION ITEMS

- A. Anchor Bolts: Furnish anchor bolts and other connectors required for securing structural steel to foundations and other in-place Work. Furnish templates and other devices as necessary for presetting bolts and other anchors to accurate locations.
- B. Equipment Supports and Mechanical Opening Framing
 - 1. All framing for equipment supports and for mechanical and electrical openings shown on Structural, Electrical, and Mechanical Drawings is for general arrangement only and may require modification to suit the actual purchased equipment. Such modification is the responsibility of the Contractor, who shall provide a complete job ready for installation of the equipment.
 - 2. Contractor shall submit a unit price per ton for fabricating and erecting support steel for equipment. This price per ton shall be for openings or equipment supports or both not shown or deleted.

2.7 SHOP-PRIMING

- A. Shop-prime steel surfaces, except the following:
 - 1. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
 - 2. Surfaces to be field-welded.
 - 3. Surfaces to be high-strength bolted with slip-critical connections.
 - 4. Surfaces to receive sprayed-on fireproofing.
 - 5. Surfaces to receive sprayed-on insulation.
 - 6. Galvanized surfaces.
 - 7. Surfaces enclosed in climate controlled, interior construction and not exposed to view.
- B. Surface Preparation: Clean surfaces to be painted. Remove loose rust, loose mill scale, and spatter, slag, or flux deposits. Prepare surfaces according to SSPC specifications as follows:
 - 1. **SSPC-SP 2** "Hand Tool Cleaning" for enclosed or protected steel, unless noted otherwise.
 - 2. **SSPC-SP 6** "Commercial Blast Cleaning," for unprotected or exposed steel and where indicated.
- C. Priming: Immediately after surface preparation, apply primer according to manufacturer's instructions and at rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.
 - 1. Stripe-paint corners, crevices, bolts, welds, and sharp edges.
 - 2. Apply 2 coats of shop-paint to inaccessible surfaces after assembly or erection. Change color of second coat to distinguish it from first.

2.8 GALVANIZING

- A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel indicated for galvanizing according to ASTM A123.
 - 1. All structural steel that is exposed to earth shall be galvanized. Do not shop-paint.
 - 2. See Drawings for structural steel required to be galvanized.

2.9 SOURCE QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform shop inspections and tests and to prepare test reports.
 - 1. Testing agency will conduct and interpret tests and state in each report whether test specimens comply with or deviate from requirements.
 - 2. Provide testing agency with access to places where structural steel Work is being fabricated or produced so required inspection and testing can be accomplished.
- B. If inspections or testing reveal deficiencies in structural steel, such deficiencies are to be corrected, or the structural steel removed and replaced.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Shop-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 - 1. Direct-tension indicator gaps will be verified to comply with ASTM F959, Table 2.
- E. In addition to visual inspection, shop-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 - 1. Liquid Penetrant Inspection: ASTM E165.
 - 2. Magnetic Particle Inspection: ASTM E709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Radiographic Inspection: ASTM E94 and ASTM E142, minimum quality level "2-2T."
 - 4. Ultrasonic Inspection: ASTM E164.
- F. In addition to visual inspection, shop-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud-welding and as follows:
 - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Before erection proceeds, and with the steel erector present, verify elevations of concrete and masonry bearing surfaces and locations of anchorages for compliance with requirements.
- B. Do not proceed with erection until unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads

and loads equal in intensity to design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place, unless otherwise indicated.

1. At no time shall the structure be subjected to loads in excess of the design loads stated on the Drawings.

3.3 ERECTION

- A. Set structural steel accurately in locations and to elevations indicated and according to ANSI/AISC 303 and 360 specifications referenced in this Section.
- B. Base and Bearing Plates: Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen surfaces prior to setting base and bearing plates. Clean bottom surface of base and bearing plates.
 1. Set base and bearing plates for structural members on wedges, shims, or setting nuts as required.
 2. Tighten anchor bolts after supported members have been positioned and plumbed. Do not remove wedges or shims but, if protruding, cut off flush with edge of base or bearing plate prior to packing with grout.
 3. Pack grout solidly between bearing surfaces and plates so no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure.
 - a. Comply with manufacturer's instructions for proprietary grout materials.
 - b. Base plates must be grouted before the connection is subject to any significant lateral load or bending moment.
- C. Maintain erection tolerances of structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 1. Maintain erection tolerances of architecturally exposed structural steel within AISC's "Code of Standard Practice for Steel Buildings and Bridges."
- D. Align and adjust various members forming part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that will be in permanent contact. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
 1. Level and plumb individual members of structure.
 2. Establish required leveling and plumbing measurements on mean operating temperature of structure. Make allowances for difference between temperature at time of erection and mean temperature at which structure will be when completed and in service.
- E. Splice members only where indicated.
- F. Remove erection bolts on welded, architecturally exposed structural steel; fill holes with plug welds, and grind smooth at exposed surfaces.
- G. Finish sections thermally cut during erection equal to a sheared appearance.
 1. No cutting of sections (including flanges, welds, stems, or angles) shall be done without written permission from A/E.
- H. Do not enlarge unfair holes in members by burning or by using drift pins. Ream holes that must be enlarged to admit bolts.

- I. Shear Connectors: Prepare steel surfaces as recommended by manufacturer of shear connectors. Use automatic end welding of headed-stud shear connectors according to AWS D1.1/D1.1M and manufacturer's written instructions.

3.4 FIELD CONNECTIONS

- A. Install and tighten non-high-strength bolts, except where high-strength bolts are indicated.
- B. Install and tighten high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 1. Bolts: ASTM A325 high-strength bolts, unless otherwise indicated.
 2. Bolts: ASTM A490 high-strength bolts, unless otherwise indicated.
 3. Connection Type: Snug-tightened, unless indicated as slip-critical, direct-tension, or tensioned shear/bearing connections.
 4. Connection Type: Slip-critical, direct-tension, or tensioned shear/bearing connections as indicated.
- C. Weld Connections: Comply with AWS D1.1 for procedures, tolerances, appearance and quality of welds, and methods used in correcting welding work.
 1. Comply with AISC specifications referenced in this Section for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
 2. Remove backing bars or runoff tabs where indicated, back gouge, and grind steel smooth.
 3. Assemble and weld built-up sections by methods that will maintain true alignment of axes without warp. Do not exceed tolerances in AISC's "Code of Standard Practice for Steel Buildings and Bridges" for mill material.
 4. Verify that weld sizes, fabrication sequence, and equipment used for architecturally exposed structural steel will limit distortions to allowable tolerances. Prevent surface bleeding of backside welding on exposed steel surfaces. Grind smooth exposed fillet welds 1/2 inch and larger. Grind flush butt welds. Dress exposed welds.

3.5 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspecting agency to perform field inspections and tests and to prepare test reports.
 1. Testing agency will conduct and interpret tests and state in each report whether tested Work complies with or deviates from requirements.
- B. Correct deficiencies in or remove and replace structural steel that inspections and test reports indicate do not comply with specified requirements.
- C. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with specified requirements.
- D. Field-bolted connections will be tested and inspected according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts."
 1. Direct-tension indicator gaps will be verified to comply with ASTM F959, Table 2.

- E. In addition to visual inspection, field-welded connections will be inspected and tested according to AWS D1.1 and the inspection procedures listed below, at testing agency's option.
 - 1. Liquid Penetrant Inspection: ASTM E165.
 - 2. Magnetic Particle Inspection: ASTM E709, performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
 - 3. Radiographic Inspection: ASTM E94 and ASTM E142; minimum quality level "2-2T."
 - 4. Ultrasonic Inspection: ASTM E164.

- F. In addition to visual inspection, field-welded shear connectors will be inspected and tested according to requirements of AWS D1.1 for stud welding and as follows:
 - 1. Bend tests will be performed when visual inspections reveal either less than a continuous 360-degree flash or welding repairs to any shear connector.
 - 2. Tests will be conducted on additional shear connectors when weld fracture occurs on shear connectors already tested, according to requirements of AWS D1.1.

3.6 CLEANING

- A. Touch-up Painting: Immediately after erection, clean field-welds, bolted connections, and abraded areas of shop-paint. Apply paint to exposed areas using same material as used for shop painting to comply with SSPC-PA1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum dry film thickness of 1.5 mils.

- B. Galvanized Surfaces: Clean field-welds, bolted connections, and abraded areas and apply galvanizing repair paint according to ASTM A780.

END OF SECTION 05 12 00

SECTION 05 31 00 – STEEL DECKING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Roof deck.
 - 2. Composite floor deck.
- B. Related Sections include the following:
 - 1. Division 03 Section "Cast-in-Place Concrete" for concrete fill and reinforcing steel.
 - 2. Division 05 Section "Structural Steel Framing" for shop-welded shear connectors.
 - 3. Division 05 Section "Metal Fabrications" for framing deck openings with miscellaneous steel shapes.

1.3 PERFORMANCE REQUIREMENTS

- A. Compute the properties of deck sections on the basis of the effective design width, as limited by the provisions of the SDI Specifications. Provide the deck section properties, including section modulus and moment of inertia per foot of width.
- B. Allowable Deflection: Design and fabricate deck for a maximum deflection of 1/360 of the span under the total uniform dead and live load.

1.4 SUBMITTALS

- A. Product Data: For each type of deck, accessory, and product indicated.
- B. Sustainable Design Submittals
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- C. Shop Drawings: Show layout and types of deck panels, anchorage details, reinforcing channels, pans, deck openings, special jointing, accessories, and attachments to other construction.
 - 1. Provide information on installation and maximum allowable hanging loads for hanger tabs.
 - 2. Provide design calculations, sealed by a professional engineer registered in the state where the Project is located, when deck configuration or design varies from the geometry or properties defined in the Contract Documents. Show the

composite action of the deck, shear connectors and beams proposed equals or exceeds the design indicated in the Contract Documents.

- D. Product Certificates: Signed by steel deck manufacturers, certifying that products furnished comply with requirements.
 - 1. UL certification, where applicable.
- E. Welding Certificates: Copies of certificates for welding procedures and personnel.
- F. Product Test Reports: From a qualified testing agency indicating that each of the following complies with requirements, based on comprehensive testing of current products:
 - 1. Acoustical roof deck.
 - 2. Powder-actuated mechanical fasteners.
- G. Evaluation Reports: For steel deck, from ICC-ES.
- H. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Source Limitations for Cellular Deck Floor Systems with Electrical Distribution: Obtain cellular floor deck units and compatible electrical components, such as preset inserts, activation kits, afterset inserts, service fittings, header ducts, and trench header ducts, from the same manufacturer. Electrical components are specified in Division 26 Section "Underfloor Raceways for Electrical Systems."
- C. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1, "Structural Welding Code-Steel," and AWS D1.3, "Structural Welding Code-Sheet Steel."
- D. AISI Specifications: Calculate structural characteristics of steel deck according to AISI's "Specification for the Design of Cold-Formed Steel Structural Members."
- E. FM Global Listing: Provide steel roof deck evaluated by FM Global and listed in FM's "Approval Guide, Building Materials" for Class 1 fire rating and Class 1-90 windstorm ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.
- B. Stack steel deck on platforms or pallets and slope to provide drainage. Protect with a waterproof covering and ventilate to avoid condensation.
 - 1. Protect and ventilate acoustical cellular roof deck with factory-installed insulation to maintain insulation free of moisture.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.
- B. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- C. Low-Emitting Materials: Paints and coatings shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.2 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following:
 - 1. Steel Deck:
 - a. Consolidated Systems, Inc., Columbia, South Carolina
 - b. Epic Metals Corp., Rankin, Pennsylvania
 - c. Nucor Corp.; Vulcraft Div., Charlotte, North Carolina
 - d. Roof Deck, Inc., Hightstown, New Jersey
 - e. Wheeling Corrugating Co.; Div. of Wheeling-Pittsburgh Steel Corp., Wheeling, West Virginia

2.3 ROOF DECK

- A. Steel Roof Deck: Fabricate panels, without top-flange stiffening grooves, to comply with "SDI Specifications and Commentary for Steel Roof Deck," in SDI Publication No. 31, and the following:
 - 1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 40, G90 zinc coating.
 - 2. Deck Profile: Type N.
 - 3. Profile Depth: 3 inches.
 - 4. Design Uncoated-Steel Thickness: 0.0358 inch.
 - 5. Span Condition: Double span or more unless indicated otherwise on Drawings.
 - 6. Side Laps: Overlapped.

2.4 COMPOSITE FLOOR DECK

- A. Composite Steel Floor Deck: Fabricate panels, with integrally embossed or raised pattern ribs and interlocking side laps, to comply with "SDI Specifications and

Commentary for Composite Steel Floor Deck," in SDI Publication No. 31, the minimum section properties indicated, and the following:

1. Galvanized-Steel Sheet: ASTM A653/A653M, Structural Steel (SS), Grade 50, G60 zinc coating.
2. Profile Depth: 1-1/2 inches.
3. Design Uncoated-Steel Thickness: 0.0358 inch.
4. Span Condition Double span or more unless indicated otherwise on Drawings.

2.5 ACCESSORIES

- A. General: Provide manufacturer's standard accessory materials for deck that comply with requirements indicated.
- B. Mechanical Fasteners: Corrosion-resistant, low-velocity, power-actuated or pneumatically driven carbon-steel fasteners; or self-drilling, self-threading screws.
- C. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.
- D. Flexible Closure Strips: Vulcanized, closed-cell, synthetic rubber.
 1. Refer to Division 07 Section, "Fire-Resistive Joint Systems" for fire-rated closures.
- E. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 40,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.
- F. Steel Sheet Accessories: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- G. Pour Stops: Steel sheet, minimum yield strength of 40,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.
- H. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck, unless otherwise indicated.
- I. Piercing Hanger Tabs: Piercing steel sheet hanger attachment devices for use with floor deck.
- J. Recessed Sump Pans: Single-piece steel sheet, 0.0747 inch thick, of same material and finish as deck, with 3-inch- wide flanges and level or sloped recessed pans of 1-1/2-inch minimum depth. For drains, cut holes in the field.
- K. Shear Connectors: ASTM A108, Grades 1010 through 1020 headed stud type, cold-finished carbon steel, AWS D1.1, Type B, with arc shields.
- L. Galvanizing Repair Paint: ASTM A780.
- M. Repair Paint: Lead and chromate-free rust-inhibitive primer complying with performance requirements of FS TT-P-664.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install deck panels and accessories according to applicable specifications and commentary in SDI Publication No. 31, manufacturer's written instructions, Factory Mutual requirements, and requirements in this Section.
- B. Install temporary shoring before placing deck panels, if required to meet deflection limitations.
- C. Locate decking bundles to prevent overloading of supporting members.
 - 1. Coordinate and cooperate with structural steel erector in locating deck bundles to prevent overloading of structural members.
- D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.
- E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.
- F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to decking.
- G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of decking, and support of other work.
 - 1. Reinforce roof deck at openings which do not support equipment and have an opening size less than 12 inches in any direction by means of a flat steel sheet placed over the opening and fusion-welded to the top surface of the deck. Provide sheet steel of the same quality as the deck units, not less than 18-gage, and at least the cut opening dimension wider and longer than the opening. Provide 5/8-inch diameter puddle welds at each corner and spaced not more than 6 inches o.c. along each side. Comply with Drawings for other roof opening details.
 - 2. Reinforce roof deck at openings which do not support equipment and have an opening size of 12 inches to 24 inches with an angle size of 3-inch by 3-inch by 1/4-inch on all sides of opening and placed on the bottom of the deck unless detailed otherwise on the Drawings. The angles on the two sides perpendicular to deck span shall extend past the opening on each side by the opening dimension. The other two angle ends shall be welded to the above mentioned angles. Weld deck to all angles with 5/8-inch diameter puddle weld at 6 inches o.c. Comply with Drawings for other roof opening details.

- H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.
- I. Mechanical fasteners may be used in lieu of welding to fasten deck. Locate mechanical fasteners and install according to deck manufacturer's written instructions.
- J. No architectural, electrical, or mechanical systems such as, but not limited to, ceilings, lighting, cable tray piping, conduit, ductwork, or fire suppression piping shall be supported by or hung from roof deck.

3.3 ROOF DECK INSTALLATION

- A. Fasten roof deck panels to steel supporting members by mechanical fasteners as indicated on the Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on Drawings.
 - 1. Button punched side laps are not permitted.
- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:
 - 1. End Joints: Lapped 2 inches minimum.
- D. Roof Sump Pans and Sump Plates: Install over openings provided in roof decking and mechanically fasten flanges to top of deck. Space fasteners at 6 inches apart with at least 1 fasteners at each corner.
- E. Miscellaneous Roof Deck Accessories: Install ridge and valley plates, finish strips, cover plates, end closures, and reinforcing channels according to deck manufacturer's written instructions. Mechanically fasten to substrate to provide a complete deck installation.
 - 1. Mechanically fasten cant strips to the top surface of the roof deck and secure to wood nailers with galvanized nails and to steel framing with welds or galvanized self-tapping screws. Space fasteners or welds at 12 inches o.c., lap end joints not less than 3 inches, and secure with galvanized sheet metal screws.
 - 2. Weld cover plates at changes in direction of roof-deck panels, unless otherwise indicated.
- F. Flexible Closure Strips: Install flexible closure strips over partitions, walls, and where indicated. Install with adhesive according to manufacturer's written instructions to ensure complete closure.

3.4 FLOOR DECK INSTALLATION

- A. Fasten floor deck panels to steel supporting members by arc spot (puddle) welds or mechanical fasteners as indicated on the Drawings.
- B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, as indicated on the Drawings.
 - 1. Button punched side laps are not permitted.

- C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 3 inches, with end joints as follows:
 - 1. End Joints: Lapped.
- D. Shear Connectors: Weld shear connectors through deck to supporting frame according to AWS D1.1 and manufacturer's written instructions. Butt end joints of deck panels; do not overlap. Remove and discard arc shields after welding shear connectors.
 - 1. Do not weld shear connectors to moment connection plates.
 - 2. Shear connectors shall be welded with a welding gun. Stick welding of shear studs is not permitted.
- E. Pour Stops: Weld or mechanically fasten steel sheet pour stops to supporting structure according to SDI recommendations, unless otherwise indicated.
- F. Floor Deck Closures: Weld or mechanically fasten steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of decking. Weld or mechanically fasten cover plates at changes in direction of floor deck panels, unless otherwise indicated.
- G. Install piercing hanger tabs not more than 24 inches apart in both directions, within 9 inches of walls at ends, and not more than 12 inches from walls at sides, unless otherwise indicated.

3.5 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing agency to perform field quality assurance testing, unless otherwise noted. Contractor is required to provide separate quality control procedures. Owner's and Contractor's quality assurance/quality control program shall conform to the ANSI/SDI QA/QC-2011 Standard for Quality Control and Quality Assurance for Installation of Steel Deck.
- B. Field welds will be subject to inspection.
 - 1. To certify that welds conform, they must be measured for size, hit with a hammer to determine soundness, and visually inspected for any burnouts.
- C. Shear connector stud welds will be inspected and tested according to AWS D1.1 for stud welding and as follows:
 - 1. Correct size and placement in accordance with final Shop Drawings.
 - 2. All shear connector stud welds will be visually inspected for full fusion or full 360-degree flash (weld fillet).
 - 3. Bend tests will be performed on a minimum of 5 studs per floor and at any location where visual inspections reveal less than a full 360-degree flash or welding repairs to any shear connector stud were performed.
 - 4. Tests will be conducted on additional shear connector studs if weld fracture occurs on shear connector studs already tested according to AWS D1.1.
- D. Testing agency will report test results promptly and in writing to Contractor and A/E.
- E. Remove and replace work that does not comply with specified requirements.

- F. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6 REPAIRS AND PROTECTION

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.
- B. Repair Painting: Wire-brush and clean rust spots, welds, and abraded areas on top surface of prime-painted deck immediately after installation, and apply repair paint.
- C. Repair blowholes in deck as recommended by Manufacturer. Holes larger than 1/2-inch diameter shall require sheet metal plate patches fastened to deck.
- D. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 31 00

SECTION 05 40 00 – COLD-FORMED METAL FRAMING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Exterior non-load-bearing wall framing.
- B. Related Requirements:
 - 1. Section 05 5000 "Metal Fabrications" for miscellaneous steel shapes, masonry shelf angles, and connections used with cold-formed metal framing.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Cold-formed steel framing materials.
 - 2. Exterior non-load-bearing wall framing.
 - 3. Soffit framing.
 - 4. Vertical deflection clips.
 - 5. Single deflection track.
 - 6. Double deflection track.
 - 7. Power-actuated anchors.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- C. Shop Drawings:
 - 1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
 - 2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.
- D. Delegated-Design Submittal: For cold-formed steel framing.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of code-compliance certification for studs and tracks.
- B. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency.
 - 1. Steel sheet.
 - 2. Mechanical fasteners.
 - 3. Vertical deflection clips.
 - 4. Miscellaneous structural clips and accessories.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.
- B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.
- C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association or the Steel Stud Manufacturers Association.
- D. Welding Qualifications: Qualify procedures and personnel according to the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Supplier to be a member of (SSMA) Steel Stud Manufacturers Association.

2.2 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design cold-formed steel framing.
- B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.
 - 1. Design Loads: As indicated on Drawings.
 - 2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

- a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 or 1/600 of the wall height as indicated on the drawings.
3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:
 - a. Upward and downward movement of 3/4 inch.
5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.
- C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:
 1. Wall Studs: AISI S211.
 2. Headers: AISI S212.
 3. Lateral Design: AISI S213.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

- A. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:
 1. Grade: As required by structural performance or as indicated on the drawings.
 2. Coating: G60
- B. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:
 1. Grade: As required by structural performance.
 2. Coating: G60.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

- A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0329 inch.
 2. Flange Width: 1-5/8 inches
- B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:
 1. Minimum Base-Metal Thickness: 0.0428 inch
 2. Flange Width: 1-1/4 inches.

- C. Vertical Deflection Clips: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.
- D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0428 inch.
 - 2. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
- E. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.
 - 1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch
 - b. Flange Width: 1 inch plus the design gap for one-story structures and 1 inch plus twice the design gap for other applications.
 - 2. Inner Track: Of web depth indicated, and as follows:
 - a. Minimum Base-Metal Thickness: 0.0428 inch
 - b. Flange Width: Equal to sum of outer deflection track flange width plus 1 inch.

2.5 SOFFIT FRAMING

- A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:
 - 1. Minimum Base-Metal Thickness: 0.0329 inch.
 - 2. Flange Width: 1-5/8 inches, minimum.

2.6 FRAMING ACCESSORIES

- A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.
- B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:
 - 1. Supplementary framing.
 - 2. Bracing, bridging, and solid blocking.

3. Web stiffeners.
4. End clips.
5. Foundation clips.

2.7 CLIPS AND FASTENERS

- A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.
- B. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.
 1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.
- D. Welding Electrodes: Comply with AWS standards.

2.8 MISCELLANEOUS MATERIALS

- A. Galvanizing Repair Paint: ASTM A780 or SSPC-Paint 20.
- B. Shims: Load-bearing, high-density, multi-monomer, non-leaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

2.9 FABRICATION

- A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.
 1. Fabricate framing assemblies using jigs or templates.
 2. Cut framing members by sawing or shearing; do not torch cut.
 3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.
- B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.
- C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:
 1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
 2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Before sprayed fire-resistive materials are applied, attach continuous angles, supplementary framing, or tracks to structural members indicated to receive sprayed fire-resistive materials.
- B. After applying sprayed fire-resistive materials, remove only as much of these materials as needed to complete installation of cold-formed framing without reducing thickness of fire-resistive materials below that required to obtain fire-resistance ratings indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.
- B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.
- C. Install shop or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.
- D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.
 1. Cut framing members by sawing or shearing; do not torch cut.
 2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.
 - a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
 - b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.
- E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.
- F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.
- G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.
- H. Install insulation, specified in Section 072100 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.
- I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

- A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.
- B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:
 1. Stud Spacing: 16 inches
- C. Set studs plumb, except as needed for diagonal bracing or required for non-plumb walls or warped surfaces and similar requirements.

- D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.
 - 1. Install single deep-leg deflection tracks and anchor to building structure.
 - 2. Install double deep-leg deflection tracks and anchor outer tracks to building structure.
 - 3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
 - 4. Connect drift clips to cold-formed steel framing and anchor to building structure.
- E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.
 - 1. Channel Bridging: Cold-rolled steel channel welded or mechanically fastened to webs of punched studs.
 - 2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
 - 3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.
- F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.
 - 1. Install solid blocking at 96-incenters.
- G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF SOFFITT FRAMING

- A. Install perimeter track sized to match studs. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on the Shop Drawings.
- B. Install studs bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten studs to both flanges of track.
 - 1. Install studs over supporting frame with a minimum end bearing of 1-1/2 inches.
- C. Space studs not more than 2 inches from abutting walls, and as follows:
 - 1. Stud Spacing: **12 inches**
- D. Install bridging at intervals indicated **on the Shop Drawings**. Fasten bridging at each stud intersection.

- E. Install miscellaneous stud framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable soffit-framing assembly.

3.6 INSTALLATION TOLERANCES

- A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:
 - 1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIR

- A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 FIELD QUALITY CONTROL

- A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.
- B. Field and shop welds will be subject to testing and inspecting.
- C. Testing agency will report test results promptly and in writing to Contractor and Architect.
- D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9 PROTECTION

- A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 05 50 00 - METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel framing and supports for ceiling-hung toilet compartments.
2. Steel framing and supports for operable partitions.
3. Steel framing and supports for overhead doors and grilles.
4. Steel framing and supports for countertops.
5. Steel framing and supports for equipment.
6. Steel tube reinforcement for low partitions.
7. Steel framing and supports for mechanical and electrical equipment.
8. Steel framing and supports for applications where framing and supports are not specified in other Sections.
9. Elevator machine beams, hoist beams.
10. Steel shapes for supporting elevator door sills.
11. Steel girders for supporting wood frame construction.
12. Steel pipe columns for supporting wood frame construction.
13. Slotted channel framing.
14. Shelf angles.
15. Metal ladders.
16. Ladder safety cages.
17. Elevator pit sump covers.
18. Structural-steel door frames.
19. Miscellaneous steel trim including steel angle corner guards.
20. Metal bollards.
21. Vehicular barrier cable systems.
22. Pipe guards.
23. Metal downspout boots.
24. Loose bearing and leveling plates for applications where they are not specified in other Sections.

B. Products furnished, but not installed, under this Section include the following:

1. Loose steel lintels.
2. Anchor bolts, steel pipe sleeves, slotted-channel inserts, and wedge-type insert indicated to be cast into concrete or built into unit masonry.
3. Steel weld plates and angles for casting into concrete for applications where they are not specified in other Sections.

C. Related Requirements:

1. Section 04 20 00 "Unit Masonry" for installing loose lintels, anchor bolts, and other items built into unit masonry.
2. Section 05 12 00 "Structural Steel Framing" for steel framing, supports, elevator machine beams, hoist beams, divider beams, door frames, and other steel items attached to the structural-steel framing.
3. Section 07 72 00 "Roof Accessories" for manufactured metal roof walkways and metal roof stairs.
4. Section 32 93 00 "Plants" for tree grates.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of metal fabrications that are anchored to or that receive other work. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchor s, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

- A. Product Data: For the following:
 1. Nonslip aggregates and nonslip-aggregate surface finishes.
 2. Fasteners.
 3. Shop primers.
 4. Shrinkage-resisting grout.
 5. Prefabricated building columns.
 6. Slotted channel framing.
 7. Manufactured metal ladders.
 8. Ladder safety cages.
 9. Metal bollards.
 10. Vehicular barrier cable systems.
 11. Pipe guards.
 12. Metal downspout boots.

- B. Sustainable Design Submittals:
1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.
- C. Shop Drawings: Show fabrication and installation details. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items. Provide Shop Drawings for the following:
1. Steel framing and supports for ceiling-hung toilet compartments.
 2. Steel framing and supports for operable partitions.
 3. Steel framing and supports for overhead doors and grilles.
 4. Steel framing and supports for countertops.
 5. Steel tube reinforcement for low partitions.
 6. Steel framing and supports for mechanical and electrical equipment.
 7. Steel framing and supports for applications where framing and supports are not specified in other Sections.
 8. Elevator machine beams, hoist beams.
 9. Steel shapes for supporting elevator door sills.
 10. Steel girders for supporting wood frame construction.
 11. Steel pipe columns for supporting wood frame construction.
 12. Prefabricated building columns.
 13. Shelf angles.
 14. Metal ladders.
 15. Ladder safety cages.
 16. Elevator pit sump covers.
 17. Structural-steel door frames.
 18. Miscellaneous steel trim including steel angle corner guards.
 19. Metal bollards.
 20. Loose steel lintels.
- D. Delegated-Design Submittal: For ladders, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the jurisdiction in which Project is located.
- B. Mill Certificates: Signed by stainless steel manufacturers, certifying that products furnished comply with requirements.
- C. Welding certificates.
- D. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- E. Research Reports: For post-installed anchors.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 - 2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum."
 - 3. AWS D1.6/D1.6M, "Structural Welding Code - Stainless Steel."

1.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls, floor slabs, decks, and other construction contiguous with metal fabrications by field measurements before fabrication.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design ladders.
- B. Structural Performance of Aluminum Ladders: Ladders, including landings, shall withstand the effects of loads and stresses within limits and under conditions specified in ANSI A14.3.
- C. Structural Performance of Alternating Tread Devices: Alternating tread devices shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Uniform Load: 100 lbf/sq. ft..
 - 2. Concentrated Load: 300 lbf applied on an area of 4 sq. in..
 - 3. Uniform and concentrated loads need not be assumed to act concurrently.
 - 4. Alternating Tread Device Framing: Capable of withstanding stresses resulting from railing loads in addition to loads specified above.
 - 5. Comply with applicable railing loadings in Section 05 52 13 "Pipe and Tube Railings."
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes acting on exterior metal fabrications by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Stainless Steel Sheet, Strip, and Plate: ASTM A240/A240M or ASTM A666, Type 304.
- D. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.
- E. Rolled-Steel Floor Plate: ASTM A786/A786M, rolled from plate complying with ASTM A36/A36M or ASTM A283/A283M, Grade C or D.
- F. Rolled-Stainless Steel Floor Plate: ASTM A793.
- G. Abrasive-Surface Floor Plate: Steel plate with abrasive granules rolled into surface or with abrasive material metallurgically bonded to steel.
 - 1. Source Limitations: Obtain floor plate from single source from single manufacturer.
- H. Steel Tubing: ASTM A500/A500M, cold-formed steel tubing.
- I. Steel Pipe: ASTM A53/A53M, Standard Weight (Schedule 40) unless otherwise indicated.
- J. Zinc-Coated Steel Wire Rope: ASTM A741.
 - 1. Wire Rope Fittings: Hot-dip galvanized-steel connectors with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- K. Stainless Steel Wire Rope: Wire rope manufactured from stainless steel wire complying with ASTM A492, Type 316.
 - 1. Wire Rope Fittings: Stainless steel connectors, Type 316, with capability to sustain, without failure, a load equal to minimum breaking strength of wire rope with which they are used.
- L. Steel Prestressing Strand: ASTM A416/A416M, Grade 270, low-relaxation, seven-wire, with 0.9-lb/sq. ft. zinc coating.
 - 1. Steel Prestressing Strand Fittings: Hot-dip galvanized-steel anchors and connectors with capability to sustain, without failure, a load equal to minimum breaking strength of steel prestressing strand with which they are used.

- M. Slotted Channel Framing: Cold-formed metal box channels (struts) complying with MFMA-4.
 - 1. Size of Channels: As indicated.
 - 2. Material: Galvanized steel, ASTM A653/A653M, structural steel, Grade 33, with G90 coating; 0.108-inch nominal thickness.
 - 3. Material: Cold-rolled steel, ASTM A1008/A1008M, structural steel, Grade 33; 0.0966-inch minimum thickness; coated with rust-inhibitive, baked-on, acrylic enamel.
- N. Cast Iron: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
- O. Aluminum Plate and Sheet: ASTM B209, Alloy 6061-T6.
- P. Aluminum Extrusions: ASTM B221, Alloy 6063-T6.
- Q. Aluminum-Alloy Rolled Tread Plate: ASTM B632/B632M, Alloy 6061-T6.
- R. Aluminum Castings: ASTM B26/B26M, Alloy 443.0-F.
- S. Bronze Extrusions: ASTM B455, Alloy UNS No. C38500 (extruded architectural bronze).
- T. Bronze Castings: ASTM B584, Alloy UNS No. C83600 (leaded red brass) or UNS No. C84400 (leaded semi-red brass).
- U. Nickel Silver Extrusions: ASTM B151/B151M, Alloy UNS No. C74500.
- V. Nickel Silver Castings: ASTM B584, Alloy UNS No. C97600 (20 percent leaded nickel bronze).

2.3 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, at exterior walls. Select fasteners for type, grade, and class required.
 - 1. Provide stainless steel fasteners for fastening aluminum stainless steel or nickel silver.
 - 2. Provide bronze fasteners for fastening bronze.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563; and, where indicated, flat washers.
- C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 3, heavy-hex steel structural bolts; ASTM A563, Grade DH3, heavy-hex carbon-steel

nuts; and where indicated, flat washers.

- D. Stainless Steel Bolts and Nuts: Regular hexagon-head annealed stainless steel bolts, ASTM F593; with hex nuts, ASTM F594; and, where indicated, flat washers; Alloy Group 1.
- E. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563; and, where indicated, flat washers.
 - 1. Hot-dip galvanize or provide mechanically deposited, zinc coating where item being fastened is indicated to be galvanized.
- F. Anchors, General: Capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing in accordance with ASTM E488/E488M, conducted by a qualified independent testing agency.
- G. Cast-in-Place Anchors in Concrete: Either threaded or wedge type unless otherwise indicated; galvanized ferrous castings, either ASTM A47/A47M malleable iron or ASTM A27/A27M cast steel. Provide bolts, washers, and shims as needed, all hot - dip galvanized per ASTM F2329/F2329M.
- H. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
 - 2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.
- I. Slotted-Channel Inserts: Cold-formed, hot-dip galvanized-steel box channels (struts) complying with MFMA-4, 1-5/8 by 7/8 inches by length indicated with anchor str aps or studs not less than 3 inches long at not more than 8 inches o.c. Provide with temporary filler and tee-head bolts, complete with washers and nuts, all zinc-plated to comply with ASTM B633, Class Fe/Zn 5, as needed for fastening to inserts.

2.4 MISCELLANEOUS MATERIALS

- A. Shop Primers: Provide primers that comply with Section 09 91 13 "Exterior Painting," Section 09 91 23 "Interior Painting," and Section 09 96 00 "High-Performance Coatings."
- B. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc -rich primer.
- C. Water-Based Primer: Emulsion type, anticorrosive primer for mildly corrosive

environments that is resistant to flash rusting when applied to cleaned steel, complying with MPI#107 and compatible with topcoat.

- D. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- E. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- F. Galvanizing Repair Paint: High-zinc-dust-content paint complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- G. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- H. Shrinkage-Resistant Grout: Factory-packaged, nonmetallic, nonstaining, noncorrosive, nongaseous grout complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- I. Concrete: Comply with requirements in Section 03 30 00 "Cast-in-Place Concrete" for normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3000 psi.

2.5 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of basemetals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed

fasteners or welds where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) fasteners unless otherwise indicated. Locate joints where least conspicuous.

- G. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated, coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.
- J. Where units are indicated to be cast into concrete or built into masonry, equip with integrally welded steel strap anchors, 1/8 by 1-1/2 inches, with a minimum 6-inch embedment and 2-inch hook, not less than 8 inches from ends and corners of units and 24 inches o.c., unless otherwise indicated.

2.6 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction.
 - 1. Fabricate units from slotted channel framing where indicated.
 - 2. Furnish inserts for units installed after concrete is placed.
- C. Fabricate supports for operable partitions from continuous steel beams of sizes indicated with attached bearing plates, anchors, and braces as indicated. Drill or punch bottom flanges of beams to receive partition track hanger rods; locate holes where indicated on operable partition Shop Drawings.
- D. Fabricate steel girders for wood frame construction from continuous steel shapes of sizes indicated.
 - 1. Provide bearing plates welded to beams where indicated.
 - 2. Drill or punch girders and plates for field-bolted connections where indicated.
 - 3. Where wood nailers are attached to girders with bolts or lag screws, drill or punch holes at 24 inches o.c.
- E. Fabricate steel pipe columns for supporting wood frame construction from steel pipe with steel baseplates and top plates as indicated. Drill or punch baseplates and top plates for anchor and connection bolts and weld to pipe with fillet welds all around. Make welds the same size as pipe wall thickness unless otherwise indicated.

1. Unless otherwise indicated, fabricate from Schedule 40 steel pipe.
2. Unless otherwise indicated, provide 1/2-inch baseplates with four 5/8-inch anchor bolts and 1/4-inch top plates.

F. Galvanize miscellaneous framing and supports where indicated.

2.7 SHELF ANGLES

- A. Fabricate shelf angles from steel angles of sizes indicated and for attachment to concrete framing. Provide horizontally slotted holes to receive 3/4-inch bolts, spaced not more than 6 inches from ends and 24 inches o.c., unless otherwise indicated.
1. Provide mitered and welded units at corners.
 2. Provide open joints in shelf angles at expansion and control joints. Make open joint approximately 2 inches larger than expansion or control joint.
- B. For cavity walls, provide vertical channel brackets to support angles from backup masonry and concrete.
- C. Galvanize and prime shelf angles located in exterior walls.
- D. Prime shelf angles located in exterior walls with primer specified in Section 09 96 00 "High-Performance Coatings."
- E. Furnish wedge-type concrete inserts, complete with fasteners, to attach shelf angles to cast-in-place concrete.

2.8 METAL LADDERS

A. General:

1. Comply with ANSI A14.3, except for elevator pit ladders.
2. For elevator pit ladders, comply with ASME A17.1/CSA B44.

B. Steel Ladders:

1. Space siderails 16 inches apart unless otherwise indicated.
2. Siderails: Continuous, 1/2-by-2-1/2-inch steel flat bars, with eased edges.
3. Rungs: 3/4-inch-diameter, steel bars.
4. Fit rungs in centerline of siderails; plug-weld and grind smooth on outer rail faces.
5. Provide nonslip surfaces on top of each rung, either by coating rung with aluminum-oxide granules set in epoxy-resin adhesive or by using a type of manufactured rung filled with aluminum-oxide grout.
6. Provide nonslip surfaces on top of each rung by coating with abrasive material metallically bonded to rung.
7. Source Limitations: Obtain nonslip surfaces from single source from single

manufacturer.

8. Provide platforms as indicated fabricated from welded or pressure -locked steel bar grating, supported by steel angles. Limit openings in gratings to no more than 1/2 inch in least dimension.
9. Support each ladder at top and bottom and not more than 60 inches o.c. with welded or bolted steel brackets.
10. Galvanize and prime exterior ladders, including brackets.
11. Prime exterior ladders, including brackets and fasteners, with primer specified in Section 09 96 00 "High-Performance Coatings."

2.9 LADDER SAFETY CAGES

A. General:

1. Fabricate ladder safety cages to comply with ANSI A14.3. Assemble by welding or with stainless steel fasteners.
2. Provide primary hoops at tops and bottoms of cages and spaced not more than 20 feet o.c. Provide secondary intermediate hoops spaced not more than 48 inches o.c. between primary hoops.
3. Fasten assembled safety cage to ladder rails and adjacent construction by welding or with stainless steel fasteners unless otherwise indicated.

B. Steel Ladder Safety Cages:

1. Primary Hoops: 1/4-by-4-inch flat bar hoops.
2. Secondary Intermediate Hoops: 1/4-by-2-inch flat bar hoops.
3. Vertical Bars: 3/16-by-1-1/2-inch flat bars secured to each hoop.
4. Galvanize and prime ladder safety cages, including brackets and fasteners.
5. Prime ladder safety cages, including brackets and fasteners, with primer specified in Section 09 96 00 "High-Performance Coatings."

2.10 ELEVATOR PIT SUMP COVERS

- A. Fabricate from 3/16-inch floor plate with four 1-inch-diameter holes for water drainage and for lifting.
- B. Provide steel angle supports unless otherwise indicated.

2.11 STRUCTURAL-STEEL DOOR FRAMES

- A. Fabricate structural-steel door frames from steel shapes, plates, and bars of size and to dimensions indicated, fully welded together, with 5/8-by-1-1/2-inch steel channel stops, unless otherwise indicated. Plug-weld built-up members and continuously weld exposed joints. Secure removable stops to frame with countersunk machine screws, uniformly spaced at not more than 10 inches o.c. Reinforce frames and drill and tap as necessary to accept finish hardware.
 1. Provide with integrally welded steel strap anchors for securing door frames

into adjoining concrete or masonry.

- B. Extend bottom of frames to floor elevation indicated with steel angle clips welded to frames for anchoring frame to floor with expansion shields and bolts.
- C. Galvanize and prime exterior steel frames.
- D. Prime exterior steel frames with primer specified in Section 09 96 00 "High-Performance Coatings."

2.12 MISCELLANEOUS STEEL TRIM

- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
- B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 - 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
- C. Galvanize and prime exterior miscellaneous steel trim.
- D. Prime exterior miscellaneous steel trim with primer specified in Section 09 96 00 "High- Performance Coatings."

2.13 METAL BOLLARDS

- A. Fabricate metal bollards from Schedule 80 steel pipe steel shapes, as indicated.
 - 1. Where bollards are indicated to receive controls for door operators, provide cutouts for controls and holes for wire.
 - 2. Where bollards are indicated to receive light fixtures, provide cutouts for fixtures and holes for wire.
- B. Fabricate bollards with 3/8-inch-thick, steel baseplates for bolting to concrete slab. Drill baseplates at all four corners for 3/4-inch anchor bolts.
 - 1. Where bollards are to be anchored to sloping concrete slabs, angle baseplates for plumb alignment of bollards.
- C. Fabricate sleeves for bollard anchorage from steel or stainless-steel pipe or tubing with 1/4-inch-thick, steel or stainless steel plate welded to bottom of sleeve. Make sleeves not less than 8 inches deep and 3/4 inch larger than OD of bollard.
- D. Fabricate internal sleeves for removable bollards from Schedule 80 steel pipe or 1/4 - inch wall-thickness steel tubing with an OD approximately 1/16 inch less than ID of bollards. Match drill sleeve and bollard for 3/4-inch steel machine bolt.

- E. Prime steel bollards with primer specified in Section 09 96 00 "High-Performance Coatings."

2.14 PIPE GUARDS

- A. Fabricate pipe guards from 3/8-inch-thick by 12-inch-wide, steel plate, bent to fit flat against the wall or column at both ends and to fit around pipe with 2-inch clearance between pipe and pipe guard. Drill each end for two 3/4-inch anchor bolts.
- B. Galvanize and prime steel pipe guards.
- C. Prime steel pipe guards with primer specified in Section 09 96 00 "High-Performance Coatings."

2.15 METAL DOWNSPOUT BOOTS

- A. Source Limitations: Obtain downspout boots from single source from single manufacturer.
- B. Provide downspout boots made from cast iron in heights indicated with inlets of size and shape to suit downspouts. Provide units with flanges and holes for countersunk anchor bolts.
 - 1. Outlet: Vertical, to discharge into pipe.
- C. Prime cast-iron downspout boots with primer specified in Section 09 96 00 "High-Performance Coatings."

2.16 LOOSE BEARING AND LEVELING PLATES

- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
- B. Galvanize bearing and leveling plates.
- C. Prime plates with zinc-rich primer.

2.17 LOOSE STEEL LINTELS

- A. Fabricate loose steel lintels from steel angles and shapes of size indicated for openings and recesses in masonry walls and partitions at locations indicated. Fabricate in single lengths for each opening unless otherwise indicated. Weld adjoining members together to form a single unit where indicated.
- B. Size loose lintels to provide bearing length at each side of openings equal to 1/12 of clear span, but not less than 8 inches unless otherwise indicated.

- C. Galvanize and prime loose steel lintels located in exterior walls.
- D. Prime loose steel lintels located in exterior walls with primer specified in Section 09 96 00 "High-Performance Coatings."

2.18 STEEL WELD PLATES AND ANGLES

- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with no fewer than two integrally welded steel strap anchors for embedding in concrete.

2.19 GENERAL FINISH REQUIREMENTS

- A. Finish metal fabrications after assembly.
- B. Finish exposed surfaces to remove tool and die marks and stretch lines, and to blend into surrounding surface.

2.20 STEEL AND IRON FINISHES

- A. Galvanizing: Hot-dip galvanize items as indicated to comply with ASTM A153/A153M for steel and iron hardware and with ASTM A123/A123M for other steel and iron products.
 - 1. Do not quench or apply post galvanizing treatments that might interfere with paint adhesion.
- B. Preparation for Shop Priming Galvanized Items: After galvanizing, thoroughly clean galvanized surfaces of grease, dirt, oil, flux, and other foreign matter, and treat with metallic phosphate process.
- C. Shop prime iron and steel items not indicated to be galvanized unless they are to be embedded in concrete, sprayed-on fireproofing, or masonry, or unless otherwise indicated.
 - 1. Shop prime with primers specified in Section 09 91 13 "Exterior Painting" primers specified in Section 09 91 23 "Interior Painting" unless primers specified in Section 09 96 00 "High-Performance Coatings" are indicated.
- D. Preparation for Shop Priming: Prepare surfaces to comply with requirements indicated below:
 - 1. Exterior Items: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 - 2. Items Indicated to Receive Zinc-Rich Primer: SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."

3. Items Indicated to Receive Primers Specified in Section 09 96 00 "High-Performance Coatings": SSPC-SP 6/NACE No. 3, "Commercial Blast Cleaning."
 4. Other Steel Items: SSPC-SP 3, "Power Tool Cleaning."
 5. Galvanized-Steel Items: SSPC-SP 16, "Brush-off Blast Cleaning of Coated and Uncoated Galvanized Steel, Stainless Steels, and Non-Ferrous Metals."
- E. Shop Priming: Apply shop primer to comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.
1. Stripe paint corners, crevices, bolts, welds, and sharp edges.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized after fabrication and are for bolted or screwed field connections.
- C. Field Welding: Comply with the following requirements:
1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 2. Obtain fusion without undercut or overlap.
 3. Remove welding flux immediately.
 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag screws, wood screws, and other connectors.
- E. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- F. Corrosion Protection: Coat concealed surfaces of aluminum that come into contact with grout, concrete, masonry, wood, or dissimilar metals with the following:

1. Cast Aluminum: Heavy coat of bituminous paint.
2. Extruded Aluminum: Two coats of clear lacquer.

3.2 INSTALLATION OF MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
- B. Anchor supports for ceiling hung toilet partitions operable partitions overhead doors and overhead grilles securely to, and rigidly brace from, building structure.
- C. Anchor shelf angles securely to existing construction with expansion anchors, anchor bolts, or through bolts.
- D. Support steel girders on solid grouted masonry, concrete, or steel pipe columns. Secure girders with anchor bolts embedded in grouted masonry or concrete or with bolts through top plates of pipe columns.
 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.
- E. Install pipe columns on concrete footings with grouted baseplates. Position and grout column baseplates as specified in "Installation of Bearing and Leveling Plates" Article.
 1. Grout baseplates of columns supporting steel girders after girders are installed and leveled.

3.3 INSTALLATION OF METAL BOLLARDS

- A. Fill metal-capped bollards solidly with concrete and allow concrete to cure seven days before installing.
 1. Do not fill removable bollards with concrete.
- B. Anchor bollards to existing construction with expansion anchors. Provide four 3/4-inch bolts at each bollard unless otherwise indicated.
 1. Embed anchor bolts at least 4 inches in concrete.
- C. Anchor bollards in concrete in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of bollard. Fill annular space around bollard solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward bollard.
- D. Anchor bollards in place with concrete footings. Center and align bollards in holes 3

inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace bollards in position until concrete has cured.

- E. Anchor internal sleeves for removable bollards in formed or core-drilled holes not less than 42 inches deep and 3/4 inch larger than OD of sleeve. Fill annular space around internal sleeves solidly with shrinkage-resistant grout; mixed and placed to comply with grout manufacturer's written instructions. Slope grout up approximately 1/8 inch toward internal sleeve.
- F. Anchor internal sleeves for removable bollards in place with concrete footings. Center and align sleeves in holes 3 inches above bottom of excavation. Place concrete and vibrate or tamp for consolidation. Support and brace sleeves in position until concrete has cured.
- G. Place removable bollards over internal sleeves and secure with 3/4-inch machine bolts and nuts. After tightening nuts, drill holes in bolts for inserting padlocks. Owner furnishes padlocks.
- H. Fill bollards solidly with concrete, mounding top surface to shed water.
 - 1. Do not fill removable bollards with concrete.

3.4 INSTALLATION OF PIPE GUARDS

- A. Provide pipe guards at exposed vertical pipes in at locations indicated on Drawings where not protected by curbs or other barriers. Install by bolting to wall or column with expansion anchors. Provide four 3/4-inch bolts at each pipe guard. Mount pipe guards with top edge 26 inches above driving surface.

3.5 INSTALLATION OF BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials, and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with shrinkage-resistant grout. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.6 REPAIRS

- A. Touchup Painting:
 - 1. Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

- a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.
 2. Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting." and Section 09 91 23 "Interior Painting."
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A780/A780M.

END OF SECTION 05 50 00

SECTION 05 51 00 – MODULAR ROOFTOP STAIRS**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Modular Crossover Stairs:
 - 1. Platform assemblies.
 - 2. Stair assemblies.
 - 3. Platform support legs.
 - 4. Safety Gates.

1.2 RELATED SECTIONS

- A. Section 05 50 00 - Metal Fabrications
- B. Section 05 52 13 - Pipe and Tube Railings.

1.3 REFERENCES

- A. Occupational Safety and Health Administration (OSHA):
 - 1. OSHA 29 CFR 1910.23 - Fixed Ladders.
 - 2. OSHA 29 CFR 1910.25 - Stairways.
 - 3. OSHA 29 CFR 1910.28 - Duty to Have Fall Protection and Falling Object Protection.
 - 4. OSHA CFR 1910.29 - Walking-Working Surfaces.
 - 5. OSHA CFR 1910.144 - Safety color code for marking physical hazards.
 - 6. OSHA CFR 1926.502 - Fall Protection Systems Criteria and Practices.
- B. American National Standards Institute (ANSI):
 - 1. ANSI A1264.1 - Safety requirements for Fixed Ladders and Workplace Surfaces Package.
- C. American Welding Society (AWS):
 - 1. AWS D1.1 - Structural Welding Code - Steel.
 - 2. AWS D1.3 - Structural Welding Code - Sheet Steel.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 - Administrative Requirements.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.
- C. Product Data:
 - 1. Manufacturer's data sheets on each product to be used.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Typical installation methods.

- D. Verification Samples: Two representative units of each type, size, pattern, and color.
- E. Shop Drawings: Include details of materials, construction, and finish. Include relationship with adjacent construction.
- F. Manufacturer's Certificates:
 - 1. Manufacturer must be American Welding Society Welding Certified for Welding Standards AWS D1.1 and AWS D1.3. Third party qualification documentation required prior to shipment.

1.5 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with a minimum five years documented experience.
- B. Installer Qualifications: Company specializing in performing Work of this section with minimum two years documented experience with projects of similar scope and complexity.
- C. Source Limitations: Provide each type of product from a single manufacturing source to ensure uniformity.

1.6 PRE-INSTALLATION CONFERENCE

- A. Convene a conference approximately two weeks before scheduled commencement of the Work. Attendees shall include Architect, Contractor and trades involved. Agenda shall include schedule, responsibilities, critical path items and approvals.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the job site in good condition and protected against damage as handrails are a finished product.
- B. Inspect rail sections for damage before signing the receipt from the trucking company. Truck driver must note damaged goods on the bill of lading if damaged product is found.
- C. Store products in manufacturer's unopened packaging until ready for installation.
- D. Products to be palletized and labeled by roof level or designated drop zone.

1.8 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's recommended limits.
- B. Field Measurements: Where stairs and platforms fit over other construction, check actual dimensions of other construction by accurate field measurements before fabrication.

1.9 WARRANTY

- A. Manufacturer's standard limited warranty unless indicated otherwise.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Safety Rail Company; Spring Park, MN 55384
 - 2. Lapeyre Stair, Inc.
 - 3. Approved equal.
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 - Product Requirements.

2.2 PERFORMANCE AND DESIGN REQUIREMENTS

- A. OSHA
 - 1. OSHA 29 CFR 1910.23.
 - 2. OSHA 29 CFR 1910.25.
 - 3. OSHA 29 CFR 1910.28.
 - 4. OSHA CFR 1910.29.
 - 5. OSHA CFR 1910.144.
 - 6. OSHA CFR 1926.502.
 - 7. ANSI A1264.1.
- B. Three Primary Components of System: Off-the-shelf parts
 - 1. Handrails.
 - 2. Universal platforms.
- C. Attachment Details: Freestanding with 72 inches (1829 mm) wide foot pad on stringers.

2.3 MODULAR CROSSOVER STAIRS

- A. Platform Assemblies:
 - 1. Universal Platform Bolted Assemblies:
 - a. Per drawings and as required to provide compliant path where indicated.
 - 2. Width Clearance: 36 inches (914 mm).
 - 3. Length Range: up to 108 inches (2743 mm) between tower support.
 - 4. Material: 12 ga hot rolled steel. Finish: Galvanized.
 - 5. Platform Surface Perforation Pattern: 1 inch (25 mm) diameter staggered perforation.
 - 6. Safety Railing: On each side of platform width.
 - a. Rails work in tandem with stair sections.
 - b. Rail Height above platform surface: 42.08 inches (1069 mm)
 - c. Finish: Powder coated yellow.
 - 7. Hardware:
 - a. Hex Head Screws: 18-8 Stainless steel 1/2-13 UNC x 3 inches (76 mm) long
 - b. Flat Washers: 18-8 Stainless steel 1/2 inch.
 - c. Nylock Nuts: 18-8 Stainless steel 1/2-13 UNC.

- B. Stair Assemblies:
 - 1. Universal Stairs Bolted Assemblies:
 - a. Per drawings and as required to provide compliant path where indicated.
 - 2. Stair Angle: 45 degrees.
 - 3. Stair Tread: 1/8 inch (3 mm) 6061 aluminum.
 - 4. Stair Width: 30 inches (762 mm) clearance.
 - 5. Stair Stringer: 7 ga. hot rolled steel. Finish: Galvanized
 - 6. Foot Pad (WxD): 72 x 24 inch (1829 x 610 mm). Material: Recycled plastic
 - 7. Safety Railing: On each side of stairs.
 - a. Finish: Powder coated yellow.
 - 8. Hardware:
 - a. Stainless Steel
- C. Tower Supports: Platform support legs. For 3 or more Platform systems in tandem.
 - 1. Materials: 2 inch (51 mm) EWSQ tubing. Welded assembly.
 - 2. Foot Pad (WxD): 72 x 24 inch (1829 x 610 mm). Material: Recycled plastic. 1 per support leg.
 - 3. Three Platforms: Two support legs.
 - 4. Four Platforms: Three support legs.
 - 5. Five Platforms: Three support legs.
 - 6. Six Platforms: Four support legs.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Do not begin installation until substrates have been properly constructed and prepared.
- B. If substrate preparation is the responsibility of another installer, notify Architect in writing of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean surfaces thoroughly prior to installation.
- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install in accordance with manufacturer's instructions, approved submittals, and in proper relationship with adjacent construction.

3.4 CLEANING AND PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 05 51 00

SECTION 05 51 13 - METAL PAN STAIRS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Preassembled steel stairs with concrete-filled treads.
 - 2. Railing gates at the level of exit discharge.

1.3 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written instructions to ensure that shop primers and topcoats are compatible with one another.
- B. Coordinate installation of anchorages for metal stairs, railings, and guards.
 - 1. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, blocking for attachment of wall-mounted handrails, and items with integral anchors, that are to be embedded in concrete or masonry.
 - 2. Deliver such items to Project site in time for installation.
- C. Coordinate locations of hanger rods and struts with other work so they do not encroach on required stair width and are within fire-resistance-rated stair enclosure.
- D. Schedule installation of railings and guards so wall attachments are made only to completed walls.
 - 1. Do not support railings and guards temporarily by any means that do not satisfy structural performance requirements.

1.4 ACTION SUBMITTALS

- A. Product Data: For metal pan stairs and the following:

1. Prefilled metal-pan-stair treads.
 2. Shop primer products.
 3. Nonslip-aggregate concrete finish.
 4. Handrail wall brackets.
 5. Grout.
- B. Sustainable Design Submittals:
1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- C. Shop Drawings:
1. Include plans, elevations, sections, details, and attachments to other work.
 2. Indicate sizes of metal sections, thickness of metals, profiles, holes, and field joints.
 3. Include plan at each level.
 4. Indicate locations of anchors, weld plates, and blocking for attachment of wall-mounted handrails.
- D. Samples for Verification: For each type and finish of nosing and welded -wire mesh.
- E. Delegated-Design Submittal: For stairs, railings and guards, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- 1.5 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For professional engineer's experience with providing delegated-design engineering services of the kind indicated, including documentation that engineer is licensed in the State in which Project is located.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- 1.6 QUALITY ASSURANCE
- A. Installer Qualifications: Fabricator of products.
- B. Welding Qualifications: Qualify procedures and personnel according to the following:
1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
 2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."
- 1.7 DELIVERY, STORAGE, AND HANDLING
- A. Store materials to permit easy access for inspection and identification.

1. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers.
2. Protect steel members and packaged materials from corrosion and deterioration.
3. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures.
 - a. Repair or replace damaged materials or structures as directed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design stairs, railings and guards, including attachment to building construction.
- B. Structural Performance of Stairs: Metal stairs shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Uniform Load: 100 lbf/sq. ft. (4.79 kN/sq. m).
 2. Concentrated Load: 300 lbf (1.33 kN) applied on an area of 4 sq. in. (2580 sq. mm).
 3. Uniform and concentrated loads need not be assumed to act concurrently.
 4. Stair Framing: Capable of withstanding stresses resulting from railing and guard loads in addition to loads specified above.
 5. Limit deflection of treads, platforms, and framing members to L/360 or 1/4 inch (6.4 mm), whichever is less.
- C. Structural Performance of Railings and Guards: Railings and guards, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 100 lbf/ft. (0.73 kN/m) applied in any direction.
 - b. Concentrated load of 300 lbf (0.89 kN) applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 2. Infill of Guards:
 - a. Concentrated load of 200 lbf (0.22 kN) applied horizontally on an area of 1 sq. ft. (0.093 sq. m).
 - b. Infill load and other loads need not be assumed to act concurrently.

2.2 METALS

- A. Metal Surfaces: Provide materials with smooth, flat surfaces unless otherwise indicated. For components exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.
- B. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- C. Steel Tubing for Railings and Guards: ASTM A500/A500M (cold formed) or ASTM A513/A513M.
- D. Uncoated, Cold-Rolled Steel Sheet: ASTM A1008/A1008M, either commercial steel, Type B, or structural steel, Grade 25 (Grade 170), unless another grade is required by design loads; exposed.

2.3 FASTENERS

- A. Fasteners for Anchoring Railings and Guards to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings and guards to other types of construction indicated and capable of withstanding design loads.
- B. Bolts and Nuts: Regular hexagon-head bolts, ASTM A307, Grade A; with hex nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- C. Anchor Bolts: ASTM F1554, Grade 36, of dimensions indicated; with nuts, ASTM A563 (ASTM A563M); and, where indicated, flat washers.
- D. Post-Installed Anchors: Torque-controlled expansion anchors or chemical anchors capable of sustaining, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E488/E488M, conducted by a qualified independent testing agency.
 - 1. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.

2.4 MISCELLANEOUS MATERIALS

- A. Handrail Wall Brackets: Provide handrail brackets for handrails at walls, manufactured specifically for the purpose of cast, forged, or wrought steel, of configuration indicated or required to suit conditions.
- B. Welding Electrodes: Comply with AWS requirements.
- C. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.

- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout; recommended by manufacturer for interior use; noncorrosive and nonstaining; mixed with water to consistency suitable for application and a 30-minute working time.
- F. Prefilled Concrete Treads:
 - 1. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with minimum 28-day compressive strength of 3000 psi (20 MPa) and maximum aggregate size of 1/2 inch (13 mm) unless otherwise indicated.
 - 2. Plain Steel Welded-Wire Reinforcement: ASTM A1064/A10645M, steel, 6 by 6 inches (152 by 152 mm), W1.4 by W1.4, unless otherwise indicated on Drawings.
 - 3. Reinforcement Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening welded-wire reinforcement in place.
 - a. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete.
- G. For galvanized reinforcement, use galvanized wire or dielectric-polymer-coated wire bar supports.

2.5 FABRICATION, GENERAL

- A. Provide complete stair assemblies, including metal framing, hangers, struts, railings and guards, clips, brackets, bearing plates, and other components necessary to support and anchor stairs and platforms on supporting structure.
 - 1. Join components by welding unless otherwise indicated.
 - 2. Use connections that maintain structural value of joined pieces.
- B. Assemble stairs, railings, and guards in shop to greatest extent possible.
 - 1. Disassemble units only as necessary for shipping and handling limitations.
 - 2. Clearly mark units for reassembly and coordinated installation.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm) unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.

- D. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- E. Form exposed work with accurate angles and surfaces and straight edges.
- F. Weld connections to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. Weld exposed corners and seams continuously unless otherwise indicated.
 - 5. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of welded joint.
- G. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible.
 - 1. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts unless otherwise indicated.
 - 2. Locate joints where least conspicuous.
 - 3. Fabricate joints that will be exposed to weather in a manner to exclude water.
 - 4. Provide weep holes where water may accumulate internally.

2.6 FABRICATION OF STEEL-FRAMED STAIRS

- A. NAAMM Stair Standard: Comply with NAAMM AMP 510, "Metal Stairs Manual," for Architectural Class, unless more stringent requirements are indicated.
- B. Stair Framing:
 - 1. Fabricate stringers as indicated on Drawings.
 - a. Stringer Size: As required to comply with "Performance Requirements" Article and As indicated on Drawings.
 - b. Provide closures for exposed ends of channel and rectangular tube stringers.
 - c. Finish: Shop primed.
 - 2. Construct platforms of steel headers and miscellaneous framing members as required to comply with "Performance Requirements" Article and as indicated on Drawings.
 - a. Provide closures for exposed ends of channel and rectangular tube framing.
 - b. Finish: Shop primed.
 - 3. Weld stringers to headers; weld framing members to stringers and headers.
 - 4. Where stairs are enclosed by gypsum board shaft-wall assemblies, provide hanger rods or struts to support landings from floor construction above or below.

- a. Locate hanger rods and struts where they do not encroach on required stair width and are within the fire-resistance-rated stair enclosure.
5. Where masonry walls support metal stairs, provide temporary supporting struts designed for erecting steel stair components before installing masonry.
- C. Metal Pan Stairs: Form risers, subread pans, and subplatforms to configurations shown from steel sheet of thickness needed to comply with performance requirements, but not less than 0.067 inch (1.7 mm).
 1. Steel Sheet: Uncoated, cold-rolled steel sheet.
 2. Directly weld metal pans to stringers; locate welds on top of subreads where they will be concealed by concrete fill. Do not weld risers to stringers.
 - a. Smooth Soffit Construction: Construct subplatforms with flat metal under surfaces to produce smooth soffits.

2.7 FABRICATION OF STAIR RAILINGS AND GUARDS

- A. Fabricate railings and guards to comply with requirements indicated for design, dimensions, details, finish, and member sizes, including wall thickness of member, post spacings, wall bracket spacing, and anchorage, but not less than that needed to withstand indicated loads.
 1. Rails and Posts: 1-1/2-inch- (38-mm-) square top and bottom rails and 1-1/2-inch- (38-mm-) square posts and as indicated on drawings.
 2. Picket Infill: 3/4-inch- (19-mm-) square pickets spaced to prohibit the passage of a 4-inch (100-mm) diameter sphere.
 3. Gates: Form gates from steel tube of same size and shape as top rails, with infill to match guards. Provide with self-closing hinges for fastening to wall or post and overlapping stop with rubber bumper to prevent gate from opening in direction opposite egress.
- B. Welded Connections: Fabricate railings and guards with welded connections.
 1. Cope components at connections to provide close fit, or use fittings designed for this purpose.
 2. Weld all around at connections, including at fittings.
 3. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 4. Obtain fusion without undercut or overlap.
 5. Remove flux immediately.
 6. Finish welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 - No evidence of a welded joint as shown in NAAMM AMP 521.
- C. Form changes in direction of railings and guards as follows:
 1. As detailed.
- D. Close exposed ends of railing and guard members with prefabricated end fittings.

- E. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated.
 - 1. Close ends of returns unless clearance between end of rail and wall is 1/4 inch (6 mm) or less.
- F. Connect posts to stair framing by direct welding unless otherwise indicated.
- G. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, end closures, flanges, miscellaneous fittings, and anchors for interconnecting components and for attaching to other work.
 - 1. Furnish inserts and other anchorage devices for connecting to concrete or masonry work.
 - 2. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch (38-mm) clearance from inside face of handrail to finished wall surface.
- H. Fillers: Provide fillers made from steel plate, or other suitably crush-resistant material, where needed to transfer wall bracket loads through wall finishes to structural supports.
 - 1. Size fillers to suit wall finish thicknesses and to produce adequate bearing area to prevent bracket rotation and overstressing of substrate.

2.8 FINISHES

- A. Finish metal stairs after assembly.
- B. Preparation for Shop Priming: Prepare uncoated, ferrous-metal surfaces to comply with SSPC-SP 3, "Power Tool Cleaning."
- C. Apply shop primer to uncoated surfaces of metal stair components, except those with galvanized finishes and those to be embedded in concrete or masonry unless otherwise indicated. Comply with SSPC-PA 1, "Paint Application Specification No. 1: Shop, Field, and Maintenance Painting of Steel," for shop painting.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify elevations of floors, bearing surfaces and locations of bearing plates, and other embedments for compliance with requirements.
 - 1. For wall-mounted railings, verify locations of concealed reinforcement within gypsum board and plaster assemblies.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF METAL PAN STAIRS

- A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing metal stairs to in-place construction.
 - 1. Include threaded fasteners for concrete and masonry inserts, through-bolts, lag bolts, and other connectors.
- B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal stairs. Set units accurately in location, alignment, and elevation, measured from established lines and levels and free of rack.
- C. Install metal stairs by welding stair framing to steel structure or to weld plates cast into concrete unless otherwise indicated.
 - 1. Grouted Baseplates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials and roughen surfaces prior to setting plates.
 - a. Clean bottom surface of plates.
 - b. Set plates for structural members on wedges, shims, or setting nuts.
 - c. Tighten anchor bolts after supported members have been positioned and plumbed.
 - d. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
 - e. Promptly pack grout solidly between bearing surfaces and plates so no voids remain.
 - 1) Neatly finish exposed surfaces; protect grout and allow to cure.
 - 2) Comply with manufacturer's written installation instructions for shrinkage-resistant grouts.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Fit exposed connections accurately together to form hairline joints.
 - 1. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations.
 - 2. Comply with requirements for welding in "Fabrication, General" Article.
- F. Place and finish concrete fill for treads and platforms to comply with Section 033000 "Cast-in-Place Concrete."

3.3 INSTALLATION OF RAILINGS AND GUARDS

- A. Adjust railing and guard systems before anchoring to ensure matching alignment at abutting joints with tight, hairline joints.
 - 1. Space posts at spacing indicated or, if not indicated, as required by design loads.

2. Plumb posts in each direction, within a tolerance of 1/16 inch in 3 feet (2 mm in 1 m).
3. Align rails and guards so variations from level for horizontal members and variations from parallel with rake of stairs for sloping members do not exceed 1/4 inch in 12 feet (6 mm in 3.5 m).
4. Secure posts, rail ends, and guard ends to building construction as follows:
 - a. Anchor posts to steel by welding to steel supporting members.
 - b. Anchor handrail and guard ends to concrete and masonry with steel round flanges welded to rail and guard ends and anchored with post-installed anchors and bolts.

B. Install railing gates level, plumb, and secure for full opening without interference.

1. Attach hardware using tamper-resistant or concealed means.
2. Adjust hardware for smooth operation.

C. Attach handrails to wall with wall brackets.

1. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.
2. Secure wall brackets to building construction as required to comply with performance requirements:
 - a. For solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
 - b. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.

3.4 REPAIR

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.

END OF SECTION 05 51 13

SECTION 05 52 13 - PIPE AND TUBE RAILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Steel railings.

B. Related Requirements:

1. Section 05 51 13 "Metal Pan Stairs" for steel tube railings associated with metal pan stairs.

1.2 COORDINATION

- A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

- B. Coordinate installation of anchorages for railings. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Manufacturer's product lines of mechanically connected railings.
2. Fasteners.
3. Post-installed anchors.
4. Handrail brackets.
5. Shop primer.
6. Intermediate coats and topcoats.
7. Bituminous paint.
8. Nonshrink, nonmetallic grout.
9. Anchoring cement.
10. Metal finishes.
11. Paint products.

B. Sustainable Design Submittals

1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS

- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

- D. Samples for Initial Selection: For products involving selection of color, texture, or design.
- E. Samples for Verification: For each type of exposed finish required.
 - 1. Sections of each distinctly different linear railing member, including handrails, top rails, posts, and balusters, including finish.
 - 2. Fittings and brackets.
 - 3. Assembled Sample of railing system, made from full-size components, including top rail, post, handrail, and infill. Sample need not be full height.
 - a. Show method of connecting and finishing members at intersections.
- F. Delegated-Design Submittal: For railings, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For delegated-design professional engineer.
- B. Welding certificates.
- C. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.
- D. Product Test Reports: For tests on railings performed by a qualified testing agency, in accordance with ASTM E894 and ASTM E935.
- E. Research Reports: For post-installed anchors, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.

1.5 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with the following:
 - 1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Protect mechanical finishes on exposed surfaces of railings from damage by applying a strippable, temporary protective covering before shipping.

1.7 FIELD CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with railings by field measurements before fabrication.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design railings, including attachment to building construction.
- B. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
 - 1. Handrails and Top Rails of Guards:
 - a. Uniform load of 50 lbf/ ft. applied in any direction.
 - b. Concentrated load of 200 lbf applied in any direction.
 - c. Uniform and concentrated loads need not be assumed to act concurrently.
 - 2. Infill of Guards:
 - a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft..
 - b. Infill load and other loads need not be assumed to act concurrently.
- C. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.
- B. Brackets, Flanges, and Anchors: Cast or formed metal of same type of material and finish as supported rails unless otherwise indicated.
 - 1. Provide type of bracket with flange tapped for concealed anchorage to threaded hanger bolt and that provides 1-1/2-inch clearance from inside face of handrail to finished wall surface.

2.3 STEEL RAILINGS

- A. Source Limitations: Obtain each type of railing from single source from single manufacturer.
- B. Tubing: ASTM A513/A513M, Type 5.
- C. Pipe: ASTM A53/A53M, Type F or Type S, Grade A, Standard Weight (Schedule 40), unless another grade and weight are required by structural loads.

1. Provide galvanized finish for exterior installations and where indicated.
- D. Plates, Shapes, and Bars: ASTM A36/A36M.
- E. Cast Iron Fittings: Either gray iron, ASTM A48/A48M, or malleable iron, ASTM A47/A47M, unless otherwise indicated.
1. Style Designation: 3/4 number 13.
 2. Galvanized-Steel Sheet, ASTM A653/A653M, G90 coating, commercial steel Type B, 0.064 inch thick, with 1/4-inch holes 3/8 inch o.c. in staggered rows.

2.4 FASTENERS

A. Fastener Materials:

1. Ungalvanized-Steel Railing Components: Plated steel fasteners complying with ASTM F1941, Class Fe/Zn 5 for zinc coating.
2. Hot-Dip Galvanized Railing Components: Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A153/A153M or ASTM F2329/F2329M for zinc coating.
3. Finish exposed fasteners to match appearance, including color and texture, of railings.

B. Fasteners for Anchoring Railings to Other Construction: Select fasteners of type, grade, and class required to produce connections suitable for anchoring railings to other types of construction and capable of withstanding design loads.

C. Fasteners for Interconnecting Railing Components:

1. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless otherwise indicated.
2. Provide concealed fasteners for interconnecting railing components and for attaching them to other work, unless exposed fasteners are unavoidable or are the standard fastening method for railings indicated.
3. Provide tamper-resistant flat-head machine screws for exposed fasteners unless otherwise indicated.

D. Post-Installed Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193.

1. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941/F1941M, Class Fe/Zn 5, unless otherwise indicated.
2. Material for Exterior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless steel bolts, ASTM F593, and nuts, ASTM F594.

2.5 MISCELLANEOUS MATERIALS

- A. Handrail Brackets: Cast iron, Cast nickel-silver, center of handrail 2-1/2 inches from wall.
- B. Welding Rods and Bare Electrodes: Select in accordance with AWS specifications for metal alloy welded.
- C. Etching Cleaner for Galvanized Metal: Complying with MPI#25.
- D. Galvanizing Repair Paint: High-zinc-dust-content paint, complying with SSPC-Paint 20 and compatible with paints specified to be used over it.
- E. Shop Primers: Provide primers that comply with Section 09 91 23 "Interior Painting."
- F. Universal Shop Primer: Fast-curing, lead- and chromate-free, universal modified-alkyd primer complying with MPI#79 and compatible with topcoat.
 - 1. Use primer containing pigments that make it easily distinguishable from zinc-rich primer.
- G. Epoxy Zinc-Rich Primer: Complying with MPI#20 and compatible with topcoat.
- H. Shop Primer for Galvanized Steel: Primer formulated for exterior use over zinc-coated metal and compatible with finish paint systems indicated.
- I. Intermediate Coats and Topcoats: Provide products that comply with Section 09 91 23 "Interior Painting."
- J. Epoxy Intermediate Coat: Complying with MPI #77 and compatible with primer and topcoat.
- K. Polyurethane Topcoat: Complying with MPI #72 and compatible with undercoat.
- L. Bituminous Paint: Cold-applied asphalt emulsion, complying with ASTM D1187/D1187M.
- M. Non-shrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout, complying with ASTM C1107/C1107M. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- N. Anchoring Cement: Factory-packaged, non-shrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with water at Project site to create pourable anchoring, patching, and grouting compound.
 - 1. Water-Resistant Product: At exterior locations and where indicated on Drawings, provide formulation that is resistant to erosion from water exposure without needing protection by a sealer or waterproof coating and that is recommended by manufacturer for exterior use.

2.6 FABRICATION

- A. General: Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finish, and anchorage, but not less than that required to support structural loads.
- B. Shop assemble railings to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations.
 - 1. Clearly mark units for reassembly and coordinated installation.
 - 2. Use connections that maintain structural value of joined pieces.
- C. Cut, drill, and punch metals cleanly and accurately.
 - 1. Remove burrs and ease edges to a radius of approximately 1/32 inch unless otherwise indicated.
 - 2. Remove sharp or rough areas on exposed surfaces.
- D. Form work true to line and level with accurate angles and surfaces.
- E. Fabricate connections that are exposed to weather in a manner that excludes water.
 - 1. Provide weep holes where water may accumulate.
 - 2. Locate weep holes in inconspicuous locations.
- F. Cut, reinforce, drill, and tap as indicated to receive finish hardware, screws, and similar items.
- G. Connections: Fabricate railings with welded connections unless otherwise indicated.
- H. Welded Connections: Cope components at connections to provide close fit, or use fittings designed for this purpose. Weld all around at connections, including at fittings.
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove flux immediately.
 - 4. At exposed connections, finish exposed welds to comply with NOMMA's "Voluntary Joint Finish Standards" for Finish #1 welds; ornamental quality with no evidence of a welded joint
- I. Nonwelded Connections: Connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.
 - 1. Fabricate splice joints for field connection, using an epoxy structural adhesive, if this is manufacturer's standard splicing method.
- J. Form changes in direction as follows:
 - 1. By bending.

- K. Bend members in jigs to produce uniform curvature for each configuration required. Maintain cross section of member throughout entire bend without buckling, twisting, cracking, or otherwise deforming exposed surfaces of components.
 - L. Close exposed ends of hollow railing members with prefabricated cap and end fittings of same metal and finish as railings.
 - M. Provide wall returns at ends of wall-mounted handrails unless otherwise indicated. Close ends of returns unless clearance between end of rail and wall is 1/4 inch or less.
 - N. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, miscellaneous fittings, and anchors to interconnect railing members to other work unless otherwise indicated.
 - 1. At brackets and fittings fastened to plaster or gypsum board partitions, provide crush-resistant fillers or other means to transfer loads through wall finishes to structural supports and prevent bracket or fitting rotation and crushing of substrate.
 - O. Provide inserts and other anchorage devices for connecting railings to concrete or masonry work.
 - 1. Fabricate anchorage devices capable of withstanding loads imposed by railings.
 - 2. Coordinate anchorage devices with supporting structure.
 - P. For railing posts set in concrete, provide stainless steel sleeves not less than 6 inches long with inside dimensions not less than 1/2 inch greater than outside dimensions of post, with metal plate forming bottom closure.
 - Q. For removable railing posts, fabricate slip-fit sockets from stainless steel tube or pipe whose ID is sized for a close fit with posts; limit movement of post without lateral load, measured at top, to not more than one-fortieth of post height.
 - 1. Provide socket covers designed and fabricated to resist being dislodged.
 - 2. Provide chain with eye, snap hook, and staple across gaps formed by removable railing sections at locations indicated. Fabricate from same metal as railings.
 - R. Toe Boards: Where indicated, provide toe boards at railings around openings and at edge of open-sided floors and platforms. Fabricate to dimensions and details indicated.
- 2.7 STEEL AND IRON FINISHES
- A. Galvanized Railings:
 - 1. Hot-dip galvanize exterior steel railings, including hardware, after fabrication.
 - 2. Comply with ASTM A123/A123M for hot-dip galvanized railings.
 - 3. Comply with ASTM A153/A153M for hot-dip galvanized hardware.
 - 4. Do not quench or apply post-galvanizing treatments that might interfere with paint adhesion.
 - 5. Fill vent and drain holes that are exposed in the finished Work, unless indicated to remain as weep holes, by plugging with zinc solder and filing off smooth.

- B. For galvanized railings, provide hot-dip galvanized fittings, brackets, fasteners, sleeves, and other ferrous components.
- C. Preparing Galvanized Railings for Shop Priming: After galvanizing, thoroughly clean railings of grease, dirt, oil, flux, and other foreign matter, and treat with etching cleaner.
 - 1. Comply with SSPC-SP 16.
- D. For nongalvanized-steel railings, provide nongalvanized ferrous-metal fittings, brackets, fasteners, and sleeves; however, hot-dip galvanize anchors to be embedded in exterior concrete or masonry.
- E. Preparation for Shop Priming: Prepare uncoated ferrous-metal surfaces to comply with SSPC-SP 6/NACE No. 3.
- F. Primer Application: Apply shop primer to prepared surfaces of railings unless otherwise indicated. Comply with requirements in SSPC-PA 1 for shop painting. Primer need not be applied to surfaces to be embedded in concrete or masonry.
 - 1. Shop prime uncoated railings with primers specified in Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" unless indicated.
 - 2. Do not apply primer to galvanized surfaces.
- G. Shop-Painted Finish: Comply with Section 09 91 13 "Exterior Painting."
 - 1. Color: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine plaster and gypsum board assemblies, where reinforced to receive anchors, to verify that locations of concealed reinforcements are clearly marked for Installer. Locate reinforcements and mark locations if not already done.

3.2 INSTALLATION, GENERAL

- A. Perform cutting, drilling, and fitting required for installing railings.
 - 1. Fit exposed connections together to form tight, hairline joints.
 - 2. Install railings level, plumb, square, true to line; without distortion, warp, or rack.
 - 3. Set railings accurately in location, alignment, and elevation; measured from established lines and levels.
 - 4. Do not weld, cut, or abrade surfaces of railing components that are coated or finished after fabrication and that are intended for field connection by mechanical or other means without further cutting or fitting.
 - 5. Set posts plumb within a tolerance of 1/16 inch in 3 feet.

6. Align rails so variations from level for horizontal members and variations from parallel with rake of steps and ramps for sloping members do not exceed 1/4 inch in 12 feet.

- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.
- C. Adjust railings before anchoring to ensure matching alignment at abutting joints.
- D. Fastening to In-Place Construction: Use anchorage devices and fasteners where necessary for securing railings and for properly transferring loads to in-place construction.

3.3 RAILING CONNECTIONS

- A. Welded Connections: Use fully welded joints for permanently connecting railing components. Comply with requirements for welded connections in "Fabrication" Article, whether welding is performed in the shop or in the field.
- B. Expansion Joints: Install expansion joints at locations indicated but not farther apart than required to accommodate thermal movement. Provide slip-joint internal sleeve, extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side; and locate joint within 6 inches of post.

3.4 ANCHORING POSTS

- A. Use stainless steel pipe sleeves preset and anchored into concrete for installing posts. After posts are inserted into sleeves, fill annular space between post and sleeve with non-shrink, nonmetallic grout, mixed and placed to comply with anchoring material manufacturer's written instructions.
- B. Anchor posts to metal surfaces with flanges, angle type, or floor type, as required by conditions, connected to posts and to metal supporting members as follows:
 - 1. For steel railings, weld flanges to post and bolt to metal supporting surfaces.
 - 2. For stainless steel railings, weld flanges to post and bolt to supporting surfaces.
- C. Install removable railing sections, where indicated, in slip-fit stainless-steel sockets cast in concrete.

3.5 ATTACHING RAILINGS

- A. Anchor railing ends to concrete and masonry with sleeves concealed within railing ends and anchored to wall construction with anchors and bolts.
- B. Attach handrails to walls with wall brackets. Provide brackets with 1-1/2-inch clearance from inside face of handrail and finished wall surface.

1. Use type of bracket with flange tapped for concealed anchorage to threaded hanger bolt.
2. Locate brackets as indicated or, if not indicated, at spacing required to support structural loads.

C. Secure wall brackets to building construction as follows:

1. For concrete and solid masonry anchorage, use drilled-in expansion shields and hanger or lag bolts.
2. For hollow masonry anchorage, use toggle bolts.
3. For wood stud partitions, use hanger or lag bolts set into studs or wood backing between studs. Coordinate with carpentry work to locate backing members.
4. For steel-framed partitions, use hanger or lag bolts set into fire-retardant-treated wood backing between studs. Coordinate with stud installation to locate backing members.
5. For steel-framed partitions, fasten brackets directly to steel framing or concealed steel reinforcements, using self-tapping screws of size and type required to support structural loads .
6. For steel-framed partitions, use toggle bolts installed through flanges of steel framing or through concealed steel reinforcements.

3.6 REPAIR

A. Touchup Painting:

1. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - a. Apply by brush or spray to provide a minimum 2.0-mil dry film thickness.

B. Touchup Painting: Cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint are specified in Section 09 91 13 "Exterior Painting." Section 09 91 23 "Interior Painting."

3.7 CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas, and repair galvanizing to comply with ASTM A780/A780M.

3.8 PROTECTION

- A. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

- B. Restore finishes damaged during installation and construction period, so no evidence remains of correction work. Return items that cannot be refinished in the field to the shop; make required alterations and refinish entire unit or provide new units.

END OF SECTION 05 52 13

SECTION 06 10 53 - MISCELLANEOUS ROUGH CARPENTRY

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Framing with dimension lumber.
 - 2. Rooftop equipment bases and support curbs.
 - 3. Wood blocking, cants, and nailers.
 - 4. Wood furring and grounds.
 - 5. Plywood backing panels.
- B. Related Requirements:
 - 1. Section 06 1600 "Sheathing" for sheathing, subflooring, and underlayment.

1.03 DEFINITIONS

- A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.
- B. Dimension Lumber: Lumber of 2 inches nominal or greater size but less than 5 inches nominal size in least dimension.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
 - 3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.
 - 4. For products receiving a waterborne treatment, include statement that moisture content of treated materials was reduced to levels specified before shipment to Project site.

- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.

1.05 INFORMATIONAL SUBMITTALS

- A. Evaluation Reports: For the following, from ICC-ES:
 - 1. Preservative-treated wood.
 - 2. Fire-retardant-treated wood.
 - 3. Power-driven fasteners.
 - 4. Post-installed anchors.
 - 5. Metal framing anchors.

1.06 QUALITY ASSURANCE

- A. Testing Agency Qualifications: For testing agency providing classification marking for fire-retardant- treated material, an inspection agency acceptable to authorities having jurisdiction that periodically performs inspections to verify that the material bearing the classification marking is representative of the material tested.
- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.
- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

PART 2 - PRODUCTS

2.01 WOOD PRODUCTS, GENERAL

- A. Regional Materials: Dimension lumber[, except treated materials,] shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- B. Certified Wood: shall be certified as "FSC Pure" or "FSC Mixed Credit" according to FSC STD-01-00 and FSC STD-40-004.
- C. Lumber: DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, provide lumber that complies with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Provide lumber graded by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.
 - 1. Factory mark each piece of lumber with grade stamp of grading agency.
 - 2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece or omit grade stamp and provide certificates of grade compliance issued by grading agency.
 - 3. Dress lumber, S4S, unless otherwise indicated.
- D. Maximum Moisture Content of Lumber: 15 percent unless otherwise indicated.

2.02 WOOD-PRESERVATIVE-TREATED MATERIALS

- A. Preservative Treatment by Pressure Process: AWWA U1; Use Category UC2 f or interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.
 - 1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium.
 - 2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.
- B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
 - 1. For exposed lumber indicated to receive a stained or natural finish, [mark end or back of each piece] [or] [omit marking and provide certificates of treatment compliance issued by inspection agency].
- D. Application: Treat items indicated on Drawings, and the following:
 - 1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
 - 2. Wood sills, sleepers, blocking, furring, and similar concealed members in contact with masonry or concrete.
 - 3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
 - 4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
 - 5. Wood floor plates that are installed over concrete slabs-on-grade.

2.03 FIRE-RETARDANT-TREATED MATERIALS

- A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Treatment shall not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified

- above for fire- retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201 at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664, and design value adjustment factors shall be calculated according to ASTM D6841.
- C. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent.[Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.]
 - D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
 - 1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece or omit marking and provide certificates of treatment compliance issued by inspection agency.
 - E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.
 - F. Application: Treat items indicated on Drawings, and the following:
 - 1. Framing for raised platforms.
 - 2. Concealed blocking.
 - 3. Roof framing and blocking.
 - 4. Wood cants, nailers, curbs, equipment support bases, blocking, and similar members in connection with roofing.
 - 5. Plywood backing panels.

2.04 DIMENSION LUMBER FRAMING

- A. Other Framing: No. 2 Construction or No. 2 Construction, Stud, or No. 3 grade of any of the following the following species:
 - 1. Hem-fir (north); NLGA.
 - 2. Southern pine; SPIB.
 - 3. Douglas fir-larch; WCLIB or WWPA.
 - 4. Southern pine or mixed southern pine; SPIB.
 - 5. Spruce-pine-fir; NLGA.
 - 6. Douglas fir-south; WWPA.
 - 7. Hem-fir; WCLIB or WWPA.
 - 8. Douglas fir-larch (north); NLGA.
 - 9. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

2.05 MISCELLANEOUS LUMBER

- A. General: Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:
 - 1. Blocking.
 - 2. Nailers.
 - 3. Rooftop equipment bases and support curbs.
 - 4. Cants.
 - 5. Furring.

6. Grounds.
 7. Utility shelving.
- B. Dimension Lumber Items: Construction or No. 2 Standard, Stud, or No. 3 grade lumber of any species. any of the following species: the following species:
1. Hem-fir (north); NLGA.
 2. Mixed southern pine or southern pine; SPIB.
 3. Spruce-pine-fir; NLGA.
 4. Hem-fir; WCLIB or WWPA.
 5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.
 6. Western woods; WCLIB or WWPA.
 7. Northern species; NLGA.
 8. Eastern softwoods; NeLMA.
- C. Concealed Boards: 15 percent maximum moisture content of any of the following the following species and grades:
1. Mixed southern pine or southern pine, [No. 2] [No. 3] grade; SPIB.
 2. Hem-fir or hem-fir (north), [Construction or No. 2 Common] [Standard or No. 3 Common] grade; NLGA, WCLIB, or WWPA.
 3. Spruce-pine-fir (south) or spruce-pine-fir, [Construction or No. 2 Common] [Standard or No. 3 Common] grade; NeLMA, NLGA, WCLIB, or WWPA.
 4. Eastern softwoods, [No. 2] [No. 3] Common grade; NELMA.
 5. Northern species, [No. 2] [No. 3] Common grade; NLGA.
 6. Western woods, [Construction or No. 2 Common] [Standard or No. 3 Common] grade; WCLIB or WWPA.
- D.
- E. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.
- F. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.
- G. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.
- 2.06 PLYWOOD BACKING PANELS
- A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, A-C, fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.
- 2.07 FASTENERS
- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
1. Where carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M.

- B. Nails, Brads, and Staples: ASTM F1667.
- C. Screws for Fastening to Metal Framing: ASTM C1002 or ASTM C954, length as recommended by screw manufacturer for material being fastened.
- D. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- E. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01 ICC-ES AC58 ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.
 - 1. Material: Carbon-steel components, zinc plated to comply with ASTM B633, Class Fe/Zn 5.

2.08 METAL FRAMING ANCHORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Cleveland Steel Specialty Co.
 - 2. KC Metals Products, Inc.
 - 3. Phoenix Metal Products, Inc.
 - 4. Simpson Strong-Tie Co., Inc.
 - 5. USP Structural Connectors.
 - 6. Insert manufacturer's name.
- B. Galvanized-Steel Sheet: Hot-dip, zinc-coated steel sheet complying with ASTM A653/A653M, G60 coating designation.
 - 1. Use for interior locations unless otherwise indicated.
- C. Hot-Dip, Heavy-Galvanized Steel Sheet: ASTM A653/A653M; Structural Steel (SS), high-strength low-alloy steel Type A (HSLAS Type A), or high-strength low-alloy steel Type B (HSLAS Type B); G185 coating designation; and not less than 0.036 inch thick.
 - 1. Use for wood-preserved-treated lumber and where indicated.
- D. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
 - 1. Use for exterior locations and where indicated.

2.09 MISCELLANEOUS MATERIALS

- A. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.
 - 1. Adhesives shall have a VOC content of 70 g/L or less.
 - 2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber rubberized-asphalt compound, bonded to a high-density

polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.
- B. Set carpentry to required levels and lines, with members plumb, true to line, cut, and fitted. Fit carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.
- C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. [Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.]
- D. Install metal framing anchors to comply with manufacturer's written instructions. Install fasteners through each fastener hole.
- E. Do not splice structural members between supports unless otherwise indicated.
- F. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.
 - 1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.
- G. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:
 - 1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
 - 2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2- inch nominal thickness.
 - 3. Fire block concealed spaces between floor sleepers with same material as sleepers to limit concealed spaces to not more than 100 sq. ft. and to solidly fill space below partitions.
 - 4. Fire block concealed spaces behind combustible cornices and exterior trim at not more than 20 feet o. c.
- H. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that

interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

- I. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.
 - 1. Use inorganic boron for items that are continuously protected from liquid water.
 - 2. Use copper naphthenate for items not continuously protected from liquid water.
- J. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.
- K. Securely attach carpentry work to substrate by anchoring and fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code.
 - 2. Table R602.3(1), "Fastener Schedule for Structural Members," and Table R602.3(2), "Alternate Attachments," in ICC's International Residential Code for One- and Two-Family Dwellings.
 - 3. ICC-ES evaluation report for fastener.
- L. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

3.02 INSTALLATION OF WOOD BLOCKING AND NAILER

- A. Install where indicated and where required for attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.
- B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.
- C. Provide permanent grounds of dressed, pressure-preservative-treated, key-beveled lumber not less than 1-1/2 inches wide and of thickness required to bring face of ground to exact thickness of finish material. Remove temporary grounds when no longer required.

3.03 INSTALLATION OF WOOD FURRING

- A. Install level and plumb with closure strips at edges and openings. Shim with wood as required for tolerance of finish work.

3.04 PROTECTION

- A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

- B. Protect miscellaneous rough carpentry from weather. If , despite protection, miscellaneous rough carpentry becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 53

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Wall sheathing.
 - 2. Roof sheathing.
 - 3. Parapet sheathing.
 - 4. Sheathing joint and penetration treatment.
- B. Related Requirements:
 - 1. Section 05 40 00 "Cold Formed Metal Framing"
 - 2. Section 06 10 00 "Rough Carpentry"
 - 3. Section 07 21 00 "Thermal Insulation"
 - 4. Section 07 27 15 "Weather Barriers"

1.03 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review air-barrier and water-resistant glass-mat gypsum sheathing requirements and installation, special details, transitions, mockups, air-leakage testing, protection, and work scheduling that covers air-barrier and water-resistant glass-mat gypsum sheathing.

1.04 ACTION SUBMITTALS

- A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.
 - 1. Include data for wood-preserved treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Indicate type of preservative used and net amount of preservative retained.
 - 2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated plywood complies with requirements. Include physical properties of treated materials.
 - 3. For fire-retardant treatments, include physical properties of treated plywood both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5516.
 - 4. For products receiving waterborne treatment, include statement that moisture

content of treated materials was reduced to levels specified before shipment to Project site.

5. For air-barrier and water-resistant glass-mat gypsum sheathing, include manufacturer's technical data and tested physical and performance properties of products.

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.

1.05 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

- B. Product Certificates: From air-barrier and water-resistant glass-mat gypsum sheathing manufacturer, certifying compatibility of sheathing accessory materials with Project materials that connect to or that come in contact with the sheathing.

- C. Product Test Reports: For each air-barrier and water-resistant glass-mat gypsum sheathing assembly, indicating compliance with specified requirements, for tests performed by a qualified testing agency.

D. Evaluation Reports: For the following, from ICC-ES:

1. Wood-preservative-treated plywood.
2. Fire-retardant-treated plywood.

E. Field quality-control reports.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer of air-barrier and water-resistant glass-mat gypsum sheathing.

1. Installer shall be licensed by ABAA according to ABAA's Quality Assurance Program and shall employ ABAA-certified installers and supervisors on Project.

- B. Certified Wood: Provide an invoice including vendor's chain-of-custody number, product cost, and entity being invoiced.

- C. Vendor Qualifications: A vendor that is certified for chain of custody by an FSC-accredited certification body.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance Ratings: As tested according to ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Fire-Resistance Ratings: Indicated by design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.02 FIRE-RETARDANT-TREATED PLYWOOD

- A. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article that are acceptable to authorities having jurisdiction and with fire-test- response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
- B. Fire-Retardant-Treated Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
 - 1. Use treatment that does not promote corrosion of metal fasteners.
 - 2. Exterior Type: Treated materials shall comply with requirements specified above for fire- retardant-treated plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
 - 3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
 - 4. Design Value Adjustment Factors: Treated lumber plywood shall be tested according to ASTM D5516 and design value adjustment factors shall be calculated according to ASTM D6305. Span ratings after treatment shall be not less than span ratings specified. For roof sheathing and where high-temperature fire-retardant treatment is indicated, span ratings for temperatures up to 170 deg F shall be not less than span ratings specified.
- C. Kiln-dry material after treatment to a maximum moisture content of 15 percent. Do not use material that is warped or does not comply with requirements for untreated material.
- D. Identify fire-retardant-treated plywood with appropriate classification marking of qualified testing agency.
- E. Application: Treat all plywood unless otherwise indicated.

2.03 WALL SHEATHING

- A. Basis of Design: Georgia Pacific 5/8" Densglass Sheathing
- B. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.

- b. Georgia-Pacific Gypsum LLC.
- c. National Gypsum Company.
- d. USG Corporation.
2. Type and Thickness: Type X, 5/8 inch thick.
3. Size: 48 by 96 inches, 48 by 108 inches, or 48 by 120 inches.

2.04 PARAPET SHEATHING

- A. Glass-Mat Gypsum Sheathing: ASTM C1177/C1177M.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. CertainTeed Corporation.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
 2. Type and Thickness: Type X, 5/8 inch thick.
 3. Size: 48 by 96 inches, 48 by 108 inches, or 48 by 120 inches.

2.05 FASTENERS

- A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.
 1. For roof parapet wall sheathing, provide fasteners of Type 304 stainless steel.
- B. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ESAC70.
- C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.
 1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
 2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.
- D. Screws for Fastening Composite Nail Base Insulated Roof Sheathing to Metal Roof Deck: Steel drill screws, in type and length recommended by sheathing manufacturer for thickness of sheathing to be attached, with organic-polymer or other corrosion-protective coating having a salt-spray resistance of more than 800 hours according to ASTM B117. Provide washers or plates if recommended by sheathing manufacturer.

2.06 SHEATHING JOINT-AND-PENETRATION TREATMENT MATERIALS

- A. Sealant for Glass-Mat Gypsum Sheathing: Silicone emulsion sealant complying with ASTM C834, compatible with sheathing tape and sheathing and recommended by tape and sheathing manufacturers for use with glass-fiber sheathing tape and for covering exposed fasteners.
 1. Sheathing Tape: Self-adhering glass-fiber tape, minimum 2 inches wide, 10 by 10 or 10 by 20 threads/inch, of type recommended by sheathing and tape manufacturers for use with silicone emulsion sealant in sealing joints in glass-mat gypsum sheathing and with a history of successful in-service use.

PART 3 - EXECUTION**3.01 INSTALLATION, GENERAL**

- A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.
- B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.
- C. Securely attach to substrate by fastening as indicated, complying with the following:
 - 1. Table 2304.9.1, "Fastening Schedule," in the ICC's International Building Code.
- D. Coordinate wall parapet roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.
- E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.
- F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.02 GYPSUM SHEATHING INSTALLATION

- A. Comply with GA-253 and with manufacturer's written instructions.
 - 1. Fasten gypsum sheathing to cold-formed metal framing with screws.
 - 2. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
 - 3. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.
- B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.
- C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
- D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.
 - 1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and

ends of panels.

- E. Seal sheathing joints according to sheathing manufacturer's written instructions.
 - 1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
 - 2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.03 FIELD QUALITY CONTROL

- A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

END OF SECTION 06 16 00

SECTION 06 41 16 – PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic-laminate-clad architectural cabinets.
2. Cabinet hardware and accessories.
3. Wood furring, blocking, shims, and hanging strips for installing plastic - laminate-clad architectural cabinets that are not concealed within other construction.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing cabinets that are concealed within other construction before cabinet installation.

1.2 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to support loads imposed by installed and fully loaded cabinets.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.

C. Shop Drawings:

1. Include plans, elevations, sections, and attachment details.
2. Show large-scale details.
3. Show locations and sizes of furring, blocking, and hanging strips, including concealed blocking and reinforcement specified in other Sections.
4. Show locations and sizes of cutouts and holes for items installed in plastic - laminate architectural cabinets.
5. Apply AWI Quality Certification Program label to Shop Drawings.

- D. Samples: For each exposed product and for each color and texture specified, in manufacturer's or manufacturer's standard size.

1. Thermally Fused Laminate (TFL) Panels: 8 by 10 inches, for each color, pattern, and surface finish.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of product.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Quality Standard Compliance Certificates: AWI Quality Certification Program certificates.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Employs skilled workers who custom fabricate products similar to those required for this Project and whose products have a record of successful in - service performance.
 1. Manufacturer's Certification: Licensed participant in AWI's Quality Certification Program.
- B. Installer Qualifications: Manufacturer of products.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver cabinets until painting and similar finish operations that might damage architectural cabinets have been completed in installation areas. Store cabinets in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.8 FIELD CONDITIONS

- A. Environmental Limitations without Humidity Control: Do not deliver or install cabinets until building is enclosed, wet-work is complete, and HVAC system is operating and maintaining temperature and relative humidity at levels planned for building occupants during the remainder of the construction period.
- B. Field Measurements: Where cabinets are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication, and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.
 1. Locate concealed framing, blocking, and reinforcements that support cabinets

by field measurements before being enclosed/concealed by construction, and indicate measurements on Shop Drawings.

PART 2 - PRODUCTS

2.1 PLASTIC-LAMINATE-CLAD ARCHITECTURAL CABINETS

- A. Quality Standard: Unless otherwise indicated, comply with the Architectural Woodwork Standards for grades of cabinets indicated for construction, finishes, installation, and other requirements.
 - 1. Provide certificates from AWI certification program indicating that woodwork complies with requirements of grades specified.
- B. Architectural Woodwork Standards Grade: Custom.
- C. Regional Materials: Manufacture wood products within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.
- D. Certified Wood: Certify wood products as "FSC Pure" or "FSC Mixed Credit" in accordance with FSC STD-01-001 and FSC STD-40-004.
- E. Type of Construction: Frameless.
- F. Door and Drawer-Front Style: Fulloverlay.
 - 1. Reveal Dimension: 1/2 inch.
- G. High-Pressure Decorative Laminate: NEMA LD 3, grades as indicated or if not indicated, as required by quality standard.
 - 1. Basis-of-Design Product: Wilsonart Portico Teak Gloss Line Finish
 - 2. Approved equal by Architect.
- H. Laminate Cladding for Exposed Surfaces:
 - 1. Horizontal Surfaces: Grade HGS.
 - 2. Vertical Surfaces: Grade HGS.
 - 3. Edges: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
 - 4. Pattern Direction: Vertically for drawer fronts, doors, and fixed panels.

- I. Materials for Semi-exposed Surfaces:
 - 1. Surfaces Other Than Drawer Bodies: High-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - a. Edges of Plastic-Laminate Shelves: PVC edge banding, 3.0 mm thick, matching laminate in color, pattern, and finish.
 - b. For semi-exposed backs of panels with exposed plastic-laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3, Grade VGS.
 - 2. Drawer Sides and Backs: Thermally fused laminate panels with PVC or polyester edge banding.
 - 3. Drawer Bottoms: Thermally fused laminate panels.
- J. Concealed Backs of Panels with Exposed Plastic-Laminate Surfaces: High-pressure decorative laminate, NEMA LD 3, Grade BKL.
- K. Drawer Construction: Fabricate with exposed fronts fastened to subfront with mounting screws from interior of body.
 - 1. Join subfronts, backs, and sides with glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints.
- L. Colors, Patterns, and Finishes: Provide materials and products that result in colors and textures of exposed laminate surfaces complying with the following requirements:
 - 1. As indicated by laminate manufacturer's designations.
- M. Provide filler panels at ends of cabinets unless noted otherwise.

2.2 WOOD MATERIALS

- A. Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Wood Moisture Content: 5 to 10 percent.
- B. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each type of architectural cabinet and quality grade specified unless otherwise indicated.
 - 1. Recycled Content of MDF and Particleboard: Postconsumer recycled content plus one - half of pre-consumer recycled content not less than 25 percent.
 - 2. Composite Wood Products: Verify products are made using ultra-low-emitting formaldehyde resins, as defined in the California Air Resources Board's "Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products," or are made with no added formaldehyde.

3. Medium-Density Fiberboard (MDF): ANSI A208.2, Grade 130.
4. Particleboard (Medium Density): ANSI A208.1, Grade M-2.
5. Softwood Plywood: DOC PS 1, medium-density overlay.
6. Thermally Fused Laminate (TFL) Panels: Particleboard or MDF finished with thermally fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.

2.3 CABINET HARDWARE AND ACCESSORIES

- A. Frameless Concealed Hinges (European Type): ANSI/BHMA A156.9, B01602, 100 degrees of opening.
- B. Back-Mounted Pulls: ANSI/BHMA A156.9, B02011.
- C. Wire Pulls: Back mounted, solid metal, 5 inches long, 2-1/2 inches deep, and 5/16 inch in diameter.
 1. Finish: Brushed Nickel
- D. Catches: Push-in magnetic catches, ANSI/BHMA A156.9, B03131.
- E. Adjustable Shelf Standards and Supports: ANSI/BHMA A156.9, B04071; with shelf rests, B04081.
- F. Shelf Rests: ANSI/BHMA A156.9, B04013; metal.
- G. Drawer Slides: ANSI/BHMA A156.9.
 1. Heavy-Duty (Grade 1HD-100 and Grade 1HD-200): Undermount.
 - a. Type: Full extension.
 - b. Material: Galvanized steel ball bearing, Stainless steel, or Zinc-plated ball bearing slides.
 - c. Motion Feature: Soft close dampener.
 2. General-purpose drawers more than 3 inches high, but not more than 6 inches high and not more than 24 inches wide, provide 75 lb load capacity.
 3. File drawers more than 6 inches high or more than 24 inches wide, provide 100 lb load capacity.
 4. Lateral file drawers more than 6 inches high and more than 24 inches but not more than 30 inches wide, provide 150 lb load capacity.
- H. Door Locks: ANSI/BHMA A156.11, E07121.
- I. Drawer Locks: ANSI/BHMA A156.11, E07041.
- J. Door and Drawer Silencers: ANSI/BHMA A156.16, L03011.
- K. Grommets for Cable Passage: 2-inch OD, molded-plastic grommets and matching plastic caps with slot for wire passage.
 1. Color: Black.

- L. Exposed Hardware Finishes: For exposed hardware, provide finish that complies with ANSI/BHMA A156.18 for ANSI/BHMA finish number indicated.
 - 1. Satin Chromium Plated: ANSI/BHMA 626 for brass or bronze base; ANSI/BHMA 652 for steel base.
 - 2. Satin Stainless Steel: ANSI/BHMA 630.
 - M. For concealed hardware, provide manufacturer's standard finish that complies with product class requirements in ANSI/BHMA A156.9.
- 2.4 MISCELLANEOUS MATERIALS
- A. Furring, Blocking, Shims, and Hanging Strips: Softwood or hardwood lumber, kiln-dried to less than 15 percent moisture content.
 - B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls and at floors.
 - C. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 - D. Adhesive for Bonding Plastic Laminate: Unpigmented contact cement.
 - 1. Adhesive for Bonding Edges: Hot-melt adhesive or adhesive specified above for faces.

2.5 FABRICATION

- A. Fabricate architectural cabinets to dimensions, profiles, and details indicated.
- B. Complete fabrication, including assembly and hardware application, to maximum extent possible before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.
- C. Shop-cut openings to maximum extent possible to receive hardware, appliances, electrical work, and similar items. Locate openings accurately and use templates or roughing -in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Before installation, condition cabinets to humidity conditions in installation areas for not less than 72 hours.

3.2 INSTALLATION

- A. Architectural Woodwork Standards Grade: Install cabinets to comply with quality standard grade of item to be installed.
- B. Assemble cabinets and complete fabrication at Project site to extent that it was not completed in the shop.
- C. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with wafer-head cabinet installation screws.
- D. Install cabinets level, plumb, and true in line to a tolerance of 1/8 inch in 96 inches using concealed shims.
 - 1. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.
 - 2. Install cabinets without distortion so doors and drawers fit openings and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.

3.3 ADJUSTING AND CLEANING

- A. Repair damaged and defective cabinets, where possible, to eliminate functional and visual defects. Where not possible to repair, replace architectural cabinets. Adjust joinery for uniform appearance.
- B. Clean, lubricate, and adjust hardware.
- C. Clean cabinets on exposed and semi-exposed surfaces.

END OF SECTION 06 41 16

BSECTION 07 05 43 - RAIN SCREEN ATTACHMENT SYSTEMS

PART 1 – GENERAL

1.1 SUMMARY

- A. Provide a non-continuous, aluminum rain screen attachment system for attachment of various siding types, installed in conjunction with exterior insulation. System shall be designed to incorporate flashing components, drainage components, and air barriers in such a way that the system will properly perform.

1.2 RELATED SECTIONS

- A. Section 05 40 00 – Cold-Formed Metal Framing
- B. Section 06 10 53 – Rough Carpentry
- C. Section 06 16 00 – Sheathing
- D. Section 07 21 00 – Thermal Insulation
- E. Section 07 27 15 – Self-Adhering Water-Resistive Air Barrier Membrane
- F. Section 07 42 13.13 – Formed Metal Wall Panels
- G. Section 07 60 00 – Sheet Metal Flashing and Trim

1.2 REFERENCES

- A. American Society for Testing and Materials (ASTM) Publications:
 - 1. ASTM E330 – Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference
 - 2. ASTM E331 – Test Method for Water Penetration of Exterior Windows
- B. American Society of Civil Engineers (ASCE) Publications:
 - 1. ASCE 7 – Minimum Design Loads for Buildings and Other Structures
- C. European Standards: DIN 4102 – Building Material Class – Germany
- D. IBC 1403.2: Reference Standard for Selection of Weather Resistive Barriers
- E. AAMA 509: Test and Classification Method for Drained and Back-Ventilated Rain Screen Wall Cladding Systems

1.3 SYSTEM DESCRIPTION

- A. System assembly shall include the following components from the substrate out:
 - 1. Substrate: Wall framing assembly and sheathing
 - 2. Weather Resistant/Air Barrier over substrate
 - 3. Exterior Insulation

4. Non-continuous aluminum rain screen attachment system
5. Exterior cladding

B. Design Requirements

1. Provide, in conjunction with wall substrate and air barrier, a weather tight wall assembly utilizing rain screen principle.
2. Manufacturer is responsible for designing system, including anchorage to structural system.
3. Design modifications shall be provided only as necessary to satisfy as built conditions and to meet performance requirements.
4. Employ registered professional engineer, licensed to practice engineering in jurisdiction where project is located, to engineer each component of rain screen attachment system.

1.4 PERFORMANCE REQUIREMENTS

A. Thermal Performance

1. Attachment system must be thermally modeled to demonstrate, at minimum, a compliance with ANSI/ASHRAE 90.1-2010 maximum U-Value for walls.
2. Continuous framing profiles (including C- or Z-shaped sections or furring) penetrating insulation are not permitted

B. Design Loads as required by applicable codes for Project location.

1. System shall be optimized based on design loads
2. Maximum panel deflection: 1/300 or per manufacturer applicable for product of span or less of span when tested in accordance with positive and negative pressures and as required to prevent damage to panel facing
3. Comply with applicable seismic requirements for Project location
4. Adequately resist wind forces and uplift for Project location with minimum PSF as indicated on drawings for wall surface and PSF as indicated on drawings for parapet and corner panels tested in accordance with ASTM E330
5. Accommodate movement of cladding components without undue stress on fasteners or other detrimental effects, when subjected to seasonal temperature range of:
 - a. Ambient: 120 degrees F
 - b. Cladding surface: 180 degrees F
6. Accommodate tolerances of support structure
7. Condensation: System shall accommodate positive drainage for moisture entering or condensation occurring within panel system.
8. Flatness: System shall be flat with no noticeable warpage, buckling, deflections or other surface irregularities

1.5 SUBMITTALS

- A. Refer to Section 01 33 00 – Submittal Procedures
- B. Product data information describing materials and fabrication for aluminum rain screen attachment system.
- C. Shop Drawings: Submit detailed shop drawings showing:
 - 1. Location, layout, and dimensions of panels, including special pieces and trim
 - 2. Locations of fixed and sliding fastening points
 - 3. Details at top, bottom, corner, windows, doors, etc.
 - 4. Installation details: attachment methods, fasteners, joints, corners, openings, intersections with adjacent materials, flashings, closures, trim and other critical conditions
- D. Copy of written approval by perimeter fastener supplier of the use of selected screws confirming use in a rainscreen wall assembly.
- E. Engineering Calculations: Submit engineering calculations as required by local building code.
- F. Samples
 - 1. 3 inches minimum length of attachment profile
 - 2. Typical anchor brackets and fasteners
- G. Provide manufacturer's sample warranty, installation and maintenance instructions.

1.6 QUALITY ASSURANCE

- A. System Manufacturer's Qualifications: Provide exterior wall system manufactured by a firm with minimum 15 years' experience in the production of systems that are similar to those indicated for this project.
- B. Installer Qualifications: Company experienced in installing rain screen systems and acceptable to Rain Screen Attachment System supplier.
- C. Attachment details shall be designed under direct supervision of licensed professional structural engineer. Calculations and shop drawings shall bear seal of supervising engineer.

1.7 QUALITY CONTROL

- A. Single Source Responsibility: Furnish engineered rain screen attachment system components under direct responsibility of single manufacturer.
- B. Field Measurements: Verify actual supporting and adjoining construction before fabrication. Record measurements on project record shop drawings.

- C. Established Dimensions: Where field measurements cannot be made without delaying work, guarantee dimensions and proceed with fabrication of rain screen attachment system corresponding to established dimensions.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Prior to shipping, pack and crate system components to prevent damage during transit and storage.
- B. Deliver materials and components in manufacturer's original, unopened, and undamaged containers or bundles, full identified. Exercise care to avoid damage during unloading, storing and installation.
- C. Inspect aluminum attachment components immediately upon delivery at site. Notify manufacturer of damage.
- D. Follow manufacturer's instruction for storage of product. Keep pieces in original packing material until ready to install.

1.9 WARRANTY

- A. One Year Warranty: Provide manufacturer's written warranty for aluminum rain screen attachment system to cover repair and replacement of defective components.

PART 2 – PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design: Alpha Vci Aluminum Rain Screen Attachment System with non-continuous, self-shimming bracket and rail assembly to accommodate out of plumb conditions with an additional subgirt for metal panel facade support.
 - 1. ecoCLADDING.com or (855) 237-3370
 - 2. Approved equal
- B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 – Product Requirements

2.2 PRODUCT REQUIREMENTS

- A. Provide all rain screen attachment system components from a single source.
- B. Materials
 - 1. Bracket and rail components
 - a. Made from 6000 series architectural grade aluminum.
 - b. Finish: Mill finish
 - c. Brackets shall be self-shimming for out of plumb conditions, with at least 1½" of built in adjustability.
 - 2. Fasteners
 - d. Minimum 304 series stainless steel fasteners and anchors of type, size and spacing required for type of substrate and Project conditions,

to meet performance requirements specified in Paragraph 1.4 and as indicated in design calculations and shop drawings.

3. The following characteristics are not acceptable:
 - a. Continuous framing profiles (including C- or Z-shaped sections or furring) penetrating insulation.
 - b. Components made from galvanized steel, galvalume, or other carbon based metals.
 - c. Components made from FRP or fiberglass materials.

2.3 EXTERIOR INSULATION

- A. Refer to Section 07 21 00 – Thermal Insulation

2.4 SIDING/RAIN SCREEN PANEL

- A. Refer to Division 7 Sections applicable to project.

PART 3 – EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of rainscreen cladding.
- B. Do not proceed with cladding installation until deficiencies have been addressed.

3.2 RAIN SCREEN ATTACHMENT SYSTEM INSTALLATION

- A. Install rain screen attachment system in accordance with manufacturer's instructions and approved shop drawings.
- B. Establish level lines for panel coursing and positioning of Alpha Vci brackets and support rail.
- C. Attach Alpha Vci brackets with engineered fasteners to accomplish performance requirements specified in Paragraph 1.4
- D. Attach vertical support rails with engineered fasteners to accomplish performance requirements specified in Paragraph 1.4
 - a. Provide 1/2"- 1" space between end of adjacent profiles
- E. Install exterior insulation to fit between wall brackets as specified by Section 07 21 00 prior.

- F. Install continuous horizontal support rail with engineered fasteners to accomplish performance requirements specified in Paragraph 1.4
 - a. Provide 1/2"- 1" space between end of adjacent profile.
- G. Attach clips to back of panels anchors to accomplish performance requirements specified in Paragraph 1.4
- H. Attach exterior cladding in compliance with manufacturer's recommendations and requirements.

3.3 QUALITY CONTROL

- A. The installing contractor shall perform daily inspections to maintain and confirm that tolerances are being met and that manufacturer's instructions are complied with.
- B. The owner may engage a third party inspection agency to verify that installed rain screen attachment system meets performance requirements and tolerances

3.4 CLEANING AND PROTECTION

- A. Remove and replace damaged, bowed, or bent pieces of aluminum.
- B. Immediately after installing, wipe down work. Do not use wire brushes, metallic tools, or abrasives for cleaning.
- C. Without damaging completed work, provide protective boards at exposed external corners which may be damaged by construction activities.

END OF SECTION 07 05 43

SECTION 07 11 13 - BITUMINOUS DAMPPROOFING**PART 1 - GENERAL****1.01 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Cold-applied, cut-back-asphalt damp proofing.
 - 2. Cold-applied, emulsified-asphalt damp proofing.
- B. Related Requirements:
 - 1. Section 03 30 00 "Cast-in-Place Concrete" for bituminous vapor retarders under slabs-on-grade.
 - 2. Section 04 20 00 "Unit Masonry" Section 04 22 00 "Concrete Unit Masonry" for mortar parge coat on masonry surfaces.
 - 3. Section 07 13 26 "Self-Adhering Sheet Waterproofing" Section 07 13 53 "Elastomeric Sheet Waterproofing" Section 07 13 54 "Thermoplastic Sheet Waterproofing" Section 07 14 13 "Hot Fluid-Applied Rubberized Asphalt Waterproofing" Section 07 14 16 "Cold Fluid-Applied Waterproofing" for waterproofing.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - a. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS

1.04 FIELD CONDITIONS

- A. Weather Limitations: Proceed with application only when existing and forecasted weather conditions permit damp proofing to be performed according to manufacturers' written instructions.
- B. Ventilation: Provide adequate ventilation during application of damp proofing in enclosed spaces. Maintain ventilation until damp proofing has cured.

PART 2 - PRODUCTS**2.01 MANUFACTURERS**

- A. Source Limitations: Obtain primary damp proofing materials and primers from single

source from single manufacturer. Provide protection course and auxiliary materials recommended in writing by manufacturer of primary materials.

2.02 PERFORMANCE REQUIREMENTS

- A. VOC Content: Products shall comply with VOC content limits of authorities having jurisdiction unless otherwise indicated.

2.03 COLD-APPLIED, CUT-BACK-ASPHALTDAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Henry Company.
 2. Karnak Corporation.
 3. W. R. Meadows, Inc.

- B. Trowel Coats: ASTM D 4586/D 4586M, Type I, Class 1, fibered.

- C. Brush and Spray Coats: ASTM D 4479/D 4479M, Type I, fibered[or non fibered].

2.04 COLD-APPLIED, EMULSIFIED-ASPHALTDAMPPROOFING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. BASF Corporation; Construction Systems.
 2. Euclid Chemical Company (The); an RPM company.
 3. Henry Company.
 4. Karnak Corporation.
 5. W. R. Meadows, Inc.

- B. Trowel Coats: ASTM D 1227, Type II, Class 1.

- C. Fibered Brush and Spray Coats: ASTM D 1227, Type II, Class 1.

- D. Brush and Spray Coats: ASTM D 1227, Type III, Class 1.

2.05 AUXILIARY MATERIALS

- A. Furnish auxiliary materials recommended in writing by damp proofing manufacturer for intended use and compatible with bituminous damp proofing.

- B. Cut-Back-Asphalt Primer: ASTM D 41/D41M.

- C. Emulsified-Asphalt Primer: ASTM D 1227, Type III, Class 1, except diluted with water as recommended in writing by manufacturer.

- D. Asphalt-Coated Glass Fabric: ASTM D 1668/D 1668M, Type I.

- E. Patching Compound: Epoxy or latex-modified repair mortar Asbestos-free fibered mastic of type recommended in writing by damp proofing manufacturer.

- F. Protection Course: ASTM D 6506, semirigid sheets of fiberglass or mineral-reinforced-asphaltic core, pressure laminated between two asphalt-saturated fibrous liners.
 - 1. Thickness: Nominal 1/8 inch 1/4 inch.
 - 2. Adhesive: Rubber-based solvent type recommended in writing by waterproofing manufacturer for protection course type.

- G. Protection Course: Fan folded, with a core of extruded-polystyrene board insulation faced on one side or both sides with plastic film, nominal thickness 1/4 inch, with a compressive strength of not less than 8 psi per ASTM D 1621, and maximum water absorption by volume of 0.6 percent per ASTM C 272/C 272M.

- H. Protection Course: Extruded-polystyrene board insulation, unfaced, ASTM C 578, Type X, 1/2 inch thick.

- I. Protection Course: Smooth-surfaced roll roofing complying with ASTM D 6380/D 6380M, Class S, Type III.

2.06 MOLDED-SHEET DRAINAGE PANELS

- A. Nonwoven-Geotextile-Faced, Molded-Sheet Drainage Panel: Composite subsurface drainage panel acceptable to damp proofing manufacturer and consisting of a studded, nonbiodegradable, molded- plastic-sheet drainage core; with a nonwoven, needle-punched geotextile facing with an apparent opening size not exceeding No. 70 sieve laminated to one side of the core, with or without a polymeric film bonded to the other side; and with a vertical flow rate through the core of 9 to 21 gpm per ft. Insert value.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. BASF Corporation; Construction Systems.
 - b. Carlisle Coatings & Waterproofing Inc.
 - c. GCP Applied Technologies Inc. (formerly Grace Construction Products).

2.07 INSULATION DRAINAGE PANELS

- A. Insulation Drainage Panels: Comply with Section 07 21 00 "Thermal Insulation" for insulation drainage panels.

- B. Insulation Drainage Panels: Unfaced or geotextile-faced, extruded-polystyrene board insulation according to ASTM C 578, Type IV, 25-psi, or Type VI, 40-psi, minimum compressive strength; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company(The).
 - c. Owens Corning.

- d. T. Clear Corporation, a subsidiary of Fin Pan Inc.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for surface smoothness, maximum surface moisture content, and other conditions affecting performance of the Work.
- B. Proceed with application only after substrate construction and penetrating work have been completed and unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean, prepare, and treat substrates according to manufacturer's written instructions. Provide clean, dust-free, and dry substrates for damp proofing application.
- B. Mask or otherwise protect adjoining exposed surfaces from being stained, spotted, or coated with damp proofing. Prevent damp proofing materials from entering and clogging weep holes and drains.
- C. Clean substrates of projections and substances detrimental to damp proofing work; fill voids, seal joints, and remove bond breakers if any.
- D. Apply patching compound to patch and fill tie holes, honeycombs, reveals, and other imperfections [; cover with asphalt-coated glass fabric].

3.03 APPLICATION, GENERAL

- A. Comply with manufacturer's written instructions for damp proofing application, cure time between coats, and drying time before backfilling unless otherwise indicated.
 - 1. Apply damp proofing to provide continuous plane of protection.
 - 2. Apply additional coats if recommended in writing by manufacturer or to achieve a smooth surface and uninterrupted coverage.
- B. Where damp proofing footings and foundation walls, apply from finished-grade line to top of footing; extend over top of footing and down a minimum of 6 inches over outside face of footing.
 - 1. Extend damp proofing 12 inches onto intersecting walls and footings, but do not extend onto surfaces exposed to view when Project is completed.
 - 2. Install flashings and corner protection stripping at internal and external corners, changes in plane, construction joints, cracks, and where indicated as "reinforced," by embedding an 8-inch-wide strip of asphalt-coated glass fabric in a heavy coat of damp proofing. Damp proofing coat for embedding fabric is in addition to other coats required.
- C. Where damp proofing exterior face of inner wythe of exterior masonry cavity walls, lap

damp proofing at least 1/4 inch onto flashing, masonry reinforcement, veneer ties, and other items that penetrate inner wythe.

1. Extend damp proofing over outer face of structural members and concrete slabs that interrupt inner wythe.
2. Lap damp proofing at least 1/4 inch onto shelf angles supporting veneer.

- D. Where damp proofing interior face of above-grade, exterior [concrete] [and] [masonry] [single-wythe masonry] walls, continue damp proofing through intersecting walls by keeping vertical mortar joints at intersection temporarily open or by damp proofing wall before constructing intersecting walls.

3.04 COLD-APPLIED, CUT-BACK-ASPHALTDAMPPROOFING

- A. Concrete Foundations: Apply [two brush or spray coats at not less than 1.25 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat] [or] [one trowel coat at not less than 4 gal./100 sq. ft..]
- B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- C. Concrete Backup for [Brick Veneer Assemblies] [Stone Veneer Assemblies] [and] [Dimension Stone Cladding]: Apply one brush or spray coat at not less than 1 gal./100 sq. ft..
- D. Masonry Backup for [Brick Veneer Assemblies] [Stone Veneer Assemblies] [and] [Dimension Stone Cladding]: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..
- E. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

3.05 COLD-APPLIED, EMULSIFIED-ASPHALTDAMPPROOFING

- A. Concrete Foundations: Apply [two brush or spray coats at not less than 1.5 gal./100 sq. ft. for first coat and 1 gal./100 sq. ft. for second coat] [one fibered brush or spray coat at not less than 3 gal./100 sq. ft.] [or] [one trowel coat at not less than 4 gal./100 sq. ft..]
- B. Unexposed Face of Concrete Retaining Walls: Apply one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- C. Unexposed Face of Masonry Retaining Walls: Apply primer and one brush or spray coat at not less than 1.25 gal./100 sq. ft..
- D. Concrete Backup for [Brick Veneer Assemblies] [Stone Veneer Assemblies] [and] [Dimension Stone Cladding]: Apply one brush or spray coat at not less than 1 gal./100 sq. ft..
- E. Masonry Backup for [Brick Veneer Assemblies] [Stone Veneer Assemblies] [and] [Dimension Stone Cladding]: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

- F. Exterior Face of Inner Wythe of Cavity Walls: Apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..
- G. Interior Face of Exterior Concrete Walls: Where above grade and indicated to be furred and finished, apply one brush or spray coat at not less than 1 gal./100 sq. ft..
- H. Interior Face of [Single-Wythe] Exterior Masonry Walls: Where above grade and indicated to be furred and finished, apply primer and one brush or spray coat at not less than 1 gal./100 sq. ft..

3.06 PROTECTION COURSE INSTALLATION

- A. Install protection course over completed-and-cured damp proofing. Comply with damp proofing-material and protection-course manufacturers' written instructions for attaching protection course.
 - 1. Support protection course over cured coating with spot application of adhesive type recommended in writing by protection-board manufacturer.
 - 2. Install protection course [on same day] [within 24 hours] of damp proofing installation (while coating is tacky) to ensure adhesion.

3.07 DRAINAGE PANEL INSTALLATION

- A. Molded- Sheet Drainage Panels: Install panels, with geotextile facing away from wall substrate, according to manufacturer's written instructions. Use adhesive or another method that does not penetrate damp proofing. Lap edges and ends of geotextile to maintain continuity. Protect installed molded-sheet drainage panels during subsequent construction.
 - 1. Install [thermal insulation specified in Section 07 21 00 "Thermal Insulation,"] [protection course] before installing drainage panels.
- B. Insulation Drainage Panels: Install panels over dampproofed surfaces. Use adhesive or another method that does not penetrate damp proofing. Cut and fit panels to within 3/4 inch of projections and penetrations.
 - 1. Ensure that drainage channels are aligned and free of obstructions.

3.08 PROTECTION

- A. Protect installed insulation drainage panels from damage due to UV light, harmful weather exposures, physical abuse, and other causes. Provide temporary coverings where panels are subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.
- B. Correct damp proofing that does not comply with requirements; repair substrates and reapply damp proofing.

END OF SECTION 07 11 13

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Polyisocyanurate foam-plastic board insulation.
 - 3. Glass-fiber blanket insulation.
 - 4. Mineral-wool blanket insulation.
- B. Related Requirements:
 - 1. Section 04 20 00 "Unit Masonry" for insulation installed in masonry cells.
 - 2. Section 06 16 00 "Sheathing" for foam-plastic board sheathing installed directly over wood or steel framing.
 - 3. Section 07 13 26 "Self-Adhering Sheet Waterproofing" Section 07 13 53 "Elastomeric Sheet Waterproofing"
 - 4. Section 07 21 19 "Foamed-in-Place Insulation" for spray-applied polyurethane foam insulation.
 - 5. Section 07 54 23 "Thermoplastic-Polyolefin (TPO) Roofing" and for insulation specified as part of roofing construction.
 - 6. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.03 ACTION SUBMITTALS

- A. Product Data: For the following:
 - 1. Extruded polystyrene foam-plastic board insulation.
 - 2. Polyisocyanurate foam-plastic board insulation.
 - 3. Glass-fiber blanket insulation.
 - 4. Mineral-wool blanket insulation.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.

1.04 INFORMATIONAL SUBMITTALS

- A. Installer's Certification: Listing type, manufacturer, and R-value of insulation installed in each element of the building thermal envelope.
 - 1. For blown-in or sprayed fiberglass and cellulosic-fiber loose-fill insulation, indicate initial installed thickness, settled thickness, settled R-value, installed density, coverage area, and number of bags installed.
 - 2. Sign, date, and post the certification in a conspicuous location on Project site.

- B. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- C. Research Reports: For foam-plastic insulation, from ICC-ES.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.
- B. Protect foam-plastic board insulation as follows:
 - 1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
 - 2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
 - 3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.01 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION

- A. Extruded Polystyrene Board Insulation, Type X as indicated on the drawings for exterior wall cavities: ASTM C578, Type X, 15-psi minimum compressive strength; unfaced.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. MBCI.
 - d. Owens Corning.
 - 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 - 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 - 4. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 - 5. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Extruded Polystyrene Board Insulation, Type VI at slab on grade under slab conditions: ASTM C578, Type VI, 40-psi minimum compressive strength.
 - 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation Limited.
 - d. Owens Corning.

2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- C. Extruded Polystyrene Board Insulation, Type VI, Drainage Panels at below grade foundation walls: ASTM C578, Type VI, 40-psi minimum compressive strength; unfaced; fabricated with shiplap or channel edges and with one side having grooved drainage channels.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. DiversiFoam Products.
 - b. Dow Chemical Company (The).
 - c. Kingspan Insulation Limited.
 - d. Owens Corning.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 450 when tested in accordance with ASTM E84.
 4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.02 POLYISOCYANURATE FOAM-PLASTIC BOARD INSULATION

- A. Polyisocyanurate Board Insulation, Foil Faced: ASTM C1289, foil faced, Type I, Class 1 or 2.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Atlas Molded Products; a Division of Atlas Roofing Corporation.
 - b. Atlas Roofing Corporation.
 - c. Carlisle Coatings & Waterproofing Inc.
 - d. Dow Chemical Company (The).
 - e. Firestone Building Products.
 - f. Hunter Panels.
 - g. Johns Manville; a Berkshire Hathaway company.
 - h. Rmax, Inc.
 2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.
- B. Polyisocyanurate Board Insulation, Glass-Fiber-Mat Faced: ASTM C1289, glass-fiber-mat faced, Type II, Class 2.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Atlas Roofing Corporation.
 - b. Carlisle Coatings & Waterproofing Inc.

- c. Firestone Building Products.
 - d. Hunter Panels.
 - e. Johns Manville; a Berkshire Hathaway company.
 - f. Rmax, Inc.
2. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.
 3. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.03 GLASS-FIBER BLANKET INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than Insert value percent.
- C. Glass-Fiber Blanket Insulation, Polypropylene-Scrim-Kraft Faced: ASTM C665, Type II (nonreflective faced), Class A (faced surface with a flame-spread index of 25 or less); Category 1 (membrane is a vapor barrier).
 1. Manufacturers: Subject to compliance with requirements, [provide products by the following]:
 - a. CertainTeed Corporation.
 - b. CertainTeed Insulation.
 - c. Johns Manville; a Berkshire Hathaway company.
 - d. Knauf Insulation.
 - e. Owens Corning.
 2. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.04 MINERAL-WOOL BLANKET INSULATION

- A. Insulation shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than Insert value percent.
- C. Mineral-Wool Blanket Insulation, Unfaced: ASTM C665, Type I (blankets without membrane facing); consisting of fibers; passing ASTM E136 for combustion characteristics.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Johns Manville; a Berkshire Hathaway company.
 - b. Rockwool International.
 - c. Thermafiber, Inc.; an Owens Corning company.
 2. Flame-Spread Index: Not more than 25 when tested in accordance with ASTM E84.
 3. Smoke-Developed Index: Not more than 50 when tested in accordance with

- ASTM E84.
4. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.05 INSULATION FASTENERS

- A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. AGM Industries, Inc.
 - b. Gemco.
 2. Plate: Perforated, galvanized carbon-steel sheet, 0.030 inch thick by 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- B. Adhesively Attached, Angle-Shaped, Spindle-Type Anchors: Angle welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Gemco.
 2. Angle: Formed from 0.030-inch- thick, perforated, galvanized carbon-steel sheet with each leg 2 inches square.
 3. Spindle: Copper-coated, low-carbon steel; fully annealed; 0.105 inch in diameter; length to suit depth of insulation.
- C. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. AGM Industries, Inc.
 - b. Gemco.
 2. Protect ends with capped self-locking washers incorporating a spring steel insert to ensure permanent retention of cap in the following locations:
 - a. Crawl spaces.
 - b. Ceiling plenums.
- D. Insulation Standoff: Spacer fabricated from galvanized mild-steel sheet for fitting over spindle of insulation anchor; refer to drawings for cavity dimension between face of insulation and substrate to which anchor is attached.
 1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Gemco.
- E. Anchor Adhesive: Product with demonstrated capability to bond insulation

anchors securely to substrates without damaging insulation, fasteners, or substrates.

1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. AGM Industries, Inc.
 - b. Gemco.

2.06 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Glass-Fiber Insulation: ASTM C764, Type II, loose fill; with maximum flame-spread and smoke- developed indexes of 5, per ASTM E84.
2. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame- spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.
3. Polyurethane Pour-In-Place Insulation: Closed cell, with maximum flame-spread and smoke- developed indexes of 75 and 450, respectively, per ASTM E84, specifically formulated for pour- in-place applications.
 - a. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - 1) Demilec (USA) LLC.

B. Adhesive for Bonding Insulation: Product compatible with insulation and air and water barrier materials, and with demonstrated capability to bond insulation securely to substrates without damaging insulation and substrates.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

C. Asphalt Coating for Cellular-Glass Block Insulation: Cutback asphalt or asphalt emulsion of type recommended by manufacturer of cellular-glass block insulation.

D. Eave Ventilation Troughs: Preformed, rigid fiberboard or plastic sheets designed and sized to fit between roof framing members and to provide ventilation between insulated attic spaces and vented eaves.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or that interfere with insulation attachment.

3.02 INSTALLATION, GENERAL

- A. Comply with insulation manufacturer's written instructions applicable to products and

applications.

- B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.
- C. Install insulation with manufacturer's R-value label exposed after insulation is installed.
- D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.
- E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.03 INSTALLATION OF SLAB INSULATION

- A. On vertical slab edge and foundation surfaces, set insulation units using manufacturer's recommended adhesive according to manufacturer's written instructions.
 - 1. If not otherwise indicated, extend insulation a minimum of [36 inches] below exterior grade line.
- B. On horizontal surfaces, loosely lay insulation units according to manufacturer's written instructions. Stagger end joints and tightly abut insulation units.
 - 1. If not otherwise indicated, extend insulation a minimum of [24 inches] in from exterior walls.

3.04 INSTALLATION OF FOUNDATION WALL INSULATION

- A. Butt panels together for tight fit.
- B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:
 - 1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive according to anchor manufacturer's written instructions.
 - 2. Space anchors according to insulation manufacturer's written instructions for insulation type, thickness, and application.
 - 3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
 - 4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
 - 5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.
- C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing according to manufacturer's written instructions.

3.05 INSTALLATION OF CAVITY-WALL INSULATION

- A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended by manufacturer.
 - 1. Fit courses of insulation between [wall ties and other] obstructions, with edges butted tightly in both directions, and with faces flush.
 - 2. Press units firmly against inside substrates.
 - 3. All joints between insulation boards to be taped.
 - 4. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

3.06 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

- A. Blanket Insulation: Install in cavities formed by framing members according to the following requirements:
 - 1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
 - 2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
 - 3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
 - 4. Attics: Install eave ventilation troughs between roof framing members in insulated attic spaces at vented eaves.
 - 5. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.
- B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:
 - 1. Glass-Fiber Insulation: Compact to approximately 40 percent of normal maximum volume equaling a density of approximately 2.5 lb/cu. ft..
 - 2. Spray Polyurethane Insulation: Apply according to manufacturer's written instructions.

3.07 INSTALLATION OF CURTAIN-WALL INSULATION

- A. Install board insulation in curtain-wall construction according to curtain-wall manufacturer's written instructions.
 - 1. Hold insulation in place by securing metal clips and straps or integral pockets within window frames, spaced at intervals recommended in writing by insulation manufacturer to hold insulation securely in place without touching spandrel glass.
 - 2. Perimeter of the insulation to be continuously taped to the frame.
 - 3. Maintain cavity width (1 inch) of dimension indicated on Drawings between insulation and glass.
 - 4. Install insulation to fit snugly without bowing.

3.08 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.
- B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 21 19 - FOAMED-IN-PLACE INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Closed-cell spray polyurethane foam insulation.

B. Related Requirements:

1. Section 072100 "Thermal Insulation" for foam-plastic board insulation.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Closed-cell spray polyurethane foam insulation.
2. Accessories

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each product, for tests performed by qualified testing agency.

B. Research Reports: For spray-applied polyurethane foam-plastic insulation, from an agency acceptable to authorities having jurisdiction showing compliance with code requirements.

C. Qualification Statements: For Installer.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

PART 2 - PRODUCTS**2.1 CLOSED-CELL SPRAY POLYURETHANE FOAM INSULATION**

- A. Closed-Cell Spray Polyurethane Foam: ASTM C1029, Type II, minimum density of 1.5 lb/cu. ft. and minimum aged R-value at 1-inch thickness of 6.2 deg F x h x sq. ft./Btu at 75 deg F.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. BASF Corporation
 - b. Dow Chemical Company
 - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 - 3. Fire Propagation Characteristics: Passes NFPA 285 testing as part of an approved assembly.

2.2 ACCESSORIES

- A. Primer: Material recommended by insulation manufacturer where required for adhesion of insulation to substrates.
- B. Thermal Barrier: Material barrier intended to prevent flame-source access to foam and delay temperature-rise of foam during a fire event.
 - 1. Gypsum Wallboard: 0.5-inch minimum thickness.
 - 2. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 50 or less.

2.3 PREPARATION

- A. Verify that substrates are clean, dry, and free of substances that are harmful to insulation.
- B. Priming: Prime substrates where recommended by insulation manufacturer. Apply primer to comply with insulation manufacturer's written instructions. Confine primers to areas to be insulated; do not allow spillage or migration onto adjoining surfaces.

2.4 INSTALLATION

- A. Comply with insulation manufacturer's written instructions applicable to products and applications.
- B. Spray insulation to envelop entire area to be insulated and fill voids.
- C. Apply in multiple passes to not exceed maximum thicknesses recommended by manufacturer. Do not spray into rising foam.
- D. Apply to thickness required to achieve no less than minimum R-values shown on Drawings.
- E. Install thermal barrier material.
 - 1. Do not cover insulation prior to any required spray foam insulation inspections.
 - 2. Use equipment and techniques best suited for substrate and type of material applied as recommended by coating manufacturer.
 - 3. Apply coatings to prepared surfaces as soon as practical after preparation and before subsequent surface soiling or deterioration.
 - 4. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Produce sharp lines and color breaks.

2.5 PROTECTION

- A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

END OF SECTION 072119

SECTION 07 21 29 – ACOUSTIC SPRAY ON SYSTEM**PART 1 – GENERAL**

1.01 Section Includes

- A. Sprayed cellulose thermal insulation.
- B. Sprayed cellulose acoustical insulation.

1.02 Related Items

- A. Clips, hangers, supports, sleeves and other attachments to spray bases are to be placed by other trades prior to the application of sprayed insulation.
- B. Ducts, piping, conduit or other suspended equipment shall not be positioned until after the application of sprayed insulation.
- C. Roof penetrations to be installed prior to application.

1.03 Quality Assurance

- A. Manufacturer must have a current Underwriters Laboratories (UL) Code Evaluation Report.
- B. Manufacturer must be in compliance with the 2009 and 2012 International Building Code.
- C. Manufacturer must be ISO 9001:2015 Certified.
- D. Applicator: Licensed by manufacturer.
- E. Manufacturer must subscribe to independent laboratory follow-up inspection services of Underwriters Laboratories and Factory Mutual. Each bag shall be labeled accordingly.
- F. Mock-up: Apply a 100 square foot representative sample to be reviewed by the Architect and/or Owner prior to proceeding.

1.04 Submittals

- A. Submit product data that the product meets or exceeds the following specified requirements.
 - 1. Bond strength shall be greater than 100 psf per ASTM E 736.
 - 2. Product shall be Class 1 Class A per ASTM E 84/ UL 723.
 - 3. Non-corrosive per ASTM C 739.
 - 4. Bond Deflection per ASTM E 759: 6" Deflection in 10' Span – No Spalling or Delamination.
 - 5. R-Value to be 3.75 per inch per ASTM C 518.
 - 6. Comply with 2009 IBC Section 803.10 stability requirements for interior finishes.
 - 7. Meet ASTM C 1149
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- C. Manufacturer's written certification that product contains no asbestos, fiberglass or other man-made mineral fibers.
- D. Copy of manufacturer's ISO 9001:2015 Certification.
- E. Minimum Fiber Recycled Content to be 75%.
- F. Cannot contain any added Urea-Formaldehyde Resins.

1.06 Delivery, Storage and Handling

- A. Deliver in original, unopened containers bearing name of manufacturer, product identification and reference to U.L. testing.
- B. Store materials dry, off ground, and under cover.
- C. Protect liquid adhesive from freezing.
- D. Water to be potable.

PART 2 – PRODUCTS

2.01 SPRAY CELLULOSE THERMAL / ACOUSTICAL INSULATION

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. International Cellulose Corporation
 - 2. North Central Insulation
 - 3. SOPREMA

- A. K-13 Spray-On-Systems.
 - 1. Color shall be from Manufacturer's standard color chart.
 - 2. Comply with local Building Code requirements.
 - 3. Material to have been tested in accordance with ASTM E 1042. Testing laboratory must be NVLAP accredited.

PART 3 – EXECUTION

3.01 Examination

- A. Examine surfaces and report unsatisfactory conditions in writing. Do not proceed until unsatisfactory conditions are corrected.
- B. Verify surfaces to receive spray insulation to determine if priming/sealing is required to insure bonding and/or to prevent discoloration caused by migratory stains.

3.02 Preparation

- A. Provide masking, drop cloths or other satisfactory coverings for materials/surfaces that are not to receive insulation to protect from over-spray.
- B. Coordinate installation of the sprayed cellulose fiber with work of other trades.
- C. Prime surfaces as required by manufacturer's instructions or as determined by examination.

3.03 Installation

- A. Install spray applied insulation according to manufacturer's recommendations.
- B. Install spray applied insulation to achieve an average R-Value of 11.4ci.

K-13 Sprayed Thermal and Acoustical Insulation ASTM C-423 on Solid Backing							
Inches	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ	4000 HZ	NRC
1"	0.11	0.32	0.84	0.99	1.01	0.98	0.80
1.75"	0.30	0.74	1.14	1.06	0.99	0.98	1.00
2"	0.47	0.90	1.06	1.06	1.08	1.07	1.00
3"	0.57	0.99	1.04	1.03	1.00	0.98	1.00
4"	0.84	1.06	1.01	1.03	1.00	0.98	1.05
5"	0.99	0.89	1.05	1.03	1.00	1.00	1.00

K-13 Sprayed Thermal and Acoustical Insulation Applied on 1.5" Metal Deck							
Inches	125 HZ	250 HZ	500 HZ	1000 HZ	2000 HZ	4000 HZ	NRC
1.50	0.36	0.89	1.26	1.07	1.01	1.00	1.05
3.00	0.97	1.04	1.13	0.99	0.95	0.98	1.05

- C. Cure insulation with continuous natural or mechanical ventilation.
- D. Remove and dispose of over-spray.

3.04 Protection

- A. Protect finished installation under provision of Division 1.

END OF SECTION 07 21 29

SECTION 07 27 15 – SELF-ADHERING WATER-RESISTIVE AIR BARRIER MEMBRANE**PART 1 - GENERAL****1.01 GENERAL REQUIREMENTS**

- A. This Specification shall be read as a whole by all parties concerned. Each Section may contain more or less the complete work of any trade. The Contractor is solely responsible to make clear to the Subcontractors the extent of their work and coordinate overlapping work.

1.02 SYSTEM DESCRIPTION

- A. Supply labor, materials and equipment for a NFPA 285 compliant fully adhered water-resistive vapor permeable air barrier membrane system.
- B. Complete Work as shown on the Drawings and specified herein to bridge gaps and seal the water- resistive vapor permeable air barrier membrane against air leakage and water intrusion, including:
 - 1. Connections of the walls to the roof membrane
 - 2. Connections of the walls to the foundations
 - 3. Seismic and expansion joints
 - 4. Openings and penetrations of window and door frames, store front, curtain wall
 - 5. Piping, conduit, duct and similar penetrations
 - 6. Masonry ties, screws, bolts and similar penetrations
 - 7. All other air leakage pathways in the building envelope
- C. Install primary water-resistive vapor permeable air barrier, flashing, and ventilation strip accessories.

1.03 RELATED SECTIONS

- A. Section 05 40 00 - Cold-Formed Metal Framing.
- B. Section 06 10 53 – Miscellaneous Rough Carpentry
- C. Section 06 16 00 – Sheathing
- D. Section 07 21 00 – Thermal Insulation
- E. Section 07 25 00 – Weather Barriers
- F. Section 07 44 53 – Glassfiber Reinforced Concrete Panel Rainscreen
- G. Section 075423 – TPO Roofing
- H. Section 07 62 00 – Sheet Metal Flashing and Trim
- I. Section 08 44 13 – Glazed Aluminum Curtain Walls

1.04 REFERENCE STANDARD

- A. ASTM International (ASTM):
 - 1. ASTM D5034 - Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).
 - 2. ASTM E 96/E 96M - Test Methods for Water Vapor Transmission of Materials.
 - 3. ASTM E398 Standard Test Method for Water Vapor Transmission Rate of Sheet Materials Using Dynamic Relative Humidity Measurement.
 - 4. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials.
 - 5. ASTM E2357 - Standard Test Method for Determining Air Leakage of Air Barrier Assemblies.
 - 6. ASTM E283 - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
 - 7. ASTM E84 - Test Method for Surface Burning Characteristics of Building Materials.
- B. American Association of Textile Chemists and Colorists (AATCC): ATCC 127 - Test Method for Water Resistance: Hydrostatic Pressure Test.
- C. International Code Council Evaluation Service, Inc. (ICC-ES): ICC-ES AC38 - Acceptance Criteria for Water-Resistive Barriers.

1.05 SUBMITTALS

- A. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- B. Manufacturers required to test all sealant used for compatibility and adhesion to the self-adhering air water barrier including all transition membrane and mastics.
- C. Submit manufacturers' current product data sheets, details and installation instructions for the water-resistive vapor permeable air barrier membrane components and accessories.
- D. Submit samples of the following:
 - 1. Manufacturer's sample warranty
 - 2. Water-resistive vapor permeable air barrier sheet, minimum 8 by 10 inches
 - 3. Components, minimum 12-inch lengths
 - 4. Membrane flashings

1.06 QUALITY ASSURANCE

- A. Single Source: Self-adhered water-resistive vapor permeable air barrier membrane components and accessories must be obtained as a single-source membrane system to ensure total system compatibility and integrity.
- B. Manufacturer Qualifications
 - 1. Manufacturer of specified products listed in this Section to have minimum 10 years of continued experience in the manufacture and

- supply of highly vapor permeable water resistive air barrier products successfully installed in similar project applications.
2. Manufacturer of specified products listed in this Section to have experienced in-house technical and field observation personal qualified to provide expert technical support.
- C. Fire Performance Characteristics: Provide water-resistive barrier meeting the following fire-test characteristics.
1. Surface-Burning Characteristics: ASTM E84 Class "A" Rating
 2. Flame spread index: 0 or less.
 3. Smoke developed index: 75 or less.

1.07 MOCK-UP

- A. Provide mock-up of specified water-resistive vapor permeable air barrier materials as part of rainscreen system mock-up. See requirements in that section and below.
- B. Where directed by architect, construct typical exterior wall panel, 6 foot long by 6 foot wide incorporating the sheathing board or substrate, window rough opening preparation or flashing method, window frame and attachment method, clips, strapping or masonry ties, or cladding attachment components, attachment of insulation and detailing of water-resistive vapor permeable air barrier membrane application and lap seams.
 - i. Perform water spray test of mockup to demonstrate performance, as per ASTM E1105 without an applied pressure. Test to be run for a minimum of 1 hour (if cladding is not installed).
 - ii. Perform air testing per ASTM E1186, chamber depressurization in conjunction with leak detection liquid to identify locations of the air leakage at air barrier seams, transitions and penetrations.
 - iii. Perform adhesion testing of the self-adhering air barrier per ASTM D4541.
- C. Allow 48 hours for inspection of mock-up by architect before proceeding with water-resistive vapor permeable air barrier work. Mock-up may remain as part of the work.

1.08 PRE-INSTALLATION CONFERENCE

- A. Contractor shall convene one week prior to commencing work of this section, under provisions of Section 01 Project Meetings.
- B. Ensure all contractors responsible for creating a continuous plane of water and air tightness are present.

1.09 DELIVERY, STORAGE AND HANDLING

- A. Refer to current Product Installation Instructions and SDS at www.vaproshield.com for proper storage and handling.
- B. Deliver materials to the job site in undamaged and original packaging indicating the name of the manufacturer and product.
- C. Store roll materials on end in original packaging. Protect rolls from direct sunlight and inclement weather until ready for use.
- D. Waste Management and Disposal
 1. Separate and recycle waste materials in accordance with the Waste Reduction Work Plan.

1.10 COORDINATION

- A. Ensure continuity of the fully self-adhered water-resistive vapor permeable air barrier system throughout the scope of this section.
 - 1. Air barrier vapor permeable membrane to include self-adhered air barrier, transition membranes and sealants at penetrations.
 - 2. Drainage plane to include drainage cavity, water resistive barrier and flashings to the exterior.

1.11 ALTERNATES

Submit request for alternates in accordance with Section 01– Substitution Procedures.

- A. Submit requests for alternates a minimum of ten (10) working days prior to bid date.
- B. Alternate submission to include:
 - 1. Evidence that alternate materials meet or exceed performance characteristics of specified Product requirements as well as documentation from an approved independent testing laboratory certifying the minimum physical dimensions, tensile strength, fire burning characteristics, vapor permeance and air leakage rates of the fully self-adhered water- resistive vapor permeable air barrier membrane. All testing to be performed without the aid of primers or surface conditioners.
 - 2. Manufacturer's complete set of details for fully self-adhered water-resistive vapor permeable air barrier membrane system showing a continuous plane of water and air tightness throughout the building enclosure.
 - 3. Manufacturer of alternate materials has experienced in-house technical and field observation personal qualified to provide expert technical support.

1.12 WARRANTY

- A. Provide manufacturer's standard material warranty in which manufacturer agrees to provide replacement material for the fully self-adhered water-resistive vapor permeable air barrier sheets installed in accordance with manufacturer's instructions that fail due to material defects within 20 years of the date of Purchase.

PART 2 - PRODUCTS**2.01 MATERIALS**

- A. Primary fully self-adhered water-resistive vapor permeable air barrier membrane components and accessories must be obtained from a single-source manufacture to ensure total system compatibility and integrity.
 - 1. Self-Adhered water-resistive vapor permeable air barrier membrane by VaproShield LLC., Gig Harbor, WA, Phone: (866) 731-7663, Website: www.vaproshield.com.
- B. WATER-RESISTIVE VAPOR PERMEABLE SELF-ADHERED AIR BARRIER MATERIALS (Basis of Design)

1. Primary fully self-adhered air barrier sheet membrane shall be RevealShield SA[®] Self- Adhered Water-Resistive Vapor Permeable Air Barrier Sheet by VaproShield, a zero VOC fully self-adhered vapor permeable air barrier sheet membrane consisting of multiple layers of spun-bonded polypropylene tested in accordance with ICC-ES AC 308 criteria to meet IBC and IRC requirements for weather resistive barriers having the following properties:
 - a. Color: Black UV stable, 12 months 100% exposure prior to coverage with an open joint cladding.
 - b. Breaking strength and Elongation to ASTM D5034: 119 lbf (529 N), machine direction; 96 lbf (427 N), cross-machine direction.
 - c. Water Vapor Permeance tested to ASTM E96 Method B: minimum of 63 perms (3620 ng/Pa.s.m²)
 - d. Water Vapor Permeance tested to ASTM E398: minimum of 63 perms (3620 ng/Pa.s.m²)
 - e. Air Leakage: ≤0.00002 cfm/ft² @ 1.57 psf (≤0.0001 L/s m² @ 75 Pa) when tested in accordance with ASTM E2178 and <0.002 cfm/ft² @ 1.57 psf (<0.01 L/s m² @ 75 Pa) when tested in accordance with ASTM E2357. Meets Air Barrier Association of America (ABAA) requirements for “Adhesive Backed Commercial Building Wraps”.
 - f. Water Resistance tested to AATCC 127, 550 mm hydrostatic head for 5 hours:
No leakage
 - g. Application Temperature: Ambient temperature must be above - 40 °F (- 40 °C)
 - h. Surface Burning Characteristics tested to ASTM E84: Class A, Flame-spread index of less than 0, Smoke-developed index of less than 75
 - i. Physical Dimensions: 0.0189 inches (0.48 mm) thick and 59 inches (1.5 m) wide and 11.0 oz/yd² (373 g/m²).
- C. WATER-RESISTIVE VAPOR PERMEABLE TRANSITION AND FLASHING MEMBRANE Part I of Two Part Flashing System
 1. Self-adhered air barrier transition and flashing membrane for all window jambs, headers, door openings, inside and outside corners, and other transitions shall be pre-cut RevealFlashing SA[™] Self-Adhered by VaproShield, a zero VOC fully self-adhered water- resistive vapor permeable sheet membrane having the following properties:
 - a. RevealFlashing SA[™] Self-Adhered Black: 11 3/4 inches (30 cm) wide x 102 feet (31 m) long
 - i. Breaking strength and Elongation to ASTM D 5034: 119 lbf (529 N), machine direction; 96 lbf (427 N), cross-machine direction.
 - ii. Water Vapor Permeance tested to ASTM E 96 Method B: minimum of 63 perms (3620 ng/Pa.s.m²)
 - iii. Water Vapor Permeance tested to ASTM E398: minimum of 63 perms (3620 ng/Pa.s.m²)
 - iv. Air Leakage: ≤0.00002 cfm/ft² @ 1.57 psf (≤0.0001 L/s m² @ 75 Pa) when tested in accordance with ASTM

- E2178 and $<0.002 \text{ cfm/ft}^2 @ 1.57 \text{ psf} (<0.01 \text{ L/s m}^2 @ 75 \text{ Pa})$) when tested in accordance with ASTM E2357
- v. Water Resistance tested to AATCC 127, 550 mm hydrostatic head for 5 hours: No leakage
- D. VAPROLIQUI-FLASH™ VAPOR PERMEABLE WATER RESISTIVE FLASHING FOR ROUGH OPENINGS Part II of Two Part Flashing System
1. Window and door pre-cut RevealFlashing™ SA Self-Adhered shall include VaproLiqui-Flash™ by VaproShield, a liquid-applied vapor permeable air barrier flashing material with vapor permeance and resistance to air leakage properties compatible with the primary air barrier membrane.
- E. ALTERNATE: VAPROBOND™ FLASHING WATER IMPERMEABLE LOW VAPOR PERMEANCE FLASHING FOR ROUGH OPENINGS Alternate for Part II of Two Part Flashing System
1. Window and door shall include VaproBond™ Flashing by VaproShield, a modified silicon sealant.
- a. VaproBond™ Flashing: 20 ounce (592 ml) sausage.
- b. Elongation: 1,500 % when tested in accordance with ASTM D412.
- F. ALTERNATE: VAPRO-SS FLASHING™ WATER AND VAPOR IMPERMEABLE FLASHING FOR ROUGH OPENINGS Alternate for Part II of Two Part Flashing System
2. Window and door shall include Vapro-SS Flashing™ by VaproShield, a flexible 2 mil (0.05 mm) stainless steel sheet with an 8 mil (0.20 mm) butyl adhesive backing.
- a. Vapro-SS Flashing™: 4, 6, 9, 12, 18 or 24 inches (10.2, 15.2, 22.9, 30.5, 45.7, 61 cm) x 50 feet (15.24 m) long.
- b. Tensile Strength/Puncture: 100,000 psi when tested in accordance with ASTM D882 and 2,500 psi when tested in accordance with ASTM E154.
- G. THROUGH WALL FLASHING
1. Thru-wall flashing self-adhered shall include Vapro-SS Flashing™ by VaproShield, a flexible 2 mil (0.05 mm) stainless steel sheet with an 8 mil (0.20 mm) butyl adhesive backing and may include a VaproTermination Bar™ when the top section of the Vapro-SS Flashing™ is exposed.
- a. Vapro-SS Flashing™: 4, 6, 9, 12, 18 or 24 inches (10.2, 15.2, 22.9, 30.5, 45.7, 61 cm) x 50 feet (15.24 m) long.
- b. Tensile Strength/Puncture: 100,000 psi when tested in accordance with ASTM D882 and 2,500 psi when tested in accordance with ASTM E154
- c. VaproTermination Bar™: 1 inch (25 mm) wide x 8 feet (2.4 m) long, UV-resistance rigid thermoplastic extrusion, if required by sequence of installation.
- H. TRANSITION FLASHING
2. Transition flashing shall include VaproSilicone Transition™ by VaproShield, a flexible 80 mil (2 mm) extruded silicone sheet.
- a. VaproSilicone Transition™: 4, 6 or 9 inches (10.2, 15, 23 cm) x 50 feet (15.24 m) long.
- b. Dynamic Movement Capability: +200 / -50 % when tested in accordance to ASTM C1523.
- c. Elongation: 400 % when tested in accordance to ASTM D412.

- d. Tensile Strength: 295 psi (2.03 MPa) when tested in accordance with ASTM D412.
- e. Tear Strength: 20 ppi (3.5 N/mm) when tested in accordance to ASTM D624.
- a. VaproMat™ Lightweight, hydrophobic filter fabric with a 3 mm or 7 mm polypropylene drainage matrix attached, designed to keep the drainage cavity clean and unobstructed during the lath and plaster or adhesive mortar installation, promoting rapid draining and drying of the rain screen cavity

2.02 PENETRATION SEALANT

- A. Provide sealant for penetrations as recommended by manufacturer and as specified under Division 07 Section: Sealants. Appropriate sealants shall be VaproBond™ or VaproLiqui-Flash™.

PART 3 EXECUTION

3.01 GENERAL

- A. Verify that surfaces and conditions are ready to accept the work of this section. Notify architect in writing of any discrepancies. Commencement of the work or any parts thereof shall mean acceptance of the prepared substrates.
- B. All surfaces must be dry, sound, clean, free of oil, grease, dirt, excess mortar or other contaminants detrimental to the adhesion of the water resistive air barrier membrane and flashings. Fill voids and gaps in substrate greater than $\frac{7}{8}$ inch (22 mm) in width to provide an even surface. Strike masonry joints full-flush.
- C. Minimum application temperature of fully self-adhered membrane and flashings to be above 20 °F (minus 6.0 °C).
- D. Ensure all preparatory Work is complete prior to applying primary fully self-adhered vapor permeable air barrier sheet membrane.
- E. Mechanical fasteners used to secure sheathing surfaces or penetrate sheathing surfaces shall be set flush with sheathing, fastened into solid backing and covered with the upper overlapping membrane. If exposed fasteners are present on the surface of the membrane, cover and seal with Vapro-LiquiFlash™ or VaproBond™.
- F. If exposed fasteners are required, use VaproCaps™ to insure water/air tight seal.

3.02 COORDINATION OF SELF-ADHERED VAPOR PERMEABLE AIR BARRIER MEMBRANE INSTALLATION

- A. Download Installation Instructions at <http://vaprosshield.com/public-documents/installation-instructions>.
- B. Installation Summary:
 - a. Self-adhered vapor permeable air barrier sheets may be installed vertically or horizontally over the outside face of exterior sheathing board or other approved substrates.
 - b. Complete detail work at; wall openings, building transitions and penetrations prior to field applications.
 - c. Install fully self-adhered vapor permeable air barrier sheet over the outside face of exterior sheathing board or substrate, measure and pre-

- cut into manageable sized sheets to suit the application conditions.
- d. Install fully self-adhered vapor permeable air barrier sheet complete and continuous to substrate in a sequential minimal 3 inch (76 mm) overlapping weatherboard.
 - e. Stagger all end lap seams.
 - f. Roll installed membrane with roller to ensure positive contact and adhesion with substrate immediately.

3.03 BUILDING TRANSITION CONDITIONS

- A. Consult published details at WWW.VaproShield.com.
- B. Tie-in to structural beams, columns, floor slabs and intermittent floors, parapet curbs, foundation walls, roofing systems and at the interface of dissimilar materials with self-adhering air barrier transition and flashing membrane.
- C. Align and position fully self-adhered air barrier transition and flashing membrane, remove protective film and press firmly into place. Provide minimum 3 inch (76 mm) lap on to substrates.
- D. Ensure minimum 3 inch (76 mm) overlap at side and end laps of membrane and 6 inch (152 mm) at inside and outside corners, if joints occur at corner locations.
- E. Roll membrane and lap seams with roller to ensure positive contact and adhesion, immediately.

3.04 MECHANICAL EQUIPMENT PENETRATIONS

- A. Mechanical pipe, electrical conduit and/or duct work must be secured solid into position prior to installation of fully self-adhered vapor permeable air barrier membrane.
- B. Electrical services penetrating the wall assembly and fully self-adhered vapor permeable air barrier membrane must be placed in appropriate conduit and secured solid into position.
- C. Install manufactured flanged penetration sleeves as recommended by sleeve manufacturer.
- D. For straight sided penetrations, cut and fit fully self-adhered vapor permeable air barrier to accommodate sleeve, install VaproLiqui-Flash™ to seal the air barrier membrane to ductwork or preformed flange sleeve.
- E. For pipe penetrations, refer to manufacturer's standard details.

3.05 WINDOW, DOOR AND OTHER WALL OPENINGS

- A. Consult published installation instructions at WWW.VaproShield.com.
- B. Two part flashing system; RevealFlashing™ SA Self Adhered flashing and VaproLiqui-Flash™, Vapro-SS Flashing™ or VaproBond™ Flashing by VaproShield around window or wall openings subject to the opening size and installation of window, door or louver type.
- C. RevealFlashing™ SA Self-Adhered air barrier transition and flashing membrane installed 2 ¾ inch (70 mm) into rough wall openings for the sill, jambs and head.
- D. Remove release film, align flashing membrane and apply pressure to ensure positive contact. Roll Lap seams to ensure adhesion. Provide lap seams in singled fashion, to shed water.

- E. VAPROLIQUI-FLASH VAPOR PERMEABLE WATER RESISTIVE FLASHING FOR ROUGH OPENINGS
1. Download Installation Instructions at <http://vaprosshield.com/public-documents/installation-instructions>.
 2. Liquid-applied window and door flashing shall be VaproLiqui-Flash™ by VaproShield, a liquid-applied vapor permeable air barrier flashing material with resistance to moisture and air leakage properties compatible with the primary weather resistant air barrier membrane.
 3. Apply a 12-15 wet mil (0.030-0.038 mm) coating onto the installed RevealFlashing™ SA Self-Adhered flashing, 1 inch (25.4 mm) onto the face continuing into the rough opening, covering the 2 ¾ inch (70 mm) RevealFlashing™ SA Self-Adhered flashing and the exposed rough opening surface.
- F. THROUGH-WALL FLASHING MEMBRANE
1. Download Installation Instructions at <http://vaprosshield.com/public-documents/installation-instructions>.
 2. Apply through-wall flashing membrane along the base of masonry veneer walls and over shelf angles as detailed by designer.
 - a. Press membrane firmly into place, overlap minimum 3 inches (76 mm) at all laps. Promptly roll all surfaces using a hand roller to ensure good adhesion.
 - b. Applications shall form a continuous flashing membrane and shall extend up a minimum of 8 inches (20 cm) up the back-up wall.
 - c. Seal the top edge of the membrane where it meets the substrate using VaproBond™. Trowel-apply a feathered edge to seal termination to shed water or install VarpoTermination™ Bar and VaproBond™ sealant at the top edge.
 - d. Install through-wall flashing membrane ½ inch (13 mm) from outside edge of veneer. Provide “end dam” flashing as detailed by designer.
 - e. System to include a stainless steel pan flashing with an upturned leg at end dams.
- G. OPTIONAL VAPROBOND™ FLASHING WATER IMPERMEABLE LOW VAPOR PERMEANCE FLASHING FOR ROUGH OPENINGS
1. Fluid applied membrane for window and door flashing shall be VaproBond™ Flashing by VaproShield, a low vapor permeable, impermeable air and water barrier flashing material, replaces VaproLiqui-Flash™. Not recommended for wood framing.
 2. Apply VaproBond™ Flashing, 1 inch (25 mm) onto the face continuing into the rough opening, covering the 2 ¾ inch (70 mm) RevealFlashing™ SA Self-Adhered flashing and the exposed rough opening surface.
- H. OPTIONAL VAPRO-SS FLASHING VAPOR IMPERMIABLE FLASHING FOR ROUGH OPENINGS
3. Self-Adhered stainless steel membrane for window and door flashing shall be Vapro-SS Flash™ by VaproShield, an impermeable air and water barrier flashing material, replaces VaproLiqui-Flash. Not recommended for wood framing.

4. Apply Reveal Flashing™ SA Self-Adhered flashing, 1 inch (25 mm) onto the face continuing into the rough opening, covering the 2 ¾ inch (70 mm) Reveal Flashing™ SA Self-Adhered flashing and the exposed rough opening surface.

3.06 VERTICAL APPLICATIONS SUMMARY

- A. Download Installation Instructions at <http://vaproshield.com/public-documents/installation-instructions>.
- B. For vertical applications, align sheets with an 'inside' or 'outside' corner to avoid wrinkles and misalignment of subsequent applications.
- C. Measure and pre-cut into manageable sized fully self-adhered sheets to suit the application conditions.
- D. Allow for excess material at bottom of wall to accommodate tie-ins and connections to adjacent surfaces.
- E. Roll up pre-cut material lengths with release paper facing OUTWARD.
- F. Starting at a corner of the roll, peel back approx. 6" (152 mm) of release film from across the width of the pre-cut material roll.
- G. Using hand pressure, lightly apply the exposed adhesive surface to the substrate.
- H. Allow the rolled up material to drop down the wall, with the remainder of the release film still attached (facing the wall), and extend down to lowest point of wall, checking for proper alignment, repositioning as necessary.
- I. Allow for excess material at bottom of wall to accommodate tie-ins and connections to adjacent surfaces.
- J. Align and position fully self-adhered membrane, remove release film and press firmly into place. Provide minimum 3 inch (76 mm) overlap at side and end laps of membrane.
- K. Continue to remove release film and apply pressure to ensure positive contact onto wall substrate.
- L. Install subsequent sheets of fully self-adhered vapor permeable air barrier sheets in overlapping weatherboard format. Ensure sheets lay smooth and flat to surfaces. Roll membrane and lap seams with two handed roller to ensure contact and adhesion.
- M. Refer to <http://vaproshield.com/installation/instructions> for the most current and complete installation instructions.

3.07 HORIZONTAL APPLICATIONS

- A. For horizontal applications, align sheets and begin installation of water-resistive weather barrier at bottom or lowest point of wall.
- B. Mechanical fastening to be performed for all self-adhering membranes installed at an overhead application. To avoid wrinkles and misalignment of subsequent applications, it is recommended to pre-mark or "Snap" a level line to work from.
- C. Measure and pre-cut into manageable sized sheets to suit the application conditions.
- D. Allow for excess material at bottom of wall to accommodate tie-ins and connections to adjacent surfaces.
- E. Align and position fully self-adhered membrane, remove release film and press firmly into place. Provide minimum 3 inch (76 mm) overlap at all side and end

laps of membrane. Roll membrane and lap seams with two handed roller to ensure contact and adhesion.

- F. Continue to remove release film and apply pressure to ensure positive contact onto wall substrate.
- G. Install subsequent sheets of fully self-adhered vapor permeable air barrier sheets in overlapping weatherboard format. Ensure sheets lay smooth and flat to surfaces. Roll membrane and lapped seams with a two handed roller to ensure contact and adhesion.
- H. Refer to <http://vaprosshield.com/installation/instructions> for the most current and complete installation instructions.

3.8 FIELD QUALITY CONTROL

- A. Make notification when sections of work are complete to allow review prior to covering fully self- adhered water-resistive vapor permeable air barrier system.
- B. Contractor to engage independent consultant to observe substrate and membrane installation prior to:
 - a. To observe substrate and membrane installation prior to placement of cladding system(s) and provide written documentation of observations.
 - b. Undertake water penetration testing per ASTM E1105 without applied air pressure (prior to cladding installation) for 1 hour minimum at Architect selected locations.

3.11 PROTECTION

- A. Protect wall areas covered with self-adhered water-resistive vapor permeable air barrier from damage due to construction activities, high wind conditions, and extended exposure to inclement weather.
- B. Review condition of fully self-adhered water-resistive vapor permeable air barrier prior to installation of cladding. Repair, or remove and replace damaged sections with new membrane.
- C. Recommend to cap and protect exposed back-up walls against wet weather conditions during and after application of membrane, including wall openings and construction activity above completed fully self-adhered water-resistive vapor permeable air barrier installations.
- D. Remove and replace water-resistive weather barrier membrane affected by chemical spills or surfactants.

END OF SECTION 07 27 15

SECTION 07 42 13.13 – FORMED METAL WALL PANELS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 RELATED SECTIONS

- A. Section 05 40 00 – Cold-Formed Metal Framing
- B. Section 06 10 00 – Rough Carpentry
- C. Section 06 16 00 – Sheathing
- D. Section 07 21 00 – Thermal Insulation
- E. Section 07 27 00 – Air Barriers
- F. Section 07 42 00 – Wall Panels
- G. Section 07 62 00 – Sheet Metal Flashing and Trim

1.3 SUMMARY

- A. Section includes vertical concealed fastener panels and formed pan metal wall panels also noted as rainscreen panels on drawings.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Meet with Owner, Architect, Owner's insurer if applicable, metal panel Installer, metal panel manufacturer's representative, structural-support Installer, and installers whose work interfaces with or affects metal panels, including installers of doors, windows, and louvers.
 - 2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 3. Review methods and procedures related to metal panel installation, including manufacturer's written instructions.
 - 4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.

5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect metal panels.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for metal panel assembly during and after installation.
8. Review procedures for repair of metal panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.
- B. Shop Drawings:
 1. Include fabrications and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, and accessories; and special details including mounting details onto metal framing substrates and thermal spacer accessories: Include details of the flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
- C. Sustainable Design Submittals:
 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- D. Samples for Initial Selection: For each type of metal panel indicated with factory-applied color finishes.
 1. Include similar Samples of trim and accessories involving color selection.
- E. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below.
 1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each product, tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For special warranties.

1.7 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For metal panels to include in maintenance manuals.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical metal panel assembly, including corner, supports, attachments, and accessories.
 - 2. Water-Spray Test: Conduct water-spray test of mockup of metal panel assembly, testing for water penetration according to AAMA 501.2.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.
- B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.
- C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.
- D. Retain strippable protective covering on metal panels during installation.

1.10 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

- A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including rupturing, cracking, or puncturing.
 - b. Deterioration of metals and other materials beyond normal weathering.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Hunter units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E330:
 - 1. Wind Loads: As indicated on Drawings.
 - 2. Other Design Loads: As indicated on Drawings.
 - 3. Deflection Limits: For wind loads, no greater than 1/120 of the span.
- B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. (0.3 L/s per sq. m) when tested according to ASTM E283 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

- C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E331 at the following test-pressure difference:
 - 1. Test-Pressure Difference: 15.0 lb/sq.ft.
- D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- E. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency.

2.2 FORMED METAL WALL PANELS

- A. Formed Metal Wall Panels: Provide factory-formed, corrugated metal wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment assembly components panel stiffeners, and accessories required for weathertight system.
- B. Basis of Design panels and manufacturer to be as noted below. Distribution of the following three profiles as required per architect, MP2 (max. 25%), MP3 (max. 25%), MP1 (% balance remaining):
 - 1. MP1: Basis of Design – CENTRIA, CONCEPT SERIES, vertically oriented metal panels, 7/8" depth, concealed fasteners. Profile 1: CS-260
 - 2. MP2: Basis of Design – CENTRIA, CONCEPT SERIES, vertically oriented metal panels, 7/8" depth, concealed fasteners. Profile 2: CS-220
 - 3. MP3: Basis of Design – CENTRIA, CONCEPT SERIES, vertically oriented metal panels, 7/8" depth, concealed fasteners. Profile 3: CS-200
- C. Panel Depth: As noted herein.
- D. Aluminum Sheet: Tension-leveled, smooth aluminum sheet, ASTM B209 (ASTM B209M), 0.050 inch (1.27 mm) thick.
 - 1. Exterior Finish: Two-coat fluoropolymer.
 - a. 2 Colors: As selected by Architect from manufacturer's full range.
 - 1) Refer to enlarged building elevation drawing.
 - 2) Distribution of two colors is to be determined by architect.
- E. Attachment Assembly: Manufacturer's standard Rainscreen principal system.

2.3 FORMED PAN METAL WALL PANELS

- A. Formed Pan Metal Wall Panels: Provide factory-formed, metal wall panels fabricated from single sheets of metal formed into profile for installation method indicated. Include attachment assembly components panel stiffeners, and accessories required for weathertight system.
- B. Basis of Design panels and manufacturer to be as noted below:
 - 1. MP4: Basis of Design – CENTRIA, INTERCEPT+ ENTYRE SERIES, factory formed rectangular metal panels, 1 3/8" depth, concealed fasteners. Profile: Flat
- C. Panel Depth: As noted herein.
- D. Panel Size: As indicated on drawings.
- E. Reveal Width: 3/4 inch.
- F. Metal: Aluminum alloy 3003-H-14 or equal for PVDF finish.
- G. Exterior Finish: Two-coat fluoropolymer.
 - 1. Color: As selected by Architect from manufacturer's full range.
 - a. Refer to enlarged building elevation drawing.
- H. Attachment Assembly: Manufacturer's standard Rainscreen principal system.

2.4 MISCELLANEOUS MATERIALS

- A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A792/A792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.
- B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.
- C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, end walls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.
- D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

- E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer. Provide sealant types that are compatible with panel materials, are non-staining, and do not damage panel finish.

2.5 FABRICATION

- A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.
- B. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.
 - 1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
 - 3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 4. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
 - 5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
 - 6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
 - a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.6 FINISHES

- A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.
- C. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.
 1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
 2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.
 - a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION

- A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.
 1. Shim or otherwise plumb substrates receiving metal panels.
 2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
 3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.
 5. Install flashing and trim as metal panel work proceeds.
 6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.
 7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
 8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.
- B. Fasteners:
1. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
- C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.
- D. Attachment Assembly, General: Install attachment assembly required to support metal plate wall panels and to provide a complete weathertight wall system, including subgirts, perimeter extrusions, thermal spacers, tracks, drainage channels, panel clips, and anchor channels.
1. Include attachment to supports, panel-to-panel joinery, panel-to-dissimilar-material joinery, and panel-system joint seals.
- E. Installation: Attach metal plate wall panels to supports at locations, spacings, and with fasteners recommended by manufacturer to achieve performance requirements specified.
1. Rainscreen Systems: Do not apply sealants to joints unless otherwise indicated.
- F. Rainscreen-Principle Installation: Install using manufacturer's standard assembly with vertical channel that provides support and secondary drainage assembly, draining at base of wall. Notch vertical channel to receive support pins. Install vertical channels supported by channel brackets or adjuster angles and at locations, spacings, and with fasteners recommended by manufacturer. Attach metal plate wall panels by inserting horizontal support pins into notches in vertical channels and into flanges of panels. Leave horizontal and vertical joints with open reveal.
1. Install metal plate wall panels to allow individual panels to be installed and removed without disturbing adjacent panels.
 2. Do not apply sealants to joints unless otherwise indicated.
- G. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting and provide for thermal expansion. Coordinate installation with flashings and other components.
1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips,

and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended in writing by metal panel manufacturer.

- H. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.
 - 1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to result in waterproof performance.
 - 2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (605 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4 ERECTION TOLERANCES

- A. Installation Tolerances: Shim and align metal plate wall panel units within installed tolerance of 1/4 inch in 20 feet (6 mm in 6 m), non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch (3-mm) offset of adjoining faces and of alignment of matching profiles.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified independent testing agency to perform field tests and inspections.
- B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration according to AAMA 501.2.
- C. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.
- D. Remove and replace metal wall panels where tests and inspections indicate that they do not comply with specified requirements.
- E. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.
- F. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

- A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation

instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

- B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.
- C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.13

SECTION 07 54 23 - THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Fully adhered, thermoplastic polyolefin (TPO) roofing system.
 2. Substrate board.
 3. Vapor retarder.
 4. Roof insulation.
 5. Cover board.
 6. Walkways.
- B. Related Requirements:
 1. Section 061053 "Miscellaneous Rough Carpentry" for wood nailers, curbs, and blocking; and for wood-based, structural- use roof deck panels.
 2. Section 061600 "Sheathing" for wood-based, structural-use roof deck panels.
 3. Section 072100 "Thermal Insulation" for insulation beneath the roof deck.
 4. Section 076000 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
 5. Section 077129 "Manufactured Roof Expansion Joints" for manufactured roof expansion-joint assemblies.
 6. Section 079200 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.
 7. Section 221316 "Building Sanitary and Storm Drainage" for roof drains.

1.3 DEFINITIONS

- A. Roofing Terminology: Definitions in ASTM D1079 and glossary in NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to Work of this Section.

1.4 QUALITY CONTROL

- A. Prior to the Notice of Award, the Contractor shall submit evidence that his existing company has five (5) years continuous successful experience in applying specified material(s), and is currently an approved applicator for the specific material manufacturer(s).

- B. Reference Standards: Except as modified by the Drawings and Specifications, the following documents, or applicable portions thereof, govern the work.
 - 1. National Roofing Contractors Association (NRCA) "Roofing and Waterproofing Manual - Fifth Edition.
- C. Qualifications:
 - 1. Contractor: Have installations of specified materials in use for a minimum period of five (5) years or authorized by manufacturer for application of specified roofing system.
 - 2. Same contractor that performed roof installation for adjacent Phase 1 existing building to be used for any required repair/tie-in work on this Project.
- D. Manufacturer's Products: Obtain roofing materials from only one manufacturer. Provide materials not available from the manufacturer from sources which are recommended and approved by the manufacturer.
- E. Underwriters Laboratories (UL) Listed Products: Provide materials which have been tested and listed by UL, and bear UL label on each package, or are shipped to the project with a UL certification of compliance.
- F. Fire and Insurance Ratings: Comply with ratings as required by governing authorities and codes, and comply with the following:
 - 1. Underwriters Laboratories (UL) "Class A" rating.
 - 2. Factory Mutual (FM) "1-90" minimum rating.
- G. Roofing System Design: Provide a membrane roofing system that is identical to systems that have been successfully tested by a qualified testing and inspecting agency to resist the factored design uplift pressures calculated according to SPRI's "Wind Load Design Guide for Fully Adhered and Mechanically Fastened Roofing Systems."

1.5 PREINSTALLATION MEETINGS

- A. Preinstallation Roofing Conference: Conduct conference at Project site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. For insulation and roof system component fasteners, include copy of FM Approvals' Roof Nav listing.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS
- C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane termination details.
3. Flashing details at penetrations.
4. Tapered insulation layout, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane, fastening spacings, and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with adjoining air barrier.

D. Samples for Verification: For the following products:

1. Roof membrane and flashings, of color required.
2. Walkway pads or rolls, of color required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer manufacturer and testing agency.

B. Product Test Reports: For roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

C. Evaluation Reports: For components of roofing system, from ICC-ES.

D. Field Test Reports:

1. Fastener-pullout test results and manufacturer's revised requirements for fastener patterns.

E. Field quality-control reports.

F. Sample Warranties: For manufacturer's special warranties.

1.8 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

B. Certified statement from existing roof membrane manufacturer stating that existing roof warranty has not been affected by Work performed under this Section.

C. Copy of membrane manufacturer's guarantee inspection report.

1.9 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is UL listed and listed in

FM Approvals' RoofNav for roofing system identical to that used for this Project.

- B. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.
- B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.
- C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.
- D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.11 PROTECTION

- A. Temporary tie-offs and water cut-offs shall be provided by the Roofing Contractor at the end of each day, and where and when a danger exists that water caused by precipitation may get under the new roofing membrane. Tie-offs or cut-offs shall extend beyond new insulation and membrane, and be adhered to the existing roof system. All temporary tie-offs and water cut-offs shall be removed prior to proceeding with the work by uncovering the edge of the insulation and removing all temporary materials.
- B. When installing temporary tie-offs or water cut-offs, do not cut any staggered insulation pieces that are already installed. Rather, straighten the staggered insulation with unattached pieces of insulation. Remove all temporary insulation pieces prior to proceeding with the work.
- C. Avoid heavy traffic on completed work.
- D. Restore to original condition or replace all work and materials damaged by roofing operations.

- E. Protect paving and building surfaces adjacent to hoists and other roofing equipment.
- F. Remove protection upon completion of roofing work.

1.12 FIELD CONDITIONS

- A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed according to manufacturer's written instructions and warranty requirements.

1.13 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.
 - 1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, vapor retarder, substrate board, and other components of roofing system.
 - 2. Warranty Period: 20 years from date of Substantial Completion.
- B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:
 - 1. Warranty Period: Two years from date of Substantial Completion.
- C. Existing Roof Warranty: Maintain existing roof warranty at Phase I building for modification of existing roof. See drawings for extents of existing roof modification.
 - 1. Utilize previous installer or other methods approved by architect to maintain existing roof warranty. Provide documentation that warranty has not been affected after completion of Phase I building roof modification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Installed roofing system and flashings shall withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roof system and flashings shall remain watertight.
 - 1. Accelerated Weathering: Roof membrane shall withstand 2000 hours of exposure when tested according to ASTM G152, ASTM G154, or ASTM G155.
 - 2. Impact Resistance: Roof membrane shall resist impact damage when tested according to ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic

Test" in FM Approvals 4470.

- B. **Material Compatibility:** Roofing materials shall be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.
- C. **Wind Uplift Resistance:** Design roofing system to resist the following wind uplift pressures when tested according to FM Approvals 4474, UL 580, or UL 1897:
- D. **Puncture Resistance:** 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
- E. **Solar Reflectance Index (SRI):** Three-year-aged SRI not less than 64 or initial SRI not less than 82 when calculated according to ASTM E 1980, based on testing identical products by a qualified testing agency.
- F. **ENERGY STAR Listing:** Roofing system shall be listed on the DOE's ENERGY STAR "Roof Products Qualified Product List" for low-slope roof products.
- G. **Energy Performance:** Roofing system shall have an initial solar reflectance of not less than 0.70 and an emissivity of not less than 0.75 when tested according to CRRC-1.
- H. **Exterior Fire-Test Exposure:** ASTM E108 or UL 790, Class B; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- I. **Fire-Resistance Ratings:** Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 THERMOPLASTIC POLYOLEFIN (TPO) ROOFING

- A. **TPO Sheet:** ASTM D6878/D6878M, internally fabric- or scrim-reinforced, fleece-backed TPO sheet.
 - 1. **Manufacturers:** Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Holcim-Elevate Building Products.
 - c. GAF.
 - d. Johns Manville; a Berkshire Hathaway company.
 - 2. **Source Limitations:** Obtain components for roofing system from roof membrane manufacturer.
 - 3. **Thickness:** 60 mils (1.5 mm), nominal.
 - 4. **Exposed Face Color:** White.
 - 5. **Recycled Content:** Postconsumer recycled content plus one-half of preconsumer recycled content not less than 20 percent.

2.3 AUXILIARY ROOFING MATERIALS

- A. General: Auxiliary materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.
 - 1. Adhesive and Sealants: Comply with VOC limits of authorities having jurisdiction.
 - 2. Verify adhesives and sealants comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Sheet Flashing: Manufacturer's standard unreinforced TPO sheet flashing, 60 mils (1.5 mm) thick, minimum, of same color as TPO sheet.
- C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.
- D. Roof Vents: As recommended by roof membrane manufacturer.
 - 1. Size: Not less than 4-inch (100-mm) diameter.
- E. Bonding Adhesive: Manufacturer's standard.
- F. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch (25 by 3 mm) thick; with anchors.
- G. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick (25 mm wide by 1.3 mm thick), prepunched.
- H. Fasteners: Factory-coated stainless steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roofing components to substrate, and acceptable to roofing system manufacturer.
- I. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, preformed inside and outside corner sheet flashings, T-joint covers, lap sealants, termination reglets, and other accessories.

2.4 SUBSTRATE BOARDS

- A. Substrate Board: ASTM C1177/C1177M, glass-mat, water-resistant gypsum board or ASTM C1278/C1278M, fiber-reinforced gypsum board.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- a. CertainTeed Corporation; Saint-Gobain North America.
 - b. Georgia-Pacific Gypsum LLC.
 - c. National Gypsum Company.
 - d. USG Corporation.
2. Thickness: 1/2 inch (13 mm) thick.
 3. Surface Finish: Unprimed.
- B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate board to roof deck.

2.5 VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil (1.0-mm) total thickness; maximum permeance rating of 0.1 perm (6 ng/Pa x s x sq. m); cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer. Vapor retarder to be produced by roof membrane manufacturer or approved by roofing manufacturer.

2.6 ROOF INSULATION

- A. General: Preformed roof insulation boards manufactured or approved by TPO roof membrane manufacturer.
- B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 1, Grade 2, felt or glass-fiber mat facer on both major surfaces.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Carlisle SynTec Incorporated.
 - b. Holcim-Elevate Building Products.
 - c. GAF.
 - d. Johns Manville; a Berkshire Hathaway company.
 2. Compressive Strength: 20 psi (138 kPa).
 3. Size: 48 by 48 inches (1219 by 1219 mm).
 4. Thickness:
 - a. Base Layer: 1-1/2 inches (38 mm).
 - b. Upper Layer: 4 inches (101.6 mm).
- C. Composite Polyisocyanurate Board Insulation: ASTM C1289, with factory-applied facing board on one major surface, as indicated below by type, and felt or glass-fiber mat facer on the other.
1. Manufacturers: Subject to compliance with requirements, provide products by

one of the following:

- a. Holcim-Elevate Building Products.
 - b. GAF.
 - c. Insulfoam; Carlisle Construction Materials Company.
 - d. Johns Manville; a Berkshire Hathaway company.
2. Facer: Type VII, glass-mat-faced gypsum board facer.
 3. Size: 48 by 48 inches (1219 by 1219 mm).
 4. Thickness: 1/2 inches.
- D. Tapered Insulation: Provide factory-tapered insulation boards.
1. Material: Match roof insulation.
 2. Minimum Thickness: 1/2 inch (12.7 mm).
 3. Slope:
 - a. Roof Field: 1/4 inch per foot (1:48) unless otherwise indicated on Drawings.
 - b. Saddles and Crickets: 1/2 inch per foot (1:24) unless otherwise indicated on Drawings.

2.7 INSULATION ACCESSORIES

- A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.
- B. Fasteners: Factory-coated steel fasteners with metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation and cover boards to substrate, and acceptable to roofing system manufacturer.
- C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:
1. Bead-applied, low-rise, one-component or multicomponent urethane adhesive.
 2. Verify adhesives and sealants comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Cover Board: HD Polyiso Coverboard
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Georgia-Pacific Gypsum LLC.
 - b. National Gypsum Company.
 - c. USG Corporation.

2. Thickness: 1/2 inch (13 mm).
3. Surface Finish: Unprimed.

2.8 EXPANSION JOINT COVERS

- A. Manufacturer List: Expansion joint covers of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 1. Johns Manville – Expand-O-Flash Expansion Joint Cover
 2. Approved equal
- B. Thickness: 0.060" (1.52 mm)
- C. Width: 16" min.
- D. Color: White

2.9 WALKWAYS

- A. Walkway Roof Pads: Thermoplastic walk pads, welded to roofing membrane with top edges beveled 3/16 inch (5 mm), factory cast for use as roof pavers; absorption not greater than 5 percent, ASTM C140/C140M; no breakage and maximum 1 percent mass loss when tested for freeze-thaw resistance, ASTM C67; and as follows:
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Hanover Architectural Products.
 - b. Wausau Tile Inc.
 2. Size: 24 by 24 inches (600 by 600 mm). Manufacture pavers to dimensional tolerances of plus or minus 1/16 inch (1.6 mm) in length, height, and thickness.
 3. Weight: 18 lb/sq. ft. (90 kg/sq. m).
 4. Compressive Strength: 6500 psi (45 MPa), minimum.
 5. Colors and Textures: As selected by Architect from manufacturer's full range.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
 1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
 2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
 3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 053100 "Steel Decking."
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation according to roofing system manufacturer's written instructions. Remove sharp projections.

- B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.
- C. Examine the surface condition of the substrate and the conditions under which roofing work is to be performed. Do not proceed with the work until unsatisfactory conditions have been corrected in an approved manner.
- D. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- E. Provide temporary protection as needed if watertightness is compromised.
- F. Close off roof drains and other penetrations to prevent materials from entering and clogging drains and conductors, and from spilling or migrating onto adjacent surfaces. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION OF ROOFING, GENERAL

- A. Install roofing system according to roofing system manufacturer's written instructions, listed roof assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.
- B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning Work on adjoining roofing.
- C. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 072715 "Self-Adhering Water Resistive Air Barrier Membrane."
- D. Install roofing membrane and base flashings according to roofing-system manufacturer's written instructions and applicable recommendations of NRCA/ARMA Quality Control Guidelines for Application of Thermoplastic Polyolefin Roofing.

3.4 INSTALLATION OF SUBSTRATE BOARD

- A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches (610 mm) in adjacent rows.
 - 1. At steel roof decks, install substrate board at right angle to flutes of deck.
 - a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck according to recommendations in FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof according to roofing system manufacturers' written instructions.

3.5 INSTALLATION OF VAPOR RETARDER

- A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches (90 and 150 mm), respectively.
 1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
 2. Seal laps by rolling.
- B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF INSULATION

- A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.
- B. Comply with roofing system and roof insulation manufacturer's written instructions for installing roof insulation.
- C. Installation Over Metal Decking:
 1. Install base layer of insulation with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
 - a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.

- e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Cut and fit insulation within 1/4 inch (6 mm) of nailers, projections, and penetrations.
 - 1) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.
2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches (305 mm) from previous layer of insulation.
- a. Install with long joints continuous and with end joints staggered not less than 12 inches (305 mm) in adjacent rows.
 - b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - c. Make joints between adjacent insulation boards not more than 1/4 inch (6 mm) in width.
 - d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches (610 mm).
 - 1) Trim insulation so that water flow is unrestricted.
- e. Fill gaps exceeding 1/4 inch (6 mm) with insulation.
 - f. Adhere each layer of insulation to substrate using adhesive according to FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:
 - 1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF COVER BOARDS

- A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches (150 mm) in each direction.
 - 1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
 - 2. At internal roof drains, conform to slope of drain sump.
 - a. Trim cover board so that water flow is unrestricted.
 - 3. Cut and fit cover board tight to nailers, projections, and penetrations.
 - a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.8 INSTALLATION OF SELF-ADHERING ROOF MEMBRANE

- a. Adhere roof membrane over area to receive roofing according to roofing system manufacturer's written instructions.

- b. Unroll roof membrane and allow to relax before installing.
- c. Start installation of roofing in presence of roofing system manufacturer's technical personnel and Owner's testing and inspection agency.
- d. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer.
 - 1) Stagger end laps.
- e. Fold roof membrane to expose half of sheet width's bottom surface.
 - 1) Remove release liner on exposed half of sheet.
 - 2) Roll roof membrane over substrate while avoiding wrinkles.
- f. Fold remaining half of roof membrane to expose bottom surface.
 - 1) Remove release liner on exposed half of sheet.
 - 2) Roll roof membrane over substrate while avoiding wrinkles.
- g. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeter of roofing.
- h. Apply roof membrane with side laps shingled with slope of roof deck where possible.
- i. Seams: Clean seam areas, overlap roof membrane, and hot-air weld side and end laps of roof membrane and sheet flashings, to ensure a watertight seam installation.
 - 1) Test lap edges with probe to verify seam weld continuity.
 - 2) Apply lap sealant to seal cut edges of roof membrane and flashing sheet.
 - 3) Verify field strength of seams a minimum of twice daily, and repair seam sample areas.
 - 4) Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.
- j. Spread sealant bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

3.9 INSTALLATION OF BASE FLASHING

- A. Install sheet flashings and preformed flashing accessories, and adhere to substrates according to roofing system manufacturer's written instructions.
- B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.
- C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

- D. Clean seam areas, overlap, and firmly roll sheet flashings into the adhesive. Hot-air weld side and end laps to ensure a watertight seam installation.
- E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.10 INSTALLATION OF WALKWAYS

- A. Roof Walkway Pads: Install walkway roof pads according to manufacturer's written instructions.
 - 1. Install roof walkway pads at the following locations:
 - a. Perimeter of each rooftop unit.
 - b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
 - c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
 - d. Top and bottom of each roof access ladder.
 - e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
 - f. Locations indicated on Drawings.
 - g. As required by roof membrane manufacturer's warranty requirements.
 - 2. Provide 3 inches (75 mm) of space between adjacent roof pads

3.11 FIELD QUALITY CONTROL

- A. Testing Agency: Owner to engage a qualified testing agency to perform tests and to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.
- B. Perform the following tests:
 - 1. High or Low Voltage Electronic Leak Detection: Perform testing for each roof area.
 - 2. Flood Testing: Flood test at each drain location to identify leaks, according to recommendations in ASTM D5957, after completing roofing and flashing but before overlying construction is placed. Install temporary containment assemblies, plug or dam drains, and flood with potable water.
 - a. Perform tests before overlying construction is placed.
 - b. Flood to an average depth of 2-1/2 inches (65 mm) with a minimum depth of 1 inch (25 mm) and not exceeding a depth of 4 inches (100 mm). Maintain 2 inches (50 mm) of clearance from top of base flashing.
 - c. Flood each area for 24 hours.
 - d. After flood testing, repair leaks, repeat flood tests, and make further repairs until roofing and flashing installations are watertight.
 - 1) Cost of retesting is Contractor's responsibility.

- e. Testing agency shall prepare survey report indicating locations of initial leaks, if any, and final survey report.
- C. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.
- D. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.
- E. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.12 PROTECTING AND CLEANING

- A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.
- B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and according to warranty requirements.

3.13 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS _____
of _____,
_____, herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1. Owner: _____
 - 2. Address: _____
 - 3. Building Name/Type: _____
 - 4. Area of Work: _____
 - 5. Acceptance Date: _____.
 - 6. Warranty Period: _____
 - 7. Expiration Date: _____.
- B. AND WHEREAS Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- C. NOW THEREFORE Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period Roofing Installer will, at Roofing Installer's own cost and expense, make or cause to be made such repairs to

or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.

- D. This Warranty is made subject to the following terms and conditions:
1. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - a. lightning;
 - b. peak gust wind speed exceeding 55 mph;
 - c. fire;
 - d. failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - e. faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - f. vapor condensation on bottom of roofing; and
 - g. activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner.
 2. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof have been paid by Owner or by another responsible party so designated.
 3. Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents resulting from leaks or faults or defects of work.
 4. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 5. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 6. Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 7. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure.

Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.

E. IN WITNESS THEREOF, this instrument has been duly executed this _____

1. Authorized Signature: _____.
2. Name: _____.
3. Title: _____.

END OF SECTION 07 54 23

SECTION 07 60 00 – SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Manufactured reglets with counterflashing.
 - 2. Formed roof-drainage sheet metal fabrications.
 - 3. Formed low-slope roof sheet metal fabrications.
 - 4. Formed wall sheet metal fabrications.
 - 5. Formed equipment support flashing.
 - 6. Formed overhead-piping safety pans.
- B. Related Requirements:
 - 1. Section 07 54 23 "Thermoplastic-Polyolefin (TPO) Roofing " for installation of sheet metal flashing and trim integral with roofing.
 - 2. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
 - 3. Section 07 95 13.16 "Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.3 COORDINATION

- A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.
- B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review construction schedule. Verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review special roof details, roof drainage, roof-penetration flashing, equipment curbs, and condition of other construction that affect sheet metal flashing and

- trim.
- 3. Review requirements for insurance and certificates if applicable.
- 4. Review sheet metal flashing observation and repair procedures after flashing installation.

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Verify existing dimensions and details prior to start of sheet-metal Work. Notify Architect/Engineer of conditions found to be different than those indicated in the Contract Documents. Architect/Engineer will review situation and inform Contractor and Installer of changes.
- B. Comply with Owner's limitations and restrictions for Site use and accessibility.
- C. Environmental Limitations: Install sheet-metal members when existing and forecast weather conditions permit sealants, coatings, and miscellaneous materials to be installed according to sealant, coating, or miscellaneous material manufacturer's written instructions and warranty requirements.
- D. Handle and install materials in strict accordance with safety requirements required by sheet-metal manufacturer; Safety Data Sheets (SDS); and local, state, and federal rules and regulations. Maintain Safety Data Sheets (SDS) with materials in storage area and available for ready reference on Site.

1.6 ACTION SUBMITTALS

- A. Product Data: For each of the following:
 - 1. Elastomeric sealant.
 - 2. Butyl sealant.
 - 3. Epoxy seam sealer.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements
- C. Shop Drawing: For sheet metal flashing and trim.
 - 1. Include plans, elevations, sections, and attachment details.
 - a. Detail fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
 - b. Include identification of material, thickness, weight, and finish for each item and location in Project.
 - c. Include details for forming, including profiles, shapes, seams, and dimensions.
 - d. Include details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
 - e. Include details of termination points and assemblies.
 - f. Include details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
 - g. Include details of roof-penetration flashing.

- h. Include details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counter-flashings.
 - i. Include details of special conditions.
 - j. Include details of connections to adjoining work.
 - k. Detail formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches.
- D. Samples: For each exposed product and for each color and texture specified, 12 inches long by actual width.
- E. Samples for Verification: For each type of exposed finish.
- 1. Sheet Metal Flashing: 12 inches 300 mm long by actual width of unit, including finished seam and in required profile. Include fasteners, cleats, clips, closures, and other attachments.
 - 2. Trim, Metal Closures, Expansion Joints, Joint Intersections, and Miscellaneous Fabrications: 12 inches 300 mm long and in required profile. Include fasteners and other exposed accessories.
 - 3. Anodized Aluminum Samples: Samples to show full range to be expected for each color required.

1.7 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For fabricator.
- B. Product Certificates: For each type of coping and roof edge flashing that is ANSI/SPRI/FM 4435/ES-1 tested.
- C. Product Test Reports: For each product, for tests performed by a qualified testing agency.
- D. Evaluation Reports: For copings and roof edge flashing, from an agency acceptable to authority having jurisdiction showing compliance with ANSI/SPRI/FM 4435/ES-1.
- E. Sample Warranty: For special warranty.

1.8 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For sheet metal flashing and trim, and its accessories, to include in maintenance manuals.
- B. Special warranty.

1.9 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced firm that has successfully completed sheet-metal work similar in material, design, and extent to that indicated for Project. Must have successful installations of specified materials in local area in use for minimum of five years.

1. Employ foreman with minimum five years of experience as foreman on similar projects, to be on Site at all times during Work. Do not change foremen during the course of the Project except for reasons beyond the control of the Installer; inform Architect/Engineer in advance of any changes.
- B. Fabricator Qualifications: Employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.
 1. For copings and roof edge flashings that are ANSI/SPRI/FM 4435/ES-1 tested, shop shall be listed as able to fabricate required details as tested and approved.
- C. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockup of typical roof edge, including, approximately 10 feet (3.0 m) long, including supporting construction cleats, seams, attachments, underlayment, and accessories.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations in writing.
 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Installer Qualifications: Experienced firm that has successfully completed sheet-metal work similar in C. Limit stored materials on structures.
- B. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.
- C. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
 1. Protect stored sheet metal flashing and trim from contact with water.
- D. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.11 PROJECT CONDITIONS

- A. Coordinate Work to ensure that adjacent areas are not adversely affected.
Coordinate:
 1. With Contractor
 2. With other trades:
 - a. To ensure that work done by other trades is complete and ready for sheet- metal Work.
 - b. To avoid or minimize work on, or in immediate vicinity of, sheet-metal

- Work in progress.
- c. To ensure that subsequent work will not adversely affect completed sheet-metal Work.
3. With interfacing and adjoining construction to provide leakproof, secure, and non-corrosive installation. Coordinate:
- a. Installation of roof drainage system with installation of roof perimeter flashing.
 - b. Counterflashing installation with base flashing installation.
 - c. Installation of roof-penetration flashing with installation of roofing and other items penetrating roof.
 - d. Installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

1.12 WARRANTY

- A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.
- B. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:
 - 1. Chalking in excess of a No.8 rating when tested in accordance with ASTM D4214.
 - 2. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
- C. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, shall withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim shall not rattle, leak, or loosen, and shall remain watertight.
- B. Sheet Metal Standard for Flashing and Trim: Comply with NRCA's "The NRCA Roofing Manual: Architectural Metal Flashing, Condensation and Air Leakage Control, and Reroofing" and SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.
- C. SPRI Wind Design Standard: Manufacture and install copings and roof edge flashings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:
 - 1. Design Pressure: As indicated on Drawings.
- D. Thermal Movements: Allow for thermal movements from ambient and surface

temperature changes to prevent buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change: 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.

2.2 SHEET METALS

- A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.
- B. Aluminum Sheet: ASTM B209 (ASTM B209M), alloy as standard with manufacturer for finish required, with temper as required to suit forming operations and performance required; with smooth, flat embossed surface.
 1. Recycled Content: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 50 percent.
 2. Clear Anodic Finish, Coil Coated: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 3. Exposed Coil-Coated Finish:
 - a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent polyvinylidene fluoride (PVDF) resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions for seacoast and severe environments.
 - 1) Color: As selected by Architect from manufacturer's full range.
 4. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester backer finish, consisting of prime coat and wash coat with minimum total dry film thickness of 0.5 mil.

2.3 UNDERLAYMENT MATERIALS

- A. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt; nonperforated.
- B. Synthetic Underlayment: Laminated or reinforced, woven polyethylene or polypropylene, synthetic roofing underlayment; bitumen free; slip resistant; suitable for high temperatures over 220 deg F (111 deg C); and complying with physical requirements of ASTM D226/D226M for Type I and Type II felts.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Atlas EPS; a Division of Atlas Roofing Corporation.
 - b. Intertape Polymer Group.
 - c. Kirsch Building Products, LLC.
 - d. SDP Advanced Polymer Products Inc.
 2. Source Limitations: Obtain underlayment from single source from single manufacturer.

- C. Self-Adhering, High-Temperature Sheet Underlayment: Minimum 30 mils thick, consisting of a slip-resistant polyethylene- or polypropylene-film top surface laminated to a layer of butyl- or SBS-modified asphalt adhesive, with release-paper backing; specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer in accordance with underlayment manufacturer's written instructions.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Carlisle Residential; a division of Carlisle Construction Materials.
 - b. GCP Applied Technologies Inc.
 - c. Henry Company.
 - d. Metal-Fab Manufacturing, a Drexel Metals Company.
 - e. Owens Corning
 2. Source Limitations: Obtain underlayment from single source from single manufacturer.
 3. Low-Temperature Flexibility: ASTM D1970/D1970M; passes after testing at minus 20 deg F (29 deg C) or lower.
 4. Slip Sheet: Rosin-sized building paper, 3 lb/100 sq. ft. (0.16 kg/sq. m) minimum.

2.4 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and as recommended by manufacturer of primary sheet metal or manufactured item unless otherwise indicated.
- B. Fasteners: Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by manufacturer of primary sheet metal or manufactured item.
- C. General: Blind fasteners or self-drilling screws, gasketed, with hex-washer head.
1. Blind Fasteners: High-strength aluminum or stainless-steel rivets suitable for metal being fastened.
- D. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory- applied coating. Provide metal-backed EPDM or PVC sealing washers under heads of exposed fasteners bearing on weather side of metal.
- E. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
- F. Sealant Tape: Pressure-sensitive, 100 percent solids, polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
- G. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polysulfide silicone polymer sealant; of type, grade, class, and use classifications required to seal joints in sheet metal flashing and trim and remain watertight.

- H. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for hooked-type expansion joints with limited movement. All bed joints or slices between metal panels to have a transverse row of butyl sealant.
- I. Epoxy Seam Sealer: Two-part, noncorrosive, aluminum seam-cementing compound, recommended by aluminum manufacturer for exterior nonmoving joints, including riveted joints.
- J. Bituminous Coating: Cold-applied asphalt emulsion in accordance with ASTM D1187/D1187M.
- K. Asphalt Roofing Cement: ASTM D4586, asbestos free, of consistency required for application.
- L. Reglets: Units of type, material, and profile required, formed to provide secure interlocking of separate reglet and counterflashing pieces, and compatible with flashing indicated with factory-mitered and -welded corners and junctions with interlocking counterflashing on exterior face, of same metal as reglet.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Heckmann Building Products, Inc.
 - b. Hickman Company, W. P.
 - c. Hohmann & Barnard, Inc.
 - d. Keystone Flashing Company, Inc.
 - e. National Sheet Metal Systems, Inc.
 - 2. Source Limitations: Obtain reglets from single source from single manufacturer.
 - 3. Material: Stainless steel, 0.0188 inch thick, Aluminum, 0.024 inch thick.
 - 4. Surface-Mounted Type: Provide with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
 - 5. Concrete Type: Provide temporary closure tape to keep reglet free of concrete materials, special fasteners for attaching reglet to concrete forms, and guides to ensure alignment of reglet section ends.

2.5 FABRICATION, GENERAL

- A. Custom fabricate to comply with recommendations in SMACNA's Architectural Sheet Metal Manual, that apply to design, dimensions, metal, and other characteristics of item indicated. Conform to dimensions and profiles shown in SMACNA's Architectural Sheet Metal Manual, unless requirements that are more stringent are indicated.
 - 1. Obtain field measurements for accurate fit before fabrication.
 - 2. Shop fabricate items where practicable.
- B. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

- C. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
 - 1. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
 - 2. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
 - 3. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
 - 4. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

- D. Fabrication Tolerances:
 - 1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
 - a. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

- E. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.
 - 1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
 - 2. Use lapped expansion joints only where indicated on Drawings.

- F. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.
 - 1. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.
 - 2. Retain option in first paragraph below if Project is FM Global insured or if FM Global requirements set a minimum installation standard. FM Global states that cleats (hook strips) for fasciae "should be at least one gauge heavier than the fascia metal."

- G. Seams:
 - 1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
 - 2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer.

- H. Conceal fasteners and expansion provisions, where possible, on exposed sheet-metal flashing and trim, unless otherwise indicated.

- I. Do not use graphite pencils to mark metal surfaces.

2.6 ROOF-DRAINAGE SHEET METAL FABRICATIONS

- A. Downspouts: Fabricate round rectangular open-face downspouts to dimensions indicated on Drawings, complete with mitered elbows. Furnish with metal hangers from same material as downspouts and anchors. Shop fabricate elbows.
 - 1. Fabricated Hanger Style: in accordance with SMACNA's "Architectural Sheet Metal Manual."
 - 2. Manufactured Hanger Style: in accordance with SMACNA's "Architectural Sheet Metal Manual."
 - 3. Fabricate from the following materials:
- B. Parapet Scuppers: Fabricate scuppers to dimensions required, with closure flange trim to exterior, 4-inch wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof. Fasten gravel guard angles to base of scupper. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
- C. Conductor Heads: Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shape required, complete with outlet tubes, exterior flange trim, built-in overflows. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
- D. Splash Pans: Fabricate to dimensions and shape required and from the following materials:
 - 1. Aluminum: 0.040 inch thick.

2.7 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

- A. Roof Edge Flashing (Gravel Stop) and Fascia Cap: Fabricate in minimum 96-inch long, but not exceeding 12-foot long sections. Furnish with 6-inch wide, joint cover plates. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch wide, concealed backup plate.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
- B. Cleats: To be continuous (one gauge thicker than flashing)
 - 1. Fabricate from the following materials:
 - a. Aluminum: 0.064 inch thick.
- C. Copings: Fabricate in minimum 8' long, but not exceeding 12', sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and drill elongated holes for fasteners on interior leg. Miter corners, fasten and seal watertight. Shop fabricate interior and exterior corners.
 - 1. Joint Style: Butted with expansion space and 6-inch wide, concealed backup plate.
 - 2. Fabricate from the following materials:
 - a. Aluminum: 0.050 inch thick.
- D. Roof-to-Wall Transition, Expansion-Joint Cover: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.050 inch thick.

- E. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.
- F. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.
- G. Flashing Receivers: Fabricate from the following materials:
 - 1. Aluminum: 0.032 inch thick.

2.8 WALL SHEET METAL FABRICATIONS

- A. Wall Expansion-Joint Cover: Fabricate from the following materials:
 - 1. Aluminum: 0.040 inch thick.

2.9 MISCELLANEOUS SHEET METAL FABRICATIONS

- A. Overhead-Piping Safety Pans: Fabricate from the following materials:
 - 1. Stainless Steel: 0.0250 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with installer present, for compliance with requirements for installation tolerances, substrate, and other conditions affecting performance of the Work.
- B. Verify compliance with requirements for installation tolerances of substrates.
 - 1. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
 - 2. Verify that air- or water-resistant barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

- A. Felt Underlayment: Install felt underlayment, wrinkle free, using adhesive to minimize use of mechanical fasteners under sheet metal flashing and trim.
- B. Install in shingle fashion to shed water.
 - 1. Lap joints not less than 2 inches.

- C. Synthetic Underlayment: Install synthetic underlayment, wrinkle free, in accordance with manufacturers' written instructions, and using adhesive where possible to minimize use of mechanical fasteners under sheet metal.
 - 1. Lap horizontal joints not less than 4 inches.
 - 2. Lap end joints not less than 12 inches.

- D. Self-Adhering, High-Temperature Sheet Underlayment:
 - 1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
 - 2. Prime substrate if recommended by underlayment manufacturer.
 - 3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
 - 4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
 - 5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
 - 6. Roll laps and edges with roller.
 - 7. Cover underlayment within 14 days.

- E. Install slip sheet, wrinkle free, over underlayment before installing sheet metal flashing and trim.
 - 1. Install in shingle fashion to shed water.
 - 2. Lapp joints not less than 4 inches.

3.3 INSTALLATION GENERAL

- A. General: Install sheet-metal flashings and trim according to recommendations in SMACNA's Architectural Sheet Metal Manual and as indicated.

- B. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

- C. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
 - 1. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of solder.
 - 2. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
 - 3. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
 - 4. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
 - 5. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.
 - 6. Install exposed sheet metal flashing and trim with NO oil-canning, and free of buckling and tool marks.
 - 7. Do not field cut sheet metal flashing and trim by torch.
 - 8. Do not use graphite pencils to mark metal surfaces.

- D. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or

by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum stainless steel sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
 2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.
- E. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.
1. Space movement joints at maximum of 10 feet with no joints within 24 inches of corner or intersection.
 2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
 3. Use lapped expansion joints only where indicated on Drawings.
- F. Fasteners: Use fastener sizes that penetrate substrate not less than recommended by fastener manufacturer to achieve maximum pull-out resistance.
1. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.
 2. Seal joints as required for watertight construction.
 3. Use sealant-filled joints unless otherwise indicated.
 - a. Embed hooked flanges of joint members not less than 1 inch into sealant.
 - b. Form joints to completely conceal sealant.
 - c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
 - d. Adjust setting proportionately for installation at higher ambient temperatures.
 - e. Do not install sealant-type joints at temperatures below 40 deg F.
 - f. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.4 INSTALLATION OF ROOF-DRAINAGE SYSTEM

- A. Install sheet metal roof-drainage items to produce complete roof-drainage system in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of roof perimeter flashing with installation of roof-drainage system.
1. Downspouts: Join sections with 1-1/2-inch telescoping joints.
 - a. Provide hangers with fasteners designed to hold downspouts securely to walls.
 - b. Locate hangers at top and bottom and at approximately 60 inches o.c.
 - c. Provide elbows at base of downspout to direct water away from building.
 - d. Connect downspouts to underground drainage system.
 2. Parapet Scuppers: Continuously support scupper, set to correct elevation, and seal flanges to interior wall face, over cants or tapered edge strips, and under roofing membrane.
 - a. Continuously support scupper, set to correct elevation, and seal flanges

- to interior wall face, over cants or tapered edge strips, and under roofing membrane.
- b. Anchor scupper closure trim flange to exterior wall and solder to scupper.
- c. Loosely lock front edge of scupper with conductor head.
- 3. Conductor Heads: Anchor securely to wall, with elevation of conductor head rim at minimum of 1 inch below scupper or gutter discharge.
- 4. Expansion-Joint Covers: Install expansion-joint covers at locations and of configuration indicated on Drawings. Lap joints minimum of 4 inches in direction of water flow.

3.5 INSTALLATION OF ROOF FLASHINGS

- A. Install sheet metal flashing and trim to comply with performance requirements[, sheet metal manufacturer's written installation instructions,] and cited sheet metal standard.
- B. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
 - 1. Install work with laps, joints, and seams that are permanently watertight and weather resistant.
- C. Roof Edge Flashing:
 - 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 - a. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
- D. Copings:
 - 1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
 - a. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.
- E. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.
- F. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.
Insert counterflashing in reglets or receivers and fit tightly to base flashing.
 - 1. Extend counterflashing 4 inches over base flashing.
 - 2. Lap counterflashing joints minimum of 4 inches.
- G. Roof-Penetration Flashing: Coordinate installation of roof-penetration flashing with installation of roofing and other items penetrating roof. Seal with elastomeric butyl sealant and clamp flashing to pipes that penetrate roof.

3.6 INSTALLATION OF WALL FLASHINGS

- A. Install sheet metal wall flashing to intercept and exclude penetrating moisture in accordance with cited sheet metal standard unless otherwise indicated. Coordinate installation of wall flashing with installation of wall-opening components such as windows, doors, and louvers.

3.7 INSTALLATION OF MISCELLANEOUS FLASHING

- A. Equipment Support Flashing:
 - 1. Coordinate installation of equipment support flashing with installation of roofing and equipment.
 - a. Weld or seal flashing with elastomeric sealant to equipment support member.
- B. Overhead-Piping Safety Pans:
 - 1. Suspend pans from structure above, independent of other overhead items such as equipment, piping, and conduit, unless otherwise indicated on Drawings.
 - 2. Pipe and install drain line to plumbing waste or drainage system.

3.8 INSTALLATION TOLERANCES

- A. Installation Tolerances: Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 feet on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.9 CLEANING

- A. Clean exposed metal surfaces of substances that interfere with uniform oxidation and weathering.
 - 1. Clean and neutralize flux materials. Clean off excess solder.
 - 2. Clean off excess sealants.

3.10 PROTECTION

- A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.
 - 1. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.
 - 2. Maintain sheet metal flashing and trim in clean condition during construction.
 - 3. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 60 00

SECTION 07 72 00 - ROOF ACCESSORIES**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Roof railing system.
2. Roof curbs.
3. Equipment supports.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for metal vertical ladders, ships' ladders, and stairs for access to roof hatches.
2. Section 05 52 13 "Pipe and Tube Railings" for safety railing systems not attached to roof-hatch curbs.
3. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-formed metal flashing, roof-drainage systems, roof expansion-joint covers, and miscellaneous sheet metal trim and accessories.
4. Section 23 05 48 "Vibration and Seismic Controls for HVAC" for special curbs designed to accommodate seismic and vibration controls.
5. Section 23 34 23 "HVAC Power Ventilators" for power roof-mounted ventilators.
6. Section 23 74 13 "Packaged, Outdoor, Central-Station Air-Handling Units" for standard curbs specified with rooftop units.

1.2 COORDINATION

- A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.
- B. Coordinate dimensions with rough-in information or Shop Drawings of equipment to be supported.

1.3 ACTION SUBMITTALS**A. Product Data:** For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between

plant- and field-assembled work.

- C. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements
- D. Samples: For each exposed product and for each color and texture specified, prepared on Samples of size to adequately show color.
- E. Delegated-Design Submittal: For roof curbs and equipment supports indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 1. Detail mounting, securing, and flashing of roof-mounted items to roof structure. Indicate coordinating requirements with roof membrane system.
 - 2. Wind-Restraint Details: Detail fabrication and attachment of wind restraints. Show anchorage details and indicate quantity, diameter, and depth of penetration of anchors.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:
 - 1. Size and location of roof accessories specified in this Section.
 - 2. Method of attaching roof accessories to roof or building structure.
 - 3. Other roof-mounted items including mechanical and electrical equipment, ductwork, piping, and conduit.
 - 4. Required clearances.
- B. Sample Warranties: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roof accessories to include in operation and maintenance manuals.

1.6 DELIVERY, STORAGE AND HANDLING

- A. Deliver, store, and handle materials according to manufacturer's recommendations and in such a manner as to prevent damage to materials or structure.
- B. Pack, handle, and ship roof accessories properly labeled in heavy-duty packaging to prevent damage.
- C. Deliver accessories to Site in original packages with seals unbroken, labeled with manufacturer's name, product brand name and type, date of manufacture, and directions for storing.

- D. Store accessories in original, undamaged containers in clean, dry, protected location on raised platforms with weather-protective coverings, within temperature range required by roofing system manufacturer. Protect UV-sensitive accessories from direct sunlight.
- E. Do not store accessories at locations where new roofing materials have been installed.
- F. Limit stored materials on structures to safe loading capacity of structure at time materials are stored, and to avoid permanent deck deflection.
- G. Conspicuously mark damaged accessories and remove from Site as soon as possible.

1.7 WARRANTY

- A. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finishes or replace roof accessories that show evidence of deterioration of factory-applied finishes within specified warranty period.
 - 1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested according to ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested according to ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 - 2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. General Performance: Roof accessories shall withstand exposure to weather and resist thermally induced movement without failure, rattling, leaking, or fastener disengagement due to defective manufacture, fabrication, installation, or other defects in construction.
- B. Structural performance of top rails and supports:
 - 1. Capable of withstanding a concentrated load of 200 pounds (90.6 kg), applied to the top rail at any point and in any direction.
 - 2. Capable of withstanding a uniform load of 50 pounds per linear foot (74.3 kg/m) applied to the top rail horizontally with a simultaneous load of 100 pounds per linear foot (148.6 kg/m) applied vertically downward.
 - 3. Design need not provide for both concentrated and uniform loads to be applied concurrently.
- C. Structural performance of railing infill:
 - 1. Capable of withstanding a horizontal concentrated load of 200 pounds (90.6 kg),

- applied to one foot (30.5mm) square area at any point on the infill.
- 2. Infill includes panels, intermediate rails, posts and other elements.
- 3. Design need not provide for infill loads to be applied concurrently with top rail loading.

2.2 ROOF RAILING SYSTEM

- A. Safety Guardrail: Permanent, roof-mount, guardrail system.
 - 1. Material:
 - a. Post assembly and rails: Profiled high tensile 6106-T6 aluminum. Mill finish.
 - b. End caps and elbows: Die cast aluminum.
 - 2. Dimensions:
 - a. Top rail: Aluminum 6106-T6 2-inch round handrail.
 - b. Height: 42 inches above the walking surface.
 - c. Mid rail: Aluminum 6106-T6 1-5/8 inch round kneerail tube. Distance between top rail/mid rail and mid rail/walking surface cannot exceed 19 inches.
 - d. Post: Aluminum 6106-T6 2-1/4 x 1-1/2 x 1/8 inches tube.
 - 3. Mounting: Roof mount, set to structural steel roof members, extended thru tapered insulation.

2.3 ROOF CURBS

- A. Roof Curbs: Internally reinforced roof-curb units capable of supporting superimposed live and dead loads, including equipment loads and other construction indicated on Drawings, bearing continuously on roof structure, and capable of meeting performance requirements; with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Adaptable Air Products.
 - b. AES Industries, Inc.
 - c. Air Balance; a division of MESTEK, Inc.
 - d. Conn-Fab Sales, Inc.
 - e. Curbs Plus, Inc.
 - f. Custom Solution Roof and Metal Products.
 - g. Greenheck Fan Corporation.
 - h. KCC International Inc.
 - i. Kingspan Light + Air, North America.
 - j. Lloyd Industries, Inc.
 - k. LMCurbs.

- l. Louvers & Dampers, Inc.; a division of Mestek, Inc.
 - m. Metallic Products Corp.
 - n. Pate Company (The).
 - o. Plenums Incorporated.
 - p. Roof Curb Systems.
 - q. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - r. Roof Products, Inc.
 - s. Sunoptics Skylights and Daylighting Systems; Acuity Brands International, Inc.
 - t. Thybar Corporation.
 - u. Vent Products Co., Inc.
- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.
- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.
- D. Material: Stainless steel sheet, 0.0781 inch thick, 300 series.
- 1. Finish: Manufacturer's standard.
- E. Construction:
- 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 - 2. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 - 3. Fabricate curbs to minimum height of 12 inches above new/finished roofing surface unless otherwise indicated.
 - 4. Top Surface: Level top of curb, with roof slope accommodated by sloping deck- mounting flange or by use of leveler frame.
 - 5. Sloping Roofs: Where roof slope exceeds 1:48, fabricate curb with perimeter curb height tapered to accommodate roof slope so that top surface of perimeter curb is level. Equip unit with water diverter or cricket on side that obstructs water flow.
 - 6. Insulation: Factory insulated with 2-inch- thick glass-fiber board insulation.
 - 7. Liner: Same material as curb, of manufacturer's standard thickness and finish.
 - 8. Platform Cap: Where portion of roof curb is not covered by equipment, provide weathertight platform cap formed from 3/4-inch-thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 - 9. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as curb.

2.4 EQUIPMENT SUPPORTS

- A. Equipment Supports: Rail-type metal equipment supports capable of supporting superimposed live and dead loads between structural supports, including equipment loads and other construction indicated on Drawings, spanning between structural supports; capable of meeting performance requirements; with welded corner joints, and integrally formed structure-mounting flange at bottom.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adaptable Air Products.
 - b. AES Industries, Inc.
 - c. Air Balance; a division of MESTEK, Inc.
 - d. Conn-Fab Sales, Inc.
 - e. Curbs Plus, Inc.
 - f. Custom Solution Roof and Metal Products.
 - g. Greenheck Fan Corporation.
 - h. KCC International Inc.
 - i. Lloyd Industries, Inc.
 - j. LMCurbs.
 - k. Louvers & Dampers, Inc.; a division of Mestek, Inc.
 - l. Pate Company (The).
 - m. Plenums Incorporated.
 - n. Portals Plus; a division of Hart & Cooley, Inc.
 - o. Roof Curb Systems.
 - p. Roof Products and Systems (RPS); a division of Hart & Cooley, Inc.
 - q. Roof Products, Inc.
 - r. Thybar Corporation.
 - s. Vent Products Co., Inc.

- B. Size: Coordinate dimensions with roughing-in information or Shop Drawings of equipment to be supported.

- C. Supported Load Capacity: Coordinate load capacity with information on Shop Drawings of equipment to be supported.

- D. Material: Stainless steel sheet, 0.0781 inch thick.
 1. Finish: Manufacturer's standard.

- E. Construction:
 1. Curb Profile: Manufacturer's standard compatible with roofing system.
 2. Insulation: Factory insulated with 1-1/2-inch- thick glass-fiber board insulation.
 3. Liner: Same material as equipment support, of manufacturer's standard thickness and finish.
 4. Platform Cap: Where portion of equipment support is not covered by equipment, provide weathertight platform cap formed from 3/4-inch-thick plywood covered with metal sheet of same type, thickness, and finish as required for curb.
 5. Metal Counterflashing: Manufacturer's standard, removable, fabricated of same metal and finish as equipment support.
 6. On ribbed or fluted metal roofs, form deck-mounting flange at perimeter bottom to conform to roof profile.
 7. Fabricate equipment supports to minimum height of 12 inches above new/finished roofing surface unless otherwise indicated.

8. Sloping Roofs: Where roof slope exceeds 1:48, fabricate each support with height to accommodate roof slope so that tops of supports are level with each other. Equip supports with water diverters or crickets on sides that obstruct water flow.

2.5 METAL MATERIALS

- A. Aluminum Sheet: ASTM B209, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.
 1. Mill Finish: As manufactured.
 2. Factory Prime Coating: Where field painting is indicated, apply pretreatment and white or light-colored, factory-applied, baked-on epoxy primer coat, with a minimum dry film thickness of 0.2 mil.
 3. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.
 4. Baked-Enamel or Powder-Coat Finish: AAMA 2603 except with a minimum dry film thickness of 1.5 mils. Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 5. Concealed Finish: Pretreat with manufacturer's standard white or light-colored acrylic or polyester-backer finish consisting of prime coat and wash coat, with a minimum total dry film thickness of 0.5 mil.
- B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.
- C. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.
- D. Steel Shapes: ASTM A36/A36M, hot-dip galvanized according to ASTM A123/A123M unless otherwise indicated.
- E. Steel Tube: ASTM A500/A500M, round tube.
- F. Galvanized-Steel Tube: ASTM A500/A500M, round tube, hot-dip galvanized according to ASTM A123/A123M.
- G. Steel Pipe: ASTM A53/A53M, galvanized.

2.6 MISCELLANEOUS MATERIALS

- A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.
- B. Cellulosic-Fiber Board Insulation: ASTM C208, Type II, Grade 1, thickness as indicated.
- C. Glass-Fiber Board Insulation: ASTM C726, nominal density of 3 lb/cu. ft., thermal

resistivity of 4.3 deg F x h x sq. ft./Btu x in. at 75 deg F, thickness as indicated.

- D. Polyisocyanurate Board Insulation: ASTM C1289, thickness and thermal resistivity as indicated.
- E. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.
- F. Underlayment:
 - 1. Felt: ASTM D226/D226M, Type II (No. 30), asphalt-saturated organic felt, nonperforated.
 - 2. Polyethylene Sheet: 6-mil-thick polyethylene sheet complying with ASTM D4397.
 - 3. Slip Sheet: Building paper, 3 lb/100 sq. ft. minimum, rosin sized.
 - 4. Self-Adhering, High-Temperature Sheet: Minimum 30 to 40 mils thick, consisting of slip-resisting polyethylene-film top surface laminated to layer of butyl or SBS- modified asphalt adhesive, with release-paper backing; cold applied. Provide primer when recommended by underlayment manufacturer.
- G. Fasteners: Roof accessory manufacturer's recommended fasteners suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:
 - 1. Fasteners for Zinc-Coated or Aluminum-Zinc Alloy-Coated Steel: Series 300 stainless steel or hot-dip zinc-coated steel according to ASTM A153/A153M or ASTM F2329.
 - 2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.
 - 3. Fasteners for Stainless Steel Sheet: Series 300 stainless steel.
- H. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.
- I. Elastomeric Sealant: ASTM C920, elastomeric polyurethane polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.
- J. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.
- K. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.7 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products"

for recommendations for applying and designating finishes.

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.
- B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
- C. Verify dimensions of roof openings for roof accessories.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install roof accessories according to manufacturer's written instructions.
 - 1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
 - 2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
 - 3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
 - 4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.
- B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.
 - 1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
 - 2. Underlayment: Where installing roof accessories directly on cementitious or wood substrates, install a course of underlayment and cover with manufacturer's recommended slip sheet.
 - 3. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

- C. Roof Curb Installation: Install each roof curb so top surface is level.
- D. Equipment Support Installation: Install equipment supports so top surfaces are level with each other.
- E. Seal joints with elastomeric or butyl sealant as required by roof accessory manufacturer.

3.3 REPAIR AND CLEANING

- A. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing according to ASTM A780/A780M.
- B. Touch up factory-primed surfaces with compatible primer ready for field painting.
- C. Clean exposed surfaces according to manufacturer's written instructions.
- D. Clean off excess sealants.
- E. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures.

END OF SECTION 07 72 00

SECTION 07 81 00 - APPLIED FIRE PROTECTION**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

- 1. Sprayed fire-resistive materials.

1.3 DEFINITIONS

- A. SFRM: Sprayed fire-resistive materials.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review products, design ratings, restrained and unrestrained conditions, densities, thicknesses, bond strengths, and other performance requirements.

1.5 ACTION SUBMITTALS

- A. Product Data: For the following:

- 1. Sprayed fire-resistive material.
 - 2. Substrate primers.
 - 3. Bonding agent.
 - 4. Metal lath.
 - 5. Reinforcing mesh.
 - 6. Topcoat.

- B. Sustainable Design Submittals:

- 1. Refer to Section 01 81 13 - Sustainable Design Requirements

- C. Shop Drawings: Framing plans or schedules, or both, indicating the following:

- 1. Extent of fire protection for each construction and fire-resistance rating.
 - 2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
 - 3. Minimum sprayed fire-resistive material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.

4. Treatment of sprayed fire-resistive material after application.
- D. Samples: For each exposed product and for each color and texture specified, 4 inches (102 mm) square in size.
- 1.6 INFORMATIONAL SUBMITTALS
- A. Qualification Data: For Installer and testing agency.
 - B. Product Certificates: For each type of sprayed fire-resistive material.
 - C. Evaluation Reports: For sprayed fire-resistive material, from ICC-ES.
 - D. Preconstruction Test Reports: For fire protection.
 - E. Field quality-control reports.
- 1.7 QUALITY ASSURANCE
- A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by sprayed fire-resistive material manufacturer as experienced and with sufficient trained staff to install manufacturer's products according to specified requirements.
 - B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects to set quality standards for materials and execution and for preconstruction testing.
 1. Build mockup of each type of fire protection and different substrate and each required finish as shown on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 1.8 PRECONSTRUCTION TESTING
- A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on fire protection.
 - B. Preconstruction Adhesion and Compatibility Testing: Test for compliance with requirements for specified performance and test methods.
 1. Bond Strength: Test for cohesive and adhesive strength according to ASTM E736. Provide bond strength indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 2. Density: Test for density according to ASTM E605. Provide density indicated in referenced fire-resistance design, but not less than minimum specified in Part 2.
 3. Verify that manufacturer, through its own laboratory testing or field experience, attests that primers or coatings are compatible with sprayed fire-resistive material.
 4. Schedule sufficient time for testing and analyzing results to prevent delaying the

Work.

5. For materials failing tests, obtain sprayed fire-resistive material manufacturer's written instructions for corrective measures including the use of specially formulated bonding agents or primers.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 44 deg F (7 deg C) or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.
- B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges according to manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Assemblies: Provide fire protection, including auxiliary materials, according to requirements of each fire-resistance design and manufacturer's written instructions.
- B. Source Limitations: Obtain fire protection for each fire-resistance design from single source.
- C. Fire-Resistance Design: Indicated on Drawings, tested according to ASTM E 119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 1. Steel members are to be considered unrestrained unless specifically noted otherwise.
- D. VOC Content: For field applications, verify coatings comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:
 1. Flat Paints and Coatings: 50 g/L.
 2. Nonflat Paints and Coatings: 50 g/L.
 3. Primers, Sealers, and Undercoaters: 100 g/L.
- E. Low-Emitting Materials: For field applications, verify coatings comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- F. Asbestos: Provide products containing no detectable asbestos.

2.2 SPRAYED FIRE-RESISTIVE MATERIALS

- A. Sprayed Fire-Resistive Material refer to drawings for UL-design numbers: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application.
1. High Density Exposed SFRMs: Provide at exposed structural building columns.
 - a. Physical Properties:
 - 1) Application: Designated for exterior use by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2) Bond Strength: Minimum 1000-lbf /sq. ft. (47.88-kPa) cohesive and adhesive strength based on field testing according to ASTM E736.
 - 3) Density: Not less than 40 lb/cu. ft. (640 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E605.
 - 4) Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design
 - 5) Combustion Characteristics: When tested in accordance with ASTM E136 shall be noncombustible.
 - 6) Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
 - a) Flame Spread Index [10] or less.
 - b) Smoke Developed [10] or less.
 - 7) Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 43,200 psf (2068 kPa).
 - 8) Corrosion Resistance: No evidence of corrosion according to ASTM E937.
 - 9) Deflection: No cracking, spalling, or delamination according to ASTM E 759.
 - 10) Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E 760.
 - 11) Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E 859.
 - 12) Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28 days with or without the use of a mold inhibitor.
 - b. Medium Density SFRMs
 - a. Physical Properties:
 - 1) Bond Strength: Minimum 430-lbf/sq. ft. (20.59-kPa) cohesive and adhesive strength based on field testing according to ASTM E 736.
 - 2) Density: Not less than and 22 lb. / cu. ft. (350 kg/cu. m) as specified in the approved fire-resistance design, according to ASTM E 605.
 - 3) Thickness: As required for fire-resistance design indicated, measured according to requirements of fire-resistance design.
 - 4) Combustion Characteristics: When tested in accordance with ASTM E 136 shall be noncombustible.
 - 5) Surface-Burning Characteristics: When tested in accordance with ASTM E84 or CAN4-S102, the material shall exhibit the following surface burning characteristics:
 - a) Flame Spread Index [10] or less.
 - b) Smoke Developed [10] or less.

- 6) Compressive Strength: When tested in accordance with ASTM E761, the material shall not deform more than 10 percent when subjected to a crushing force of 7,344 psf (351 kPa).
- 7) Corrosion Resistance: No evidence of corrosion according to ASTM E937.
- 8) Deflection: No cracking, spalling, or delamination according to ASTM E759.
- 9) Effect of Impact on Bonding: No cracking, spalling, or delamination according to ASTM E760.
- 10) Air Erosion: Maximum weight loss of 0.025 g/sq. ft. (0.270 g/sq. m) in 24 hours according to ASTM E859.
- 11) Fungal Resistance: When tested in accordance with ASTM G21, the material shall show resistance to mold growth for a minimum period of 28 days with or without the use of a mold inhibitor.

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.
- B. Substrate Primers: Primers approved by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:
 1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
 2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests according to ASTM E736.
- C. Bonding Agent: Product approved by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Fire Resistance Directory" or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.
- D. Metal Lath: Expanded metal lath fabricated from material of weight, configuration, and finish required, according to fire-resistance designs indicated and sprayed fire-resistive material manufacturer's written instructions. Include clips, lathing accessories, corner beads, and other anchorage devices required to attach lath to substrates and to receive sprayed fire-resistive material.
- E. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.
- F. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

- G. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.
- H. Topcoat: Suitable for application over sprayed fire-resistive material; of type recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and according to each fire-resistance design.
 - 1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
 - 2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
 - 3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.
- B. Verify that concrete work on steel deck is complete before beginning Work.
- C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.
- D. Conduct tests according to sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.
- E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.
- B. Clean substrates of substances that could impair bond of fire protection.
- C. Prime substrates where included in fire-resistance design, and where recommended in

writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

- D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

- A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting fire protection Work.
- B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.
- C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.
 - 1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
 - 2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.
- D. Metal Decks:
 - 1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
 - 2. Do not apply fire protection to underside of metal roof deck until roofing is completed.
prohibit roof traffic during application and drying of fire protection.
- E. Install auxiliary materials as required, as detailed, and according to fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.
- F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.
- G. Extend fire protection in full thickness over entire area of each substrate to be protected.
- H. Install body of fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

- I. Where sealers are used, apply products that are tinted to differentiate them from fire protection over which they are applied.
- J. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.
- K. Cure fire protection according to sprayed fire-resistive material manufacturer's written instructions.
- L. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.
- M. Finishes: Where indicated, apply fire protection to produce the following finishes:
 - 1. Manufacturer's Standard Finishes: Finish according to manufacturer's written instructions for each finish selected.
 - 2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
 - 3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.
 - 4. Skip-Troweled Finish: Even leveled surface produced by troweling spray-applied finish to smooth out the texture and neaten edges.

3.4 CLEANING

- A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.5 PROTECTION

- A. Protect fire protection, according to advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.6 REPAIRS

- A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.
- B. Repair fire protection damaged by other work before concealing it with other construction.
- C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 00

SECTION 07 84 13 - PENETRATION FIRESTOPPING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Penetration firestopping systems for the following applications:
 - a. Penetrations in fire-resistance-rated walls.
 - b. Penetrations in horizontal assemblies.
 - c. Penetrations in smoke barriers.

B. Related Requirements:

1. Section 07 84 43 "Joint Firestopping" for joints in or between fire-resistance-rated construction, at exterior curtain-wall/floor intersections, and in smoke barriers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 1. Refer to Section 01 81 13 - Sustainable Design Requirements
- C. Product Schedule: For each penetration firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing and inspecting agency.
 1. Engineering Judgments: Where Project conditions require modification to a qualified testing and inspecting agency's illustration for a particular penetration firestopping system, submit illustration, with modifications marked, approved by penetration firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly. Obtain approval of authorities having jurisdiction prior to submittal.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each penetration firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that penetration firestopping systems have been installed in compliance with requirements and manufacturer' s written instructions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install penetration firestopping system when ambient or substrate temperatures are outside limits permitted by penetration firestopping system manufacturers or when substrates are wet because of rain, frost, condensation, or other causes.
- B. Install and cure penetration firestopping materials per manufacturer's written instructions using natural means of ventilations or, where this is inadequate, forced - air circulation.

1.7 COORDINATION

- A. Coordinate construction of openings and penetrating items to ensure that penetration firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of sleeves, openings, core-drilled holes, or cut openings to accommodate penetration firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform penetration firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Penetration Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Penetration firestopping systems shall bear classification marking of a qualified testing agency.
 - 1) UL in its "Fire Resistance Directory."

2.2 PENETRATION FIRESTOPPING SYSTEMS

- A. Penetration Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated. Penetration firestopping systems shall be compatible with one another, with the substrates forming openings, and with penetrating items if any.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Everkem Diversified Products, Inc.
 - d. Grabber Construction Products.
 - e. Hilti, Inc.
 - f. HoldRite; Reliance Worldwide Company.
 - g. International Fireproof Technology Inc.
 - h. NUCO Inc.
 - i. Passive Fire Protection Partners.
 - j. RectorSeal Firestop; a CSW Industrials Company.
 - k. Roxtec.
 - l. Specified Technologies, Inc.
 - m. STC Sound Control.
 - n. Tremco, Inc.
- B. Penetrations in Fire-Resistance-Rated Walls: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: Not less than the fire-resistance rating of constructions penetrated.
- C. Penetrations in Horizontal Assemblies: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
1. F-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated.
 2. T-Rating: At least one hour, but not less than the fire-resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 3. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
- D. Penetrations in Smoke Barriers: Penetration firestopping systems with ratings determined per UL 1479, based on testing at a positive pressure differential of 0.30-inch wg.
1. L-Rating: Not exceeding 5.0 cfm/sq. ft. of penetration opening at and no more than 50-cfm cumulative total for any 100 sq. ft. at both ambient and elevated temperatures.

- E. Exposed Penetration Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, per ASTM E84.
- F. Manufactured Piping Penetration Firestopping System: Penetration firestopping systems with ratings determined per ASTM E814 or UL 1479, based on testing at a positive pressure differential of 0.01-inch wg.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ProVent Systems, Inc.
 - b. RectorSeal Firestop; a CSW Industrials Company.
 - 2. F-Rating: At least one hour, but not less than the fire -resistance rating of constructions penetrated.
 - 3. T-Rating: At least one hour, but not less than the fire -resistance rating of constructions penetrated except for floor penetrations within the cavity of a wall.
 - 4. W-Rating: Provide penetration firestopping systems showing no evidence of water leakage when tested according to UL 1479.
 - 5. Sleeve: Molded-PVC plastic, of length to match slab thickness and with integral nailing flange on one end for installation in cast-in-place concrete slabs.
 - 6. Stack Fitting: ASTM A48/A48M, gray-iron, hubless-pattern wye branch with neoprene O-ring at base and gray-iron plug in thermal-release harness. Include PVC protective cap for plug.
 - 7. Special Coating: Corrosion resistant on interior of fittings.
- G. Accessories: Provide components for each penetration firestopping system that are needed to install fill materials and to maintain ratings required. Use only those components specified by penetration firestopping system manufacturer and approved by qualified testing and inspecting agency for conditions indicated.
 - 1. Permanent forming/damming/backing materials.
 - 2. Substrate primers.
 - 3. Collars.
 - 4. Steel sleeves.

2.3 FILL MATERIALS

- A. Cast-in-Place Firestop Devices: Factory-assembled devices for use in cast-in-place concrete floors and consisting of an outer sleeve lined with an intumescent strip, a flange attached to one end of the sleeve for fastening to concrete formwork, and a neoprene gasket.
- B. Latex Sealants: Single-component latex formulations that do not re-emulsify after cure during exposure to moisture.
- C. Firestop Devices: Factory-assembled collars formed from galvanized steel and lined with intumescent material sized to fit specific diameter of penetrant.
- D. Intumescent Composite Sheets: Rigid panels consisting of aluminum-foil-faced

intumescent elastomeric sheet bonded to galvanized-steel sheet.

- E. Intumescent Putties: Nonhardening, water-resistant, intumescent putties containing no solvents or inorganic fibers.
- F. Intumescent Wrap Strips: Single-component intumescent elastomeric sheets with aluminum foil on one side.
- G. Mortars: Prepackaged dry mixes consisting of a blend of inorganic binders, hydraulic cement, fillers and lightweight aggregate formulated for mixing with water at Project site to form a nonshrinking, homogeneous mortar.
- H. Pillows/Bags: Reusable heat-expanding pillows/bags consisting of glass-fiber cloth cases filled with a combination of mineral-fiber, water-insoluble expansion agents, and fire-retardant additives. Where exposed, cover openings with steel-reinforcing wire mesh to protect pillows/bags from being easily removed.
- I. Silicone Foams: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
- J. Silicone Sealants: Single-component, silicone-based, neutral-curing elastomeric sealants.

2.4 MIXING

- A. Penetration Firestopping Materials: For those products requiring mixing before application, comply with penetration firestopping system manufacturer's written instructions for accurate proportioning of materials, water (if required), type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other items or procedures needed to produce products of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing penetration firestopping systems, clean out openings immediately to comply with manufacturer's written instructions and with the following requirements:
 - 1. Remove from surfaces of opening substrates and from penetrating items for eign materials that could interfere with adhesion of penetration firestopping materials.
 - 2. Clean opening substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with penetration firestopping materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install penetration firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications.
- B. Install forming materials and other accessories of types required to support fill materials during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings.
 - 1. After installing fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not forming permanent components of firestopping.
- C. Install fill materials by proven techniques to produce the following results:
 - 1. Fill voids and cavities formed by openings, forming materials, accessories and penetrating items to achieve required fire-resistance ratings.
 - 2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
 - 3. For fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Wall Identification: Permanently label walls containing penetration firestopping systems with the words "FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS," using lettering not less than 3 inches high and with minimum 0.375-inch strokes.

1. Locate in accessible concealed floor, floor-ceiling, or attic space at 15 feet from end of wall and at intervals not exceeding 30 feet.
- B. Penetration Identification: Identify each penetration firestopping system with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of penetration firestopping system edge so labels are visible to anyone seeking to remove penetrating items or firestopping systems. Use mechanical fasteners or self-adhering-type labels with adhesives capable of permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:
 1. The words "Warning - Penetration Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
 2. Contractor's name, address, and phone number.
 3. Designation of applicable testing and inspecting agency.
 4. Date of installation.
 5. Manufacturer's name.
 6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Engage a qualified testing agency to perform tests and inspections according to ASTM E2174.
- B. Where deficiencies are found or penetration firestopping system is damaged or removed because of testing, repair or replace penetration firestopping system to comply with requirements.
- C. Proceed with enclosing penetration firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess fill materials adjacent to openings as the Work progresses by methods and with cleaning materials that are approved in writing by penetration firestopping system manufacturers and that do not damage materials in which openings occur.
- B. Provide final protection and maintain conditions during and after installation that ensure that penetration firestopping systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, immediately cut out and remove damaged or deteriorated penetration firestopping material and install new materials to produce systems complying with specified requirements.

END OF SECTION 07 84 13

SECTION 07 84 43 - JOINT FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Joints in or between fire-resistance-rated constructions.
2. Joints at exterior curtain-wall/floor intersections.
3. Joints in smoke barriers.

B. Related Requirements:

1. Section 07 84 13 "Penetration Firestopping" for penetrations in fire-resistance-rated walls, horizontal assemblies, and smoke barriers and for wall identification.
2. Section 07 95 13.13 "Interior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
3. Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" for fire-resistive manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.
4. Section 09 22 16 "Non-Structural Metal Framing" for firestop tracks for metal-framed partition heads.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Projects site.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 - Sustainable Design Requirements

- C. Product Schedule: For each joint firestopping system. Include location, illustration of firestopping system, and design designation of qualified testing agency.

1. Engineering Judgments: Where Project conditions require modification to a qualified testing agency's illustration for a particular joint firestopping system condition, submit illustration, with modifications marked, approved by joint firestopping system manufacturer's fire-protection engineer as an engineering judgment or equivalent fire-resistance-rated assembly.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For each joint firestopping system, for tests performed by a qualified testing agency.

1.5 CLOSEOUT SUBMITTALS

- A. Installer Certificates: From Installer indicating that joint firestopping systems have been installed in compliance with requirements and manufacturer's written instructions.

1.6 PROJECT CONDITIONS

- A. Environmental Limitations: Do not install joint firestopping systems when ambient or substrate temperatures are outside limits permitted by joint firestopping system manufacturers or when substrates are wet due to rain, frost, condensation, or other causes.
- B. Install and cure joint firestopping systems per manufacturer's written instructions using natural means of ventilation or, where this is inadequate, forced-air circulation.

1.7 COORDINATION

- A. Coordinate construction of joints to ensure that joint firestopping systems can be installed according to specified firestopping system design.
- B. Coordinate sizing of joints to accommodate joint firestopping systems.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Test-Response Characteristics:
 - 1. Perform joint firestopping system tests by a qualified testing agency acceptable to authorities having jurisdiction.
 - 2. Test per testing standards referenced in "Joint Firestopping Systems" Article. Provide rated systems complying with the following requirements:
 - a. Joint firestopping systems shall bear classification marking of a qualified testing agency.

- 1) UL in its "Fire Resistance Directory."

2.2 JOINT FIRESTOPPING SYSTEMS

- A. Joint Firestopping Systems: Systems that resist spread of fire, passage of smoke and other gases, and maintain original fire-resistance rating of assemblies in or between which joint firestopping systems are installed. Joint firestopping systems shall accommodate building movements without impairing their ability to resist the passage of fire and hot gases.
- B. Joints in or between Fire-Resistance-Rated Construction: Provide joint firestopping systems with ratings determined per ASTM E1966 or UL 2079.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Hilti, Inc.
 - d. International Fireproof Technology Inc.
 - e. MarinoWARE.
 - f. Nelson Firestop; a brand of Emerson Industrial Automation.
 - g. NUCO Inc.
 - h. Passive Fire Protection Partners.
 - i. RectorSeal Firestop; a CSW Industrials Company.
 - j. Specified Technologies, Inc.
 - k. Thermafiber, Inc.; an Owens Corning company.
 - l. Tremco, Inc.
 - m. Willseal LLC.
 2. Fire-Resistance Rating: Equal to or exceeding the fire-resistance rating of the wall, floor, or roof in or between which it is installed.
- C. Joints at Exterior Curtainwall/Floor Intersections: Provide joint firestopping systems with rating determined per ASTM E2307.
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. ClarkDietrich.
 - c. Hilti, Inc.
 - d. Johns Manville; a Berkshire Hathaway company.
 - e. Nelson Firestop; a brand of Emerson Industrial Automation.
 - f. NUCO Inc.
 - g. RectorSeal Firestop; a CSW Industrials Company.
 - h. Rockwool International.
 - i. Specified Technologies, Inc.
 - j. Thermafiber, Inc.; an Owens Corning company.

- k. Tremco, Inc.
- 2. F-Rating: Equal to or exceeding the fire-resistance rating of the floor assembly.
- D. Joints in Smoke Barriers: Provide joint firestopping systems with ratings determined per UL 2079 based on testing at a positive pressure differential of 0.30-inchwg.
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. 3M Fire Protection Products.
 - b. A/D Fire Protection Systems Inc.
 - c. Everkem Diversified Products, Inc.
 - d. Hilti, Inc.
 - e. International Fireproof Technology Inc.
 - f. MarinoWARE.
 - g. Nelson Firestop; a brand of Emerson Industrial Automation.
 - h. NUCO Inc.
 - i. Passive Fire Protection Partners.
 - j. RectorSeal Firestop; a CSW Industrials Company.
 - k. Rockwool International.
 - l. Specified Technologies, Inc.
 - m. Thermafiber, Inc.; an Owens Corning company.
 - n. Tremco, Inc.
 - o. Willseal LLC.
 - 2. L-Rating: Not exceeding 5.0 cfm/ft. of joint at both ambient and elevated temperatures.
- E. Exposed Joint Firestopping Systems: Flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E84.
- F. Accessories: Provide components of joint firestopping systems, including primers and forming materials, that are needed to install elastomeric fill materials and to maintain ratings required. Use only components specified by joint firestopping system manufacturer and approved by the qualified testing agency for conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for joint configurations, substrates, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning: Before installing joint firestopping systems, clean joints immediately to comply with fire-resistive joint system manufacturer's written instructions and the following requirements:
 - 1. Remove from surfaces of joint substrates foreign materials that could interfere with adhesion of elastomeric fill materials or compromise fire-resistive rating.
 - 2. Clean joint substrates to produce clean, sound surfaces capable of developing optimum bond with elastomeric fill materials. Remove loose particles remaining from cleaning operation.
 - 3. Remove laitance and form-release agents from concrete.
- B. Prime substrates where recommended in writing by joint firestopping system manufacturer using that manufacturer's recommended products and methods. Confine primers to areas of bond; do not allow spillage and migration onto exposed surfaces.

3.3 INSTALLATION

- A. General: Install joint firestopping systems to comply with manufacturer's written installation instructions and published drawings for products and applications indicated.
- B. Install forming materials and other accessories of types required to support elastomeric fill materials during their application and in position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated.
 - 1. After installing elastomeric fill materials and allowing them to fully cure, remove combustible forming materials and other accessories not indicated as permanent components of fire-resistive joint system.
- C. Install elastomeric fill materials for joint firestopping systems by proven techniques to produce the following results:
 - 1. Elastomeric fill voids and cavities formed by joints and forming materials as required to achieve fire-resistance ratings indicated.
 - 2. Apply elastomeric fill materials so they contact and adhere to substrates formed by joints.
 - 3. For elastomeric fill materials that will remain exposed after completing the Work, finish to produce smooth, uniform surfaces that are flush with adjoining finishes.

3.4 IDENTIFICATION

- A. Joint Identification: Identify joint firestopping systems with legible metal or plastic labels. Attach labels permanently to surfaces adjacent to and within 6 inches of joint edge so labels are visible to anyone seeking to remove or joint firestopping system. Use mechanical fasteners or self-adhering-type labels with adhesives capable of

permanently bonding labels to surfaces on which labels are placed. Include the following information on labels:

1. The words "Warning - Joint Firestopping - Do Not Disturb. Notify Building Management of Any Damage."
2. Contractor's name, address, and phone number.
3. Designation of applicable testing agency.
4. Date of installation.
5. Manufacturer's name.
6. Installer's name.

3.5 FIELD QUALITY CONTROL

- A. Inspecting Agency: Engage a qualified testing agency to perform tests and inspections according to ASTM E2393.
- B. Where deficiencies are found or joint firestopping systems are damaged or removed due to testing, repair or replace joint firestopping systems so they comply with requirements.
- C. Proceed with enclosing joint firestopping systems with other construction only after inspection reports are issued and installations comply with requirements.

3.6 CLEANING AND PROTECTION

- A. Clean off excess elastomeric fill materials adjacent to joints as the Work progresses by methods and with cleaning materials that are approved in writing by joint firestopping system manufacturers and that do not damage materials in which joints occur.
- B. Provide final protection and maintain conditions during and after installation that ensure joint firestopping systems are without damage or deterioration at time of Substantial Completion. If damage or deterioration occurs despite such protection, cut out and remove damaged or deteriorated joint firestopping systems immediately and install new materials to produce joint firestopping systems complying with specified requirements.

END OF SECTION 07 84 43

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

Section Includes:

1. Nonstaining silicone joint sealants.
2. Urethane joint sealants.
3. Mildew-resistant joint sealants.
4. Latex joint sealants.

Related Requirements:

5. Section 079219 "Acoustical Joint Sealants" for sealing joints in sound-rated construction.

1.03 PREINSTALLATION MEETINGS

Preinstallation Conference: Conduct conference at [Project site].

1.04 ACTION SUBMITTALS

Product Data: For each joint-sealant product.

A. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – Sustainable Design Requirements

B. Samples for Verification: For each kind and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch-long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

C. Joint-Sealant Schedule: Include the following information: Joint-sealant application, joint location, and designation.

1. Joint-sealant manufacturer and product name.
2. Joint-sealant formulation.
3. Joint-sealant color.

1.05 INFORMATIONAL SUBMITTALS

Qualification Data: For qualified testing agency.

- A. Product Test Reports: For each kind of joint sealant, for tests performed by [manufacturer and witnessed by a qualified testing agency].
- B. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:
 - Joint-sealant location and designation.
 - 1. Manufacturer and product name.
 - 2. Type of substrate material.
 - 3. Proposed test.
 - 4. Number of samples required.

Preconstruction Laboratory Test Reports: From sealant manufacturer, indicating the following:

Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.

- 5. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

- C. Field-Adhesion-Test Reports: For each sealant application tested.

1.06 QUALITY ASSURANCE

Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

- A. Product Testing: Test joint sealants using a qualified testing agency.
Testing Agency Qualifications: Qualified according to ASTM C1021 to conduct the testing indicated.

Mockups: Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.07 PRECONSTRUCTION TESTING

Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.

- 1. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
- 2. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with substrates.

3. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
6. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

Locate test joints where indicated on Project or, if not indicated, as directed by Architect.

7. Conduct field tests for each kind of sealant and joint substrate.
8. Notify Architect seven days in advance of dates and times when test joints will be erected.
9. Arrange for tests to take place with joint-sealant manufacturer's technical representative present. Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1.1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.
For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.
Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
10. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.08 FIELD CONDITIONS

Do not proceed with installation of joint sealants under the following conditions:

When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer [or are below 40 deg F].

1. When joint substrates are wet.
2. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
3. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.09 WARRANTY

Special Installer's Warranty: Installer agrees to repair or replace joint

sealants that do not comply with performance and other requirements specified in this Section within specified warranty period. Warranty Period: Two years from date of Substantial Completion.

Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period. Warranty Period: Five years from date of Substantial Completion.

Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

- Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
1. Disintegration of joint substrates from causes exceeding design specifications.
 2. Mechanical damage caused by individuals, tools, or other outside agents.
 3. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.01 JOINT SEALANTS, GENERAL

Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint- sealant manufacturer, based on testing and field experience.

- A. VOC Content: Sealants and sealant primers shall comply with the following: Architectural sealants shall have a VOC content of 250 g/L or less.
1. Sealants and sealant primers for nonporous substrates shall have a VOC content of 250 g/L or less.
 2. Sealants and sealant primers for porous substrates shall have a VOC content of 775 g/L or less.
 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Colors of Exposed Joint Sealants: As indicated by manufacturer's designations Match Architect's samples. As selected by Architect from manufacturer's full range.

2.02 NON-STAINING SILICONE JOINT SEALANTS

Non-staining Joint Sealants: No staining of substrates when tested according to ASTM C1248.

- A. Silicone, Non-staining, S, NS, 50, NT: Non-staining, single-component, non-sag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Dow Corning Corporation; 756 SMS Building Sealant, 795 Building Sealant, and 758 Silicone Weather Barrier Sealant.

- a. GE Construction Sealants; Momentive Performance Materials Inc; SilPruf NB.
- b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 295 FPS NB.
- c. Pecora Corporation; 864NST 895NST 898NST.
- d. Tremco Incorporated; Spectrem 2 Spectrem 3.

- B. Silicone, Non-staining, S, NS, 100/50, T, NT: Non-staining, single-component, non-sag, plus 100 percent and minus 50 percent movement capability, traffic-and nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 100/50, Uses T and NT.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Dow Corning Corporation; 790.

2.03 URETHANE JOINT SEALANTS

- A. Single-Component, Non-sag, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 50, for Use NT.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. Pacific Polymers International, Inc.; Elasto-Thane 230 LM Type II.
- b. Polymeric Systems, Inc.; PSI-901.

- B. Single-Component, Non-sag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Use T.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

- a. BASF Building Systems; Sonolastic Ultra.
- b. May National Associates, Inc.; Bondaflex PUR 40 FC.
- c. Pacific Polymers International, Inc.; Elasto-Thane 230 Type II.
- d. Sika Corporation, Construction Products Division; Sikaflex - 1a.
- e. Tremco Incorporated; Vulkem 116.

- C. Immersible, Single-Component, Non-sag, Traffic-Grade, Urethane Joint Sealant: ASTM C 920, Type S, Grade NS, Class 25, for Uses T and I.

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. BASF Building Systems; Sonolastic NP1.
 - b. Sika Corporation, Construction Products Division; Sikaflex - 1a.
 - c. Tremco Incorporated; Vulkem 116.

2.04 MILDEW-RESISTANT JOINT SEALANTS

Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

- A. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, non-sag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:

Dow Corning Corporation; 786-M White.

- a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
- b. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
- c. Soudal USA; RTV GP.
- d. Tremco Incorporated; Tremsil 200.

2.05 LATEX JOINT SEALANTS

Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

Products: Subject to compliance with requirements, provide provide one of the following available products that may be incorporated into the Work include, but are not limited to, the following: BASF Construction Chemicals - Building Systems; Sonolac.

- a. May National Associates, Inc., a subsidiary of Sika Corporation U.S.; Bondaflex 600 Bondaflex Sil-A 700.
- b. Pecora Corporation; AC-20.
- c. Sherwin-Williams Company (The); 850A 950A PowerHouse Siliconized Acrylic latex Caulk.
- d. Tremco Incorporated; Tremflex 834.

2.06 JOINT-SEALANT BACKING

- A. Sealant Backing Material, General: Non-staining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin)], and of size and density to control sealant depth and otherwise

contribute to producing optimum sealant performance.

- B. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.07 MISCELLANEOUS MATERIALS

Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

- A. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way and formulated to promote optimum adhesion of sealants to joint substrates.

- B. Masking Tape: Non-staining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.01 EXAMINATION

Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

- A. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:
1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
 2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free

compressed air. Porous joint substrates include the following:

- a. Concrete
 - b. Masonry.
 - c. Exterior insulation and finish systems.
 - d. Remove laitance and form-release agents from concrete.
3. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:
- Metal.
- a. Glass.
 - b. Glazed surfaces of ceramic tile.
- B. Joint Priming: Prime joint substrates, where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.03 INSTALLATION OF JOINT SEALANTS

General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

- A. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- B. Install sealant backings of kind indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
- Do not leave gaps between ends of sealant backings.
1. Do not stretch, twist, puncture, or tear sealant backings.
 2. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.
 3. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.
- C. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses in each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- D. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
- Remove excess sealant from surfaces adjacent to joints.
1. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
 2. Provide concave joint profile per Figure 8A in ASTM C1193 unless otherwise indicated.
 3. Provide flush joint profile at locations indicated on Drawings, according to Figure 8B in ASTM C1193.
 4. Provide recessed joint configuration of recess depth and at locations indicated on Drawings, according to Figure 8C in ASTM C1193.
Use masking tape to protect surfaces adjacent to recessed tooled joints.

3.04 FIELD QUALITY CONTROL

Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows: Extent of Testing: Test completed and cured sealant joints as follows:

Perform 10 tests for the first 1000 feet of joint length for each kind of sealant and joint substrate.

- a. Perform one test for each 1000 feet of joint length thereafter or one test per each floor per elevation.

Test Method: Test joint sealants according to Method A, Field-Applied Sealant Joint Hand Pull Tab, in Appendix X1 in ASTM C1193 or Method A, Tail Procedure, in ASTM C1521.

For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

Inspect tested joints and report on the following:

Whether sealants filled joint cavities and are free of voids.

- b. Whether sealant dimensions and configurations comply with specified requirements.
- c. Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

2. Repair sealants pulled from test area by applying new sealants

following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

3.05 CLEANING

Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.06 PROTECTION

Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.07 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces.

1. Joint Locations:
 - a. Isolation and contraction joints in cast-in-place concrete slabs.
 - b. Joints in stone paving units.
 - c. Joints between different materials listed above.
 - d. Other joints as indicated.

2. Urethane Joint Sealant: Single component, non-sag, traffic grade.

B. Joint-Sealant Application: Exterior joints in horizontal traffic surfaces subject to water immersion.

1. Joint Locations:
 - a. Joints in pedestrian plazas.
 - b. Other joints as indicated.

2. Urethane Joint Sealant: Immersible, single component, non-sag, traffic grade.

C. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
 - a. Construction joints in cast-in-place concrete.
 - b. Joints between plant-precast architectural concrete units.
 - c. Control and expansion joints in unit masonry.
 - d. Joints in dimension stone cladding.
 - e. Joints in exterior insulation and finish systems.
 - f. Joints between different materials listed above.
 - g. Perimeter joints between materials listed above and frames of doors and louvers.
 - h. Control and expansion joints in ceilings and other overhead surfaces.
 - i. Other joints as indicated.

2. Silicone Joint Sealant: Single component, non-sag, neutral curing, Class 50.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

D. Joint-Sealant Application: Interior joints in horizontal traffic surfaces.

1. Joint Locations:
 - a. Isolation joints in cast-in-place concrete slabs.
 - b. Control and expansion joints in tile flooring.
 - c. Other joints as indicated.
2. Urethane Joint Sealant: Single component, non-sag, traffic grade.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors

E. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:
 - a. Control and expansion joints on exposed interior surfaces of exterior walls.
 - b. Perimeter joints of exterior openings where indicated.
 - c. Tile control and expansion joints.
 - d. Vertical joints on exposed surfaces of interior unit masonry, concrete, walls, and partitions.
 - e. Perimeter joints between interior wall surfaces and frames of interior doors and elevator entrances.
 - f. Other joints as indicated.
2. Joint Sealant: Latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

F. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Sealant Location:

- a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
 - b. Tile control and expansion joints where indicated.
 - c. Other joints as indicated.
2. Joint Sealant: Mildew resistant, single component, non-sag, neutral curing, Silicone.
 3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

G. Joint-Sealant Application: Interior acoustical joints in vertical surfaces and horizontal nontraffic surfaces where not specified in other Sections.

1. Joint Location:
 - a. Acoustical joints where indicated.
 - b. Other joints as indicated.

2. Joint Sealant: Acoustical.

H. Joint Sealant Color: As selected by Architect from manufacturer's full range.
Application: Secure areas with no movement.

1. Joint Location:
 - a. Plumbing fixtures to wall, benches to wall.

2. Joint Sealant: Pick proof epoxy joint sealant.

I. Joint Sealant Application: Secure areas with moderate movement.

1. Joint Location:
 - a. Saw cut joints in concrete, horizontal and vertical joints, concrete paving control joints.
2. Joint Sealant: Pick resistant two-component, traffic-grade polyurethane joint sealant.

END OF SECTION 07 92 00

SECTION 07 92 19 - ACOUSTICAL JOINT SEALANTS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes acoustical jointsealants.
- B. Related Requirements:
 - 1. Section 07 92 00 "Joint Sealants" for elastomeric, latex, and butyl-rubber - based joint sealants for non-acoustical applications.

1.2 ACTION SUBMITTALS

- A. Product Data: For each acoustical joint sealant.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements
- C. Samples for Initial Selection: Manufacturer's color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.
- D. Samples for Verification: For each kind and color of acoustical joint sealant required, provide Samples with joint sealants in 1/2-inch-wide joints formed between two 6-inch - long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- E. Acoustical-Joint-Sealant Schedule: Include the following information:
 - 1. Joint-sealant application, joint location, and designation.
 - 2. Joint-sealant manufacturer and product name.
 - 3. Joint-sealant formulation.
 - 4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

- A. Product Test Reports: For each kind of acoustical joint sealant, for tests performed by a qualified testing agency.
- B. Sample Warranties: For special warranties.

1.4 WARRANTY

- A. Special Installer's Warranty: Installer agrees to repair or replace acoustical joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Provide acoustical joint-sealant products that effectively reduce airborne sound transmission through perimeter joints and openings in building construction, as demonstrated by testing representative assemblies according to ASTM E90.

2.2 ACOUSTICAL JOINT SEALANTS

- A. Acoustical Sealant for Exposed Joints: Manufacturer's standard nonsag, paintable, nonstaining latex acoustical sealant complying with ASTM C834.
 - 1. Colors of Exposed Acoustical Joint Sealants: As selected by Architect from manufacturer's full range of colors.
- B. Acoustical Sealant for Concealed Joints: Manufacturer's standard nonsag, nondrying, nonhardening, nonskinning, nonstaining, gunnable, synthetic-rubber acoustical sealant.

2.3 MISCELLANEOUS MATERIALS

- A. Primer: Material recommended by acoustical-joint-sealant manufacturer where required for adhesion of sealant to joint substrates.
- B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.
- C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive acoustical joint sealants, with Installer present, for

compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. **Surface Cleaning of Joints:** Clean out joints immediately before installing acoustical joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. **Joint Priming:** Prime joint substrates where recommended by acoustical-joint-sealant manufacturer. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.
- C. **Masking Tape:** Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF ACOUSTICAL JOINT SEALANTS

- A. Comply with acoustical joint-sealant manufacturer's written installation instructions unless more stringent requirements apply.
- B. **STC-Rated Assemblies:** Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical joint sealant. Install acoustical joint sealants at both faces of partitions, at perimeters, and through penetrations. Comply with ASTM C919, ASTM C1193, and manufacturer's written recommendations for closing off sound-flanking paths around or through assemblies, including sealing partitions to underside of floor slabs above acoustical ceilings.
- C. **Acoustical Ceiling Areas:** Apply acoustical joint sealant at perimeter edge moldings of acoustical ceiling areas in a continuous ribbon concealed on back of vertical legs of moldings before they are installed.

3.4 CLEANING

- A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of acoustical joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect acoustical joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated acoustical joint sealants immediately so installations with repaired areas are indistinguishable from original work.

END OF SECTION 07 92 19

SECTION 07 95 13.16 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Architectural joint systems for building interiors.
2. Architectural joint systems for building exteriors.

B. Related Requirements:

1. 03 30 00 "Cast-in-Place Concrete" for cast-in architectural-joint-system frames furnished, but not installed, in this Section.
2. 07 62 00 "Sheet Metal Flashing and Trim" for sheet metal wall joint systems.
3. 07 92 00 "Joint Sealants" for liquid-applied joint sealants.

1.02 DEFINITIONS

- A. Maximum Joint Width: Widest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- B. Minimum Joint Width: Narrowest linear gap a joint system tolerates and in which it performs its designed function without damaging its functional capabilities.
- C. Movement Capability: Value obtained from the difference between widest and narrowest widths of a joint.
- D. Nominal Joint Width: The width of the linear opening specified in practice and in which the joint system is installed.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – Sustainable Design Requirements

C. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
 2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.
- D. Samples: For each exposed expansion joint cover assembly and for each color and texture specified, full width by 6 inches long in size.
- E. Samples for Initial Selection: For each type of exposed finish.
1. Include manufacturer's color charts showing the full range of colors and finishes available for each exposed metal and elastomeric seal material.
- F. Samples for Verification: For each type of expansion joint cover assembly, full width by 6 inches long in size.
- G. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:
1. Manufacturer and model number for each expansion joint cover assembly.
 2. Expansion joint cover assembly location cross-referenced to Drawings.
 3. Nominal, minimum, and maximum joint width.
 4. Movement direction.
 5. Materials, colors, and finishes.
 6. Product options.
 7. Fire-resistance ratings.
- 1.04 INFORMATIONAL SUBMITTALS
- A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.
- 1.05 MOCKUPS
- A. Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
1. Build mockup of typical expansion joint cover assembly as shown on Drawings.
 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Approved by manufacturer.
- B. Source Limitations: Obtain all architectural joint systems through one source from a single manufacturer.
- C. Product Options: Drawings indicate size, profiles, and dimensional requirements of architectural joint systems and are based on the specific systems indicated. Refer to 01 60 00 "Product Requirements."
 1. Do not modify intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If modifications are proposed, submit comprehensive explanatory data to Architect for review.
- D. Loading Characteristics: Standard loading refers to covers that are capable of withstanding up to 500 lb. point loads. Heavy duty refers to covers that are capable of withstanding up to 2000 lb. point loads.
- E. Fire-Test-Response Characteristics: Where indicated, provide architectural joint system and fire-barrier assemblies identical to those of assemblies tested for fire resistance per UL 2079 and/or ASTM E 1966 by a testing and inspecting agency acceptable to authorities having jurisdiction. Fire rating not less than the rating of adjacent construction.
- F. Manufacturer to provide 5 year warranty for all joint covers.

1.07 COORDINATION

- A. Coordinate installation of exterior wall joint systems with roof expansion assemblies to ensure that wall transitions are watertight.

PART 2 - PRODUCTS

2.01 ASSEMBLY DESCRIPTION

- A. Furnish units in longest practicable lengths to minimize field splicing.
- B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs,

cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.02 MATERIALS

- A. Aluminum: ASTM B 221, Alloy 6005A-T61, 6063-T5, 6061-T5, 6105-T5 for extrusions; ASTM B 209, Alloy 6061-T6, 3003-H14, 5005-H34 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.
 2. Mill Finish: AA-M10 (Mechanical Finish: as fabricated, unspecified).
 3. Class II, Clear Anodic Finish: AA-M12C22A31 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class II, clear coating 0.010 mm or thicker) complying with AAMA 611.
 4. High-Performance Organic Finish (Two-Coat Fluoropolymer): AA-C12C40R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: conversion coating; Organic Coating: manufacturer's standard two-coat, thermocured system consisting of specially formulated inhibitive primer and fluoropolymer color topcoat containing not less than 70 percent polyvinylidene fluoride resin by weight). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with AAMA 2604 and with coating and resin manufacturers' written instructions.
- B. Stainless Steel: ASTM A 666, Type 304 for plates, sheet, and strips.
1. Finish: No.4, directional satin.
 - a. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
 - b. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
- C. Brass: ASTM B 36/B 36M, UNS Alloy C26000 for half hard sheet and coil.
- D. Bronze: ASTM B 455, Alloy C38500 for extrusions; Alloy C28000 Muntz Metal for plates.
- E. Elastomeric Seals: Preformed elastomeric membranes or extrusions to be installed in metal frames.
- F. Compression Seals: ASTM D2000; preformed rectangular elastomeric extrusions having internal baffle system and designed to function under compression.
- G. Fire Barriers: Any material or material combination, when fire tested after cycling, designated to resist the passage of flame and hot gases through a movement joint and to meet performance criteria for required rating period.
- H. Moisture Barrier: 7-ply laminate reinforced Polyethylene.
- I. Accessories: Manufacturer's standard anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

2.03 ARCHITECTURAL JOINT SEALANTS, GENERAL

- A. General: Provide architectural joint systems of design, basic profile, materials, and operation indicated. Provide units with capability to accommodate variations in adjacent surfaces.
- B. Design architectural joint systems for the following size and movement characteristics:
 - 1. Nominal Joint Width: As indicated on Drawings.
 - 2. Maximum Joint Width: As indicated on Drawings.
 - 3. Minimum Joint Width: As indicated on Drawings.
 - 4. Lateral Shear Movement Capability: ± 25 percent of the nominal joint width.

2.04 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING INTERIORS

- A. Construction Specialties, Inc., 6696 Route 405 Highway, Muncy, PA, shall manufacture expansion joint cover assemblies specified herein and indicated on the drawings. Other manufacturers may be accepted as substitutions only if the manufacturer can demonstrate product compliance with the requirements of the contract documents. Basis of Design:
 - 1. EJ-4: Interior Expansion Joint Cover Assembly; Construction Specialties, Inc; FWF
- B. Substitution requests must be reviewed prior to bid and must include the following information:
 - 1. Details
 - 2. ASTM- E1399 test reports
 - 3. Mock-ups
 - 4. Reference list of projects with similar products as those specified herein.
 - 5. Sample of written 5-year warranty

2.05 ARCHITECTURAL JOINT SYSTEMS FOR BUILDING EXTERIORS

- A. Construction Specialties, Inc., P.O. Box 380 Muncy, PA, shall manufacture expansion joint cover assemblies specified herein and indicated on the drawings. Other manufacturers may be accepted as substitutions only if the manufacturer can demonstrate product compliance with the requirements of the contract documents. Basis of design:
 - 1. EJ-1: Exterior Roof to Wall Expansion Joint with Cover: Inpro 651A02-.075
 - 2. EJ-2: Exterior Expansion Joint: Seismic Colorseal, single unit.

3. EJ-3: Interior Floor Expansion Joint: Emshield DFR2, single-Unit, 2-Hour, UL2079 fire and water resistant expansion joint system for floors in concealed locations, not visible to occupants.
 4. EJ-4: Interior Floor Expansion Joint Floor to Wall: Construction Specialties, Inc; PCWS2G-300 floor expansion joint cover in combination with EJ-3.
 5. EJ-5: Interior Wall to Wall/Ceiling Expansion Joint Cover Assembly; Construction Specialties, Inc; GTWC-300
 6. EJ-6: Interior Wall to Wall/Ceiling Expansion Joint Cover Assembly Fire Rated; Construction Specialties, Inc; GTWC-300 w/ FB
- B. Substitution requests must be reviewed prior to bid and must include the following information:
1. Details
 2. ASTM- E1399 test reports
 3. Mock-ups
 4. Reference list of projects with similar products as those specified herein.
 5. Sample of written 5-year warranty

2.06 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.
- B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.
- B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.03 INSTALLATION

- A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.
- B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.
 - 1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
 - 2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
 - 3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
 - 4. Install frames in continuous contact with adjacent surfaces.
 - a. Shimming is not permitted.
 - 5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.
- C. Elastomeric Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Provide in continuous lengths for straight sections.
 - 2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
 - 3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.
- D. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.
 - 1. Install each length of seal immediately after removing protective wrapping.
 - 2. Firmly secure compressed joint seals to joint gap side to obtain full

bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.

3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.
 4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.
- E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.
- F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.
- G. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.
1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.
- H. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.04 CONNECTIONS

- A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall roof expansion joint covers.

3.05 PROTECTION

- A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.
- B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over joints. Reinstall cover plates or seals prior to Substantial Completion of the Work.

END OF SECTION 07 95 13.16

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section "Flush Wood Doors".
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 08 Section "Access Control Hardware".
7. Division 09 Sections "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

- A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.
- B. Sustainable Design Submittals
 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Maintenance manual must be provided for tornado/hurricane storm shelter impact protective systems.
- D. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.
- E. Shop Drawings: Include the following:
 1. Elevations of each door design.
 2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
 3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
 4. Locations of reinforcement and preparations for hardware.
 5. Details of anchorages, joints, field splices, and connections.
 6. Details of accessories.
 7. Details of moldings, removable stops, and glazing.
 8. Details of conduit and preparations for power, signal, and control systems.
- F. Samples for Verification:
 1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

- A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".
- C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40" above sill) or UL 10C.
 - 1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
 - 2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
 - 3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - a. Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.
- E. Storm Shelter Openings: Provide complete door systems for hurricane or tornado storm shelters, and other areas of refuge, complying and tested according to ICC 500 (2014/2020), ICC/NSSA Standard for the Design and Construction of Storm Shelters.
 - 1. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- F. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

- B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.
- C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.
 - 1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

- A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

- A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.
- B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
- B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:
 - 1. CECO Door Products (C).
 - 2. Curries Company (CU).

2.2 MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.
- B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.
- C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

- A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.
- B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.
 - 1. Design: Flush panel.
 - 2. Core Construction: Foamed in place polyurethane and steel stiffened laminated core with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22-gauge steel stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, foamed in place polyurethane core chemically bonded to all interior surfaces. No stiffener face welding is permitted.
 - b. Thermal properties to rate at a fully operable minimum U-Factor 0.37 and R-Value 2.7, including insulated door, thermal-break frame and threshold.
 - c. Kerf Type Frames: Thermal properties to rate at a fully operable minimum U-Factor 0.38 and R-Value 2.6, including insulated door, kerf type frame, and threshold.
 - 3. Level/Model: Level 3 and Physical Performance Level A (Extra Heavy Duty), Minimum 16 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
 - 4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 - 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 - 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 - 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

- C. Interior Doors (Energy Efficient): Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A366 or 620. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Steel stiffened laminated core with fiberglass filler with no stiffener face welds, in compliance with HMMA 867 "Laminated Core".
 - a. Provide 22-gauge steel-stiffeners at 6 inches on-center internally welded at 5" on-center to integral core assembly, No stiffener face welding is permitted.
 - b. Acoustical sound transmission rating shall be no less than STC 38 complying with ASTM E 90 and must be visible on factory applied labels.
 3. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 4. Vertical Edges: Vertical edges-to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
 7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.
- D. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:
1. Design: Flush panel.
 2. Core Construction: Manufacturer's standard kraft-paper honeycomb, or one-piece polystyrene core, securely bonded to both faces.
 3. Core Construction: Manufacturer's standard vertical steel-stiffener core. Minimum 22 gauge steel-stiffeners at 6 inches on-center construction attached by spot welds spaced not more than 5" on centers. Spaces between stiffeners filled with fiberglass insulation (minimum density 0.8#/cubic ft.).
 - a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.
 4. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
 5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
 6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.

7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Manufacturers Basis of Design:

1. Curries Company (CU) - Polystyrene Core - 707 Series.
2. Curries Company (CU) - Steel-Stiffened - 747 Series.
3. Curries Company (CU) - Energy Efficient - 777 Trio-E Series.

2.4 SPECIAL FUNCTION HOLLOW METAL DOORS

- A. Sound Resistant Doors: Subject to the same compliance standards and requirements as standard hollow metal doors, provide manufacturer's standard sound resistant acoustic core tested in accordance with ASTM E90, ASTM 413, and ASTM E1332 standards. Fabricate with minimum 16 gauge construction, 1-3/4" thickness, combined with standard flush frames designed for mid-range and high range sound attenuation from STC 39 through STC 52 applications. Furnish complete with perimeter sound seals, bottom seals, and threshold as required for specified STC rating.

1. Provide sound resistant doors with minimum STC sound rating (32, 38, 41, 43, 46, 50, 52, 54) as indicated on the door schedule:
2. Each unit to bear a physical label applied to door certifying the product construction and identifying the specific STC rating.
3. Manufacturers Basis of Design:
 - a. CECO Door Products (C) - Sound-Tech Express Series.
 - b. Curries Company (CU) - 757 Quiet Noise Series.

2.5 HOLLOW METAL FRAMES

- A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.
- B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16" positive thermal break and integral vinyl weatherstripping.
- C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.
1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) – Thermal Break TQ Series.

- D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.
 - 1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
 - 2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
 - 3. Manufacturers Basis of Design:
 - a. Curries Company (CU) - M Series.
- E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.
- F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.6 FRAME ANCHORS

- A. Jamb Anchors:
 - 1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
 - 2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
 - 3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.
- B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.
- C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.7 LOUVERS

- A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.
 - 1. Blade Type: Vision proof inverted V or inverted Y.
 - 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.
- B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.
 - 1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.

2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.8 LIGHT OPENINGS AND GLAZING

- A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.
- B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.
- C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.
- D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.9 ACCESSORIES

- A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.
- B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.10 FABRICATION

- A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.
- B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.
- C. Hollow Metal Doors:
 1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
 2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
 3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by

NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.

4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.
 - a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.
3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:
 - a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:
 - 1) Two anchors per jamb up to 60 inches high.
 - 2) Three anchors per jamb from 60 to 90 inches high.
 - 3) Four anchors per jamb from 90 to 120 inches high.
 - 4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.
 - b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

- 1) Three anchors per jamb up to 60 inches high.
 - 2) Four anchors per jamb from 60 to 90 inches high.
 - 3) Five anchors per jamb from 90 to 96 inches high.
 - 4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
 - 5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weather-stripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.
- E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."
1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
 2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
 3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
 4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.11 STEEL FINISHES

- A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.
1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.
- B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.
- C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."
- D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.
- E. Verify tolerances against manufacturers installations instructions for tornado and hurricane storm shelter openings.

3.3 INSTALLATION

- A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.
- B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.
 - 1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
 - 2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
 - 3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
 - 4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.
- C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.
 - 1. Non-Fire-Rated Standard Steel Doors:
 - a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.

- b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
 - c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
 - d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.
2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.
- D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

- A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.
- B. Remove grout and other bonding material from hollow metal work immediately after installation.
- C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

- A. Field Inspection (Punch Report): Reference Division 01 Sections "Closeout Procedures". Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.
 - 1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

SECTION 08 1416 - FLUSH WOOD DOORS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Solid core doors with wood veneer faces.
2. Factory finishing wood doors.
3. Factory fitting wood doors to frames and factory machining for hardware.
4. Louvers installed in flush wood doors.
5. Light frames and glazing installed in wood doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 08 Section "Door Schedule".
3. Division 08 Section "Hollow Metal Doors and Frames".
4. Division 08 Section "Glazing".
5. Division 08 Section "Door Hardware".
6. Division 08 Section "Access Control Hardware".

C. Standards and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ANSI A208.1 – Wood Particleboard.
3. Intertek Testing Service (ITS Warnock Hersey) - Certification Listings for Fire Doors.
4. NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
5. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
6. UL 10C - Positive Pressure Fire Tests of Door Assemblies; UL 1784 - Standard for Air Leakage Tests of Door Assemblies.
7. Window and Door Manufacturers Association - WDMA I.S.1-A Architectural Wood Flush Doors.

1.2 SUBMITTALS**A. Product Data: For each type of door indicated. Include details of core and edge construction, louvers, trim for openings, and WDMA I.S.1-A classifications. Include factory finishing specifications.****B. Sustainable Design Submittals**

1. Refer to Section 01 81 13 – Sustainable Design Requirements

C. Shop Drawings shall include:

1. Indicate location, size, and hand of each door.
2. Indicate dimensions and locations of mortises and holes for hardware.
3. Indicate dimensions and locations of cutouts.
4. Indicate requirements for veneer matching.
5. Indicate location and extent of hardware blocking.
6. Indicate construction details not covered in Product Data.
7. Indicate doors to be factory finished and finish requirements.
8. Indicate fire protection ratings for fire rated doors.

D. Samples for Initial Selection: For factory finished doors.

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish. For each wood species and transparent finish, provide set of three samples showing typical range of color and grain to be expected in the finished work.
2. Corner sections of doors, 8 by 10 inches, with door faces and edges representing actual materials to be used.
 - a. Provide samples for each species of veneer and core material.
 - b. Finish veneer faced door samples with same materials proposed for factory finished doors.
3. Frames for light openings, 6 inches long, for each material, type, and finish required.

E. Warranty: Provide sample of manufacturer's warranty.

1.3 QUALITY ASSURANCE

- A. Source Limitations: Obtain flush wood doors through one source from a single manufacturer wherever possible.
- B. Quality Standard: In addition to requirements specified, comply with WDMA I.S.1-A, latest edition, "Industry Standard for Architectural Wood Flush Doors".
- C. Fire Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing at positive pressure according to NFPA 252 (neutral pressure at 40" above sill) or UL10C.
 1. Oversize Fire Rated Door Assemblies: For units exceeding sizes of tested assemblies provide manufacturer's construction label, indicating compliance to independent 3rd party certification agency's procedure, except for size.
 2. Temperature Rise Limit: Where required and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire test exposure.

3. Smoke Control Door Assemblies: Comply with NFPA 105.
 - 1) Smoke "S" Label: Doors to bear "S" label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.
- D. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for receiving, handling, and installing flush wood doors.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Comply with requirements of referenced standard and manufacturer's written instructions.
- B. Package pre-finished doors individually in plastic bags and wrap bundles of doors in plastic sheeting.
- C. Mark each door on top rail with opening number used on Shop Drawings.

1.5 PROJECT CONDITIONS

- A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weather tight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

- A. Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.
 1. Failures include, but are not limited to, the following:
 - a. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
 - b. Telegraphing of core construction in wood face veneers exceeding 0.01 inch in a 3-inch span.
 2. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.
 3. Warranty Period for Solid Core Interior Doors: Life of installation.

PART 2 - PRODUCTS**2.1 DOOR CONSTRUCTION – GENERAL**

- A. WDMA I.S.1-A Performance Grade: Extra Heavy Duty; Aesthetic Grade: Premium.
- B. Fire Rated Doors: Provide construction and core as needed to provide fire ratings indicated.
 - 1. Category A Edge Construction: Provide fire rated door edge construction with intumescent seals concealed by outer stile (Category A) at 45, 60, and 90 minute rated doors. Comply with specified requirements for exposed edges.
 - 2. Pairs: Provide stiles with concealed intumescent seals. Comply with specified requirements for exposed edges.
 - a. Provide fire retardant stiles that are listed and labeled for applications indicated without formed steel edges and astragals.

2.2 CORE CONSTRUCTION

- A. Particleboard Core Doors:
 - 1. Particleboard: Wood fiber based materials complying with ANSI A208.1 Particleboard standard. Grade LD-2.
 - 2. Adhesive: Fully bonded construction using Polyurethane (PUR) glue.
 - 3. Blocking: As indicated under article "Blocking".
- B. Fire Resistant Composite Core Doors:
 - 1. Core: Non-combustible mineral product complying with requirements of referenced quality standard and testing and inspecting agency for fire protection rating indicated.
 - 2. Blocking: As indicated under article "Blocking".
 - 3. Edge Construction: At hinge stiles, provide laminated edge construction with improved screw holding capability and split resistance. Comply with specified requirements for exposed edges.

2.3 BLOCKING

- A. Fire Rated Doors:
 - 1. Provide blocking as indicated below:

- a. HB3: 5 inch top and bottom rail blocking in doors indicated to have closers and kick plates.
- b. HB4: Two 5 inch x 14 inch lock blocking in doors indicated to have exit devices.

2.4 VENEERED DOORS FOR TRANSPARENT FINISH

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Eggers Industries: Premium Series.
 2. Graham: GPD Series.
 3. Marshfield-Algoma: Signature Series.
 4. Mohawk: Cendura Series.
 5. VT Industries: Artistry Series.
- B. Interior Solid Core Doors:
 1. Grade: Premium.
 2. Faces: Veneer grades as noted below; veneer minimum 1/50-inch (0.5mm) thickness at moisture content of 12% or less.
 - a. Manufacturer Standard Face: as selected by architect/owner.
 - b. Manufacturer Custom Face: as selected by architect/owner.
 - c. Match Existing.
 - d. Plain Sliced Select White Maple, A grade faces.
 3. Match between Veneer Leaves: Book match.
 4. Assembly of Veneer Leaves on Door Faces:
 - a. Balance match.
 5. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
 6. Transom Match: Continuous match.
 7. Vertical Edges: Matching same species as faces. Wood or composite material, one piece, laminated, or veneered. Minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors.
 8. Horizontal Edges: Solid wood or structural composite material meeting the minimum requirements per WDMA section P-1, Performance Standards for Architectural Wood Flush Doors
 9. Construction: Five plies. Stiles and rails are bonded to core, then entire unit sanded before applying face veneers.

10. At doors over 40% of the face cut-out for lights and or louvers, furnish engineered composite lumber core.

2.5 LOUVERS

- A. Metal Louvers: Door manufacturer's standard metal louvers unless otherwise indicated.
 1. Blade Type: Vision proof inverted V or inverted Y.
 2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish.

2.6 LIGHT FRAMES AND GLAZING

- A. Wood Beads for Light Openings in Wood Doors up to and including 20-minute rating:
 1. Wood Species: Same species as door faces.
 2. Profile:
 - a. M1 Flush Bead.
 - b. At wood core doors with 20-minute fire protection ratings, provide wood beads and metal glazing clips approved for such use.
- B. Metal Frames for Light Openings in Fire Rated Doors over 20-minute Rating: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated.
 1. Manufacturers:
 - a. Air Louver (LV).
 - b. All Metal Stamping (AP).
 - c. Anemostat (AN).
 - d. Pemko (PE).
- C. Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with the flush wood door manufacturer's written instructions.

2.7 FABRICATION

- A. Factory fit doors to suit frame opening sizes indicated.
 1. Comply with requirements in NFPA 80 for fire rated doors.
 2. Undercut: As required per manufacturer's templates and sill condition.
- B. Factory machine doors for hardware that is not surface applied. Comply with final hardware schedules, door frame Shop Drawings, DHI A115-W series standards, and hardware templates.
 1. Coordinate with hardware mortises in metal frames to verify dimensions and alignment before factory machining.
 2. Metal Astragals: Factory machine astragals and formed steel edges for hardware for pairs of fire rated doors.

- C. Openings: Cut and trim openings through doors in factory.
 - 1. Light Openings: Trim openings with moldings of material and profile indicated.
 - 2. Glazing: Comply with applicable requirements in Division 08 Section "Glazing."
 - 3. Louvers: Factory install louvers in prepared openings.

- D. Electrical Raceways: Provide flush wood doors receiving electrified hardware with concealed wiring harness and standardized Molex™ plug connectors on both ends to accommodate up to twelve wires. Coordinate connectors on end of the wiring harness to plug directly into the electrified hardware and the through wire transfer hardware or wiring harness specified in hardware sets in Division 08 "Door Hardware". Wire nut connections are not acceptable.

2.8 FACTORY FINISHING

- A. General: Comply with referenced quality standard for factory finishing. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
 - 1. Finish faces, all four edges, edges of cutouts, and mortises. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

- B. Transparent Finish: Provide a clear protective coating over the wood veneer allowing the natural color and grain of the selected wood species to provide the appearance specified. Stain is applied to the wood surface underneath the transparent finish to add color and design flexibility.
 - 1. Finish: Meet or exceed WDMA I.S. 1A TR8 UV Cured Acrylated Polyester finish performance requirements.
 - 2. Staining:
 - a. Custom stain to match architect's sample.
 - 3. Sheen: Satin.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine doors and installed door frames before hanging doors.
 - 1. Verify that frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
 - 2. Reject doors with defects.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Hardware: For installation, see Division 8 Section "Door Hardware."
- B. Installation Instructions: Install doors and frames to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.
 - 1. Install fire rated doors in corresponding fire rated frames according to NFPA 80.
- C. Factory Fitted Doors: Align in frames for uniform clearance at each edge.
- D. Factory Finished Doors: Restore finish before installation if fitting or machining is required at Project site.
- E. Field modifications to doors shall not be permitted, except those specifically allowed by manufacturer or fire rating requirements.

3.3 ADJUSTING

- A. Operation: Re-hang or replace doors that do not swing or operate freely.
- B. Finished Doors: Replace doors that do not comply with requirements. Doors may be repaired or refinished if work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 081416

SECTION 08 31 13 - ACCESS DOORS AND FRAMES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Access doors and frames.
 - 2. Fire-rated access doors and frames.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, fire ratings, material descriptions, dimensions of individual components and profiles, and finishes.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Samples: For each type of access door and frame and for each finish specified, complete assembly minimum 6 by 6 inches in size.
- D. Product Schedule: For access doors and frames, sizes, and locations.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing and inspecting agency.
 - 1. Fire-Rated Door Inspector: Submit documentation of compliance with NFPA 80, Section 5.2.3.1.
 - 2. Submit a copy of DHI Fire and Egress Door Assembly Inspector (FDAI) certificate.

1.4 CLOSEOUT SUBMITTALS

- A. Record Documents: For fire-rated doors, list of applicable room name and number in which access door is located.

1.5 QUALITY ASSURANCE

- A. Fire-Rated Door Inspector Qualifications: The inspector for field quality control inspections of fire-rated door assemblies shall meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. Door and Hardware Institute Fire and Egress Door Assembly Inspector (FDAI) certification.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Rated Access Doors and Frames: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection and temperature-rise limit ratings indicated, according to NFPA 252 or UL 10B.

2.2 ACCESS DOORS AND FRAMES

- A. Flush Access Doors with Exposed Flanges:
 1. Description: Face of door flush with frame, with exposed flange and concealed hinge.
 2. Optional Features: Gasketing.
 3. Locations: Wall and ceiling.
 4. Door Size: 16" x 16".
 5. Thickness: Nominal 0.060 inch, 14 gauge
 6. Frame Material: Same material, thickness 16 gauge
 7. Latch and Lock: Cam latch, key operated.
 8. Finish: White Powder Coat (Steel)

2.3 FIRE-RATED ACCESS DOORS AND FRAMES

- A. Fire-Rated, Flush Access Doors with Exposed Flanges:
 1. Description: Door face flush with frame, with a core of mineral-fiber insulation enclosed in sheet metal; with exposed flange, self-closing door, and concealed hinge.
 2. Optional Features: Gasketing.
 3. Locations: Wall and ceiling.
 4. Door Size: 16" x 16".
 5. Fire-Resistance Rating: Not less than that of adjacent construction.
 6. Temperature-Rise Rating: 450 deg F at the end of 30 minutes.
 7. Thickness: Nominal 0.060 inch, 14 gauge
 8. Frame Material: Same material, thickness 16 gauge
 9. Latch and Lock: Self-latching door hardware, operated by key.
 10. Finish: White Powder Coat

2.4 MATERIALS

- A. Steel Plates, Shapes, and Bars: ASTM A36/A36M.
- B. Steel Sheet: Uncoated or electrolytic zinc coated, ASTM A879/A879M, with cold-rolled steel sheet substrate complying with ASTM A1008/A1008M, Commercial Steel (CS), exposed.

- C. Frame Anchors: Same material as door face.
- D. Inserts, Bolts, and Anchor Fasteners: Hot-dip galvanized steel according to ASTM A153/A153M or ASTM F2329.

2.5 FABRICATION

- A. General: Provide access door and frame assemblies manufactured as integral units ready for installation.
- B. Metal Surfaces: For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.
- C. Doors and Frames: Grind exposed welds smooth and flush with adjacent surfaces. Furnish mounting holes, attachment devices and fasteners of type required to secure access doors to types of supports indicated.
 - 1. For concealed flanges with drywall bead, provide edge trim for gypsum panels securely attached to perimeter of frames.
 - 2. For concealed flanges with plaster bead for full-bed plaster applications, provide zinc-coated expanded-metal lath and exposed casing bead welded to perimeter of frames.
- D. Recessed Access Doors: Form face of panel to provide recess for application of applied finish. Reinforce panel as required to prevent buckling. Provide access sleeves for each latch operator and install in holes cut through finish.
 - 1. For recessed doors with plaster infill, provide self-furring expanded-metal lath attached to door panel.
- E. Latch and Lock Hardware:
 - 1. Quantity: Furnish the number of latches and locks required to hold doors tightly closed.
 - 2. Keys: Furnish two keys per lock and key all locks alike.

2.6 FINISHES

- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
- B. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they

are within the range of approved Samples and are assembled or installed to minimize contrast.

- D. Painted Finishes: Comply with coating manufacturer's written instructions for cleaning, conversion coating, and applying and baking finish.
 - 1. Factory Primed: Apply manufacturer's standard, lead- and chromate-free, universal primer immediately after surface preparation and pretreatment.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions for installing access doors and frames.

3.3 FIELD QUALITY CONTROL

- A. Inspection Agency: Engage a qualified inspector to perform inspections and to furnish reports to Architect.
- B. Inspections:
 - 1. Fire-Rated Door Inspections: Inspect each fire-rated access door in accordance with NFPA 80, Section 5.2.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.
- E. Prepare and submit separate inspection report for each fire-rated access door indicating compliance with each item listed in NFPA 80.

3.4 ADJUSTING

- A. Adjust doors and hardware, after installation, for proper operation.

END OF SECTION 08 31 13

SECTION 08 33 23 - OVERHEAD COILING DOORS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Insulated service doors.

B. Related Requirements:

1. Section 05 50 00 "Metal Fabrications" for miscellaneous steel supports, door-opening framing, corner guards, and bollards.
2. Section 09 91 13 "Exterior Painting" and Section 09 91 23 "Interior Painting" for finish painting of factory-primed doors.

1.2 ACTION SUBMITTALS**A. Product Data:** For each type and size of overhead coiling door and accessory.

1. Include construction details, material descriptions, dimensions of individual components, profiles for slats, and finishes.
2. Include rated capacities, operating characteristics, electrical characteristics, and furnished accessories.
3. Include a description of automatic-closing device and testing and resetting instructions.

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – Sustainable Design Requirements

C. Shop Drawings: For each installation and for special components not dimensioned or detailed in manufacturer's product data.

1. Include plans, elevations, sections, and mounting details.
2. Include details of equipment assemblies, and indicate dimensions, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include points of attachment and their corresponding static and dynamic loads imposed on structure.
4. For exterior components, include details of provisions for assembly expansion and contraction and for excluding and draining moisture to the exterior.
5. Include diagrams for power, signal, and control wiring.

D. Samples for Initial Selection: Manufacturer's finish charts showing full range of colors and textures available for units with factory-applied finishes.

1. Include similar Samples of accessories involving color selection.

- E. Samples for Verification: For each type of exposed finish on the following components, in manufacturer's standard sizes:
 - 1. Curtain slats.
 - 2. Bottom bar with sensor edge.
 - 3. Guides.
 - 4. Brackets.
 - 5. Hood.
 - 6. Locking device(s).
 - 7. Include similar Samples of accessories involving color selection.

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and testing and inspecting agency.
- B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Special warranty.
- B. Maintenance Data: For overhead coiling doors to include in maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer for both installation and maintenance of units required for this Project.
 - 1. Maintenance Proximity: Not more than two hours' normal travel time from Installer's place of business to Project site.

1.6 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of doors that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain overhead coiling doors from single source from single manufacturer.

1. Obtain operators and controls from overhead coiling-door manufacturer.

2.2 PERFORMANCE REQUIREMENTS

- A. Sound-Control Doors: Assemblies tested in a laboratory for sound-transmission-loss performance according to ASTM E90, calculated according to ASTM E413, and rated for not less than the STC value indicated.
- B. Accessibility Standard: Comply with applicable provisions in the USDOJ's "2010 ADA Standards for Accessible Design" the ABA standards of the Federal agency having jurisdiction and ICC A117.1.
- C. Structural Performance, Exterior Doors: Capable of withstanding the following design wind loads:
 1. Design Wind Load: Uniform pressure (velocity pressure) of 20 lbf/sq. ft., acting inward and outward.
 2. Testing: According to ASTM E330/E330M.
 3. Deflection Limits: Design overhead coiling doors to withstand design wind load without evidencing permanent deformation or disengagement of door components.
 4. Operability under Wind Load: Design overhead coiling doors to remain operable under uniform pressure (velocity pressure) of 20-lbf/sq. ft. wind load, acting inward and outward.

2.3 DOOR ASSEMBLY

- A. Insulated Service Door: Overhead coiling door formed with curtain of interlocking metal slats.
 1. Basis-of-Design Product: Subject to compliance with requirements, provide Overhead Door Corporation; Stormtite Series 625 or a comparable product by one of the following:
 - a. C.H.I Overhead Doors, Inc.
 - b. Cookson; a CornellCookson company
 - c. Raynor Garage Doors
- B. Operation Cycles: Door components and operators capable of operating for not less than 50,000. One operation cycle is complete when a door is opened from the closed position to the fully open position and returned to the closed position.
- C. Air Infiltration: Maximum rate of 0.4 cfm/sq. ft. at 15 and 25 mph when tested according to ASTM E283.
- D. Windlocks: Every sixth slat
- E. STC Rating: 21.
- F. Insulated Door Assembly U-Factor: 0.90 Btu/deg F x h x sq. ft.

- G. Door Curtain Material: Stainless steel, 22 gauge
- H. Door Curtain Slats: Curved or Flat profile slats of 1-7/8-inch to 3-1/4-inch center-to-center height.
 - 1. Gasket Seal. Manufacturer's standard continuous gaskets between slats.
- I. Bottom Bar: Two angles, each not less than 1-1/2 by 1-1/2 by 1/8 inch thick; fabricated from stainless steel and finished to match door.
- J. Curtain Jamb Guides: Galvanized steel with exposed finish matching curtain slats.
- K. Hood: Match curtain material and finish.
 - 1. Shape: Round.
 - 2. Mounting: Face of wall.
 - 3. Thickness: 22 gauge
- L. Locking Devices: Equip door with slide bolt for padlock.
 - 1. Locking Device Assembly: Cremone-type, both jamb sides locking bars, operable from inside and outside with cylinders.
- M. Ferrous Surfaces: Powder Coated, Black.
- N. Electric Door Operator:
 - 1. Usage Classification: Standard duty, up to 25 cycles per hour and up to 90 cycles per day.
 - 2. Operator Location: Top of hood.
 - 3. Motor Exposure: Interior.
 - 4. Motor Electrical Characteristics:
 - a. Horsepower: 1 hp.
 - b. Voltage: 460 V, three phase.
 - 5. Emergency Manual Operation: Push-up Chain type.
 - 6. Obstruction-Detection Device: Automatic photoelectric sensor.
 - a. Sensor Edge Bulb Color: Black.
 - 7. Control Station(s): Interior mounted.
 - 8. Other Equipment: Audible and visual signals.

2.4 MATERIALS, GENERAL

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.5 DOOR CURTAIN MATERIALS AND CONSTRUCTION

- A. Door Curtains: Fabricate overhead coiling-door curtain of interlocking metal slats, designed to withstand wind loading indicated, in a continuous length for width of door without splices. Unless otherwise indicated, provide slats of thickness and mechanical properties recommended by door manufacturer for performance, size, and type of door indicated, and as follows:
1. Stainless Steel Door Curtain Slats: ASTM A240/A240M or ASTM A666, Type 304; sheet thickness of 0.025 inch; and as required.
 2. Insulation: Fill slats for insulated doors with manufacturer's standard thermal insulation complying with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, according to ASTM E84 or UL 723. Enclose insulation completely within slat faces.
- B. Curtain Jamb Guides: Manufacturer's standard angles or channels and angles of same material and finish as curtain slats unless otherwise indicated, with sufficient depth and strength to retain curtain, to allow curtain to operate smoothly, and to withstand loading. Slot bolt holes for guide adjustment. Provide removable stops on guides to prevent overtravel of curtain, and a continuous bar for holding windlocks.

2.6 HOODS

- A. General: Form sheet metal hood to entirely enclose coiled curtain and operating mechanism at opening head. Contour to fit end brackets to which hood is attached. Roll and reinforce top and bottom edges for stiffness. Form closed ends for surface-mounted hoods and fascia for any portion of between-jamb mounting that projects beyond wall face. Equip hood with intermediate support brackets as required to prevent sagging.
1. Stainless Steel: 0.025-inch-thick, stainless-steel sheet, Type 304, complying with ASTM A240/A240M or ASTM A666.

2.7 LOCKING DEVICES

- A. Locking Device Assembly: Fabricate with cylinder lock, spring-loaded dead bolt, operating handle, cam plate, and adjustable locking bars to engage through slots in tracks.
1. Lock Cylinders: As standard with manufacturer.
 2. Keys: Three for each cylinder.
- B. Chain Lock Keeper: Suitable for padlock.
- C. Safety Interlock Switch: Equip power-operated doors with safety interlock switch to disengage power supply when door is locked.

2.8 CURTAIN ACCESSORIES

- A. Weather seals for Exterior Doors: Equip each exterior door with weather-stripping gaskets fitted to entire exterior perimeter of door for a weather-resistant installation unless otherwise indicated.
 - 1. At door head, use 1/8-inch-thick, replaceable, continuous-sheet baffle secured to inside of hood or field-installed on the header.
 - 2. At door jambs, use replaceable, adjustable, continuous, flexible, 1/8-inch-thick seals of flexible vinyl, rubber, or neoprene.

2.9 COUNTERBALANCE MECHANISM

- A. General: Counterbalance doors by means of manufacturer's standard mechanism with an adjustable-tension, steel helical torsion spring mounted around a steel shaft and contained in a spring barrel connected to top of curtain with barrel rings. Use grease-sealed bearings or self-lubricating graphite bearings for rotating members.
- B. Counterbalance Barrel: Fabricate spring barrel of manufacturer's standard hot-formed, structural-quality, seamless or welded carbon-steel pipe, of sufficient diameter and wall thickness to support rolled-up curtain without distortion of slats and to limit barrel deflection to not more than 0.03 in./ft. of span under full load.
- C. Counterbalance Spring: One or more oil-tempered, heat-treated steel helical torsion springs. Size springs to counterbalance weight of curtain, with uniform adjustment accessible from outside barrel. Secure ends of springs to barrel and shaft with cast-steel barrel plugs.
- D. Torsion Rod for Counterbalance Shaft: Fabricate of manufacturer's standard cold-rolled steel, sized to hold fixed spring ends and carry torsional load.
- E. Brackets: Manufacturer's standard mounting brackets of either cast iron or cold-rolled steel plate.

2.10 ELECTRIC DOOR OPERATORS

- A. General: Electric door operator assembly of size and capacity recommended and provided by door manufacturer for door and operation-cycles requirement specified, with electric motor and factory-rewired motor controls, starter, gear-reduction unit, solenoid-operated brake, clutch, control stations, control devices, integral gearing for locking door, and accessories required for proper operation.
 - 1. Comply with NFPA 70.
 - 2. Control equipment complying with NEMA ICS 1, NEMA ICS 2, and NEMA ICS 6, with NFPA 70 Class 2 control circuit, maximum 24-V ac or dc.
- B. Usage Classification: Electric operator and components capable of operating for not less than number of cycles per hour indicated for each door.

- C. Door Operator Location(s): Operator location indicated for each door.
 - 1. Top-of-Hood Mounted: Operator is mounted to the right or left door head plate with the operator on top of the door-hood assembly and connected to the door drive shaft with drive chain and sprockets. Headroom is required for this type of mounting.
- D. Motors: Reversible-type motor with controller (disconnect switch) for motor exposure indicated for each door assembly.
 - 1. Electrical Characteristics: Minimum as indicated for each door assembly. If not indicated, large enough to start, accelerate, and operate door in either direction from any position, at a speed not less than 8 in./sec. and not more than 12 in./sec., without exceeding nameplate ratings or service factor.
 - 2. Operating Controls, Controllers, Disconnect Switches, Wiring Devices, and Wiring: Manufacturer's standard unless otherwise indicated.
 - 3. Coordinate wiring requirements and electrical characteristics of motors and other electrical devices with building electrical system and each location where installed.
- E. Limit Switches: Equip each motorized door with adjustable switches interlocked with motor controls and set to automatically stop door at fully opened and fully closed positions.
- F. Obstruction-Detection Devices: External entrapment protection consisting of indicated automatic safety sensor capable of protecting full width of door opening. For non-fire-rated doors, activation of device immediately stops and reverses downward door travel.
 - 1. Photoelectric Sensor: Manufacturer's standard system designed to detect an obstruction in door opening without contact between door and obstruction.
 - a. Self-Monitoring Type: Designed to interface with door operator control circuit to detect damage to or disconnection of sensing device. When self-monitoring feature is activated, door closes only with sustained or constant pressure on close button.
 - 2. Electric Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device. Connect to control circuit using manufacturer's standard take-up reel or self-coiling cable.
 - a. Self-Monitoring Type: Four-wire-configured device designed to interface with door operator control circuit to detect damage to or disconnection of sensor edge.
 - 3. Pneumatic Sensor Edge: Automatic safety sensor edge, located within astragal or weather stripping mounted to bottom bar. Contact with sensor activates device.

- G. Control Station: Three-button control station in fixed location with momentary-contact push-button controls labeled "Open" and "Stop" and sustained- or constant-pressure push-button control labeled "Close."
 - 1. Interior-Mounted Units: Full-guarded, surface-mounted, heavy-duty type, with general-purpose NEMA ICS 6, Type 1 enclosure.
 - 2. Exterior-Mounted Units: Full-guarded, standard-duty, surface-mounted, weatherproof type, NEMA ICS 6, Type 4 enclosure, key operated.
- H. Emergency Manual Operation: Equip each electrically powered door with capability for emergency manual operation. Design manual mechanism so required force for door operation does not exceed 25 lbf.
- I. Emergency Operation Disconnect Device: Equip operator with hand-operated disconnect mechanism for automatically engaging manual operator and releasing brake for emergency manual operation while disconnecting motor without affecting timing of limit switch. Mount mechanism so it is accessible from floor level. Include interlock device to automatically prevent motor from operating when emergency operator is engaged.
- J. Motor Removal: Design operator so motor may be removed without disturbing limit-switch adjustment and without affecting emergency manual operation.
- K. Audible and Visual Signals: Audible alarm and visual indicator lights in compliance with the accessibility standard.
 - 1. Three-channel universal coaxial receiver to open, close, and stop door.
 - 2. Portable control device to open and stop door may be momentary-contact type; control to close door shall be sustained- or constant-pressure type.
 - 3. Remote-antenna mounting kit.

2.11 GENERAL FINISH REQUIREMENTS

- A. Comply with NAAMM/NOMMA 500 for recommendations for applying and designating finishes.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

2.12 STAINLESS STEEL FINISHES

- A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.
- B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.
 - 1. Run grain of directional finishes with long dimension of each piece.

2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: ASTM A480/A480M No. 4.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates areas and conditions, with Installer present, for compliance with requirements for substrate construction and other conditions affecting performance of the Work.
- B. Examine locations of electrical connections.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

- A. Install overhead coiling doors and operating equipment complete with necessary hardware, anchors, inserts, hangers, and equipment supports; according to manufacturer's written instructions and as specified.
- B. Install overhead coiling doors, hoods, controls, and operators at the mounting locations indicated for each door.
- C. Accessibility: Install overhead coiling doors, switches, and controls along accessible routes in compliance with the accessibility standard.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and to furnish reports to Architect.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 1. Test door release, closing, and alarm operations when activated by smoke detector or building's fire-alarm system. Test manual operation of closed door. Reset door-closing mechanism after successful test.
- C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.
- D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

3.4 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. After electrical circuitry has been energized, operate doors to confirm proper motor rotation and door performance.
 - 3. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.

3.5 ADJUSTING

- A. Adjust hardware and moving parts to function smoothly so that doors operate easily, free of warp, twist, or distortion.
 - 1. Adjust exterior doors and components to be weather resistant.
- B. Lubricate bearings and sliding parts as recommended by manufacturer.
- C. Adjust seals to provide tight fit around entire perimeter.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of coiling-door Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper door operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include 24-hour-per-day, seven-day-per-week, emergency callback service.

3.7 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain overhead coiling doors.

END OF SECTION 08 33 23

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.01 SUMMARY

- A. Section Includes:
 - 1. Aluminum-framed storefront systems.
 - 2. Aluminum-framed entrance door systems.
- B. Related Requirements:
 - 1. Section 08 71 00 "Door Hardware"
 - 2. Section 08 80 00 "Glazing"

1.02 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include test data (air infiltration and water penetration resistance and thermal performance).
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Shop Drawings: For aluminum-framed entrances and storefronts. Include plans, elevations, sections, full-size details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of aluminum- framed entrances and storefronts, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
 - 4. Include point-to-point wiring diagrams showing the following:
 - a. Power requirements for each electrically operated door hardware.
 - b. Location and types of switches, signal device, conduit sizes, and number and size of wires.
- D. Samples for Initial Selection: For units with factory-applied color finishes.

- E. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- F. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- G. Entrance Door Hardware Schedule: Prepared by or under supervision of supplier, detailing fabrication and assembly of entrance door hardware, as well as procedures and diagrams. Coordinate final entrance door hardware schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of entrance door hardware.
- H. Delegated Design Submittal: For aluminum-framed entrances and storefronts including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.04 INFORMATIONAL SUBMITTALS

- A. Energy Performance Certificates: For aluminum-framed entrances and storefronts, accessories, and components, from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each aluminum-framed entrance and storefront.
- B. Product Test Reports: For aluminum-framed entrances and storefronts, for tests performed by manufacturer and witnessed by a qualified testing agency.
- C. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- D. Performance Testing:
 - 1. THERM analysis of the typical storefront head, jamb, and sill details (including the surrounding construction) to illustrate whether condensation should be expected.
- E. Source quality-control reports.

1.05 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For aluminum-framed entrances and storefronts to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed

storefront to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality- control program.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors [and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program].
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025].
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated [and accredited by the International Accreditation Service or the International Laboratory Accreditation Cooperation Mutual Recognition Arrangement as complying with ISO/IEC 17025] and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- A. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.
 - 1. Compatibility: Test materials or components using ASTM C1087.
 - 2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
 - 3. Submit no fewer than [eight] pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
 - 6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.10 WARRANTY

- A. Special Warranty: [Manufacturer] & [Installer] agrees to repair or replace components of aluminum- framed entrances and storefronts that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
1. Failures include, but are not limited to, the following:
 - a. Structural failures, including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals[, metal finishes,] and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 2. Warranty Period: [Two] years from date of Substantial Completion.
- B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.
 2. Warranty Period: [Five] years from date of Substantial Completion.
- C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.
1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
 - c. Cracking, peeling, or chipping.
 2. Warranty Period: [Five] years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations: Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrances and storefronts.
- B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrances and storefronts representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 - 1. Aluminum-framed entrances and storefronts shall withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 - 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Glass breakage.
 - c. Air leakage.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Failure of operating units.
- C. Structural Loads:
 - 1. Wind Loads: As indicated on Sheet S001.
 - 2. Other Design Loads: As indicated on Sheet S001.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 - 1. Deflection Normal to Wall Plane: Limited to [1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches].
 - 2. Deflection Parallel to Glazing Plane: Limited to [amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch].
 - a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.
 - b. Retain "Cantilever Deflection" Subparagraph below if required.
 - 3. Cantilever Deflection: Limited to $2L/175$ at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 - 1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
 - 2. When tested at [150] percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding [0.2] percent of span.
 - 3. Test Durations: As required by design wind velocity, but not less than [10] seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as

follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
 2. Maximum Water Leakage: [In accordance with AAMA 501.1]. Water leakage does not include water controlled by flashing and gutters, or water that is drained to exterior. Leakage is defined as any water penetration on interior exposed surface or any uncontrolled water at the perimeter or the system being tested.
- H. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:
1. Thermal Transmittance (U-factor):
 - a. Entrance Doors: U-factor of not more than [0.75 Btu/sq. ft. x h x deg F] as determined in accordance with NFRC 100.
 2. Solar Heat-Gain Coefficient (SHGC):
 - a. Entrance Doors: SHGC of not more than 0.25 as determined in accordance with NFRC 200.
 3. Air Leakage:
 - a. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
- I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.
1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of [180 deg F].
 - b. Low Exterior Ambient-Air Temperature: [0 deg F].
 - c. Interior Ambient-Air Temperature: [75 deg F].
- J. Structural-Sealant Joints:
1. Designed to carry gravity loads of glazing.

2.03 STOREFRONT SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
1. EFCO Corporation.
 2. Kawneer North America, an Arconic company.
 3. Trulite Glass & Aluminum Solutions, LLC.
 4. Tubelite Inc.

5. Pittco Architectural Metals
- B. Basis of Design: Pittco Architectural Metals Storefront
 - C. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.
 1. Interior Framing Construction: Nonthermal.
 2. Glazing System: Retained mechanically with gaskets on four sides Retained mechanically with gaskets on two sides and structural sealant on two sides.
 3. Glazing Plane: Center
 4. Finish: Clear anodic finish.
 5. Fabrication Method: Field-fabricated stick system.
 6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 7. Steel Reinforcement: As required by manufacturer.
 - D. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.
 - E. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
 - F. Subsills: Manufacturer's thermally improved subsills to be used at all storefronts, mechanically attached with fully sealed end dams.
 - G. Head receptors: Manufacturer's standard to be installed.

2.04 ENTRANCE DOOR SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, [provide products by the following] [provide products by one of the following] [available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following]:
 1. EFCO Corporation.
 2. Kawneer North America, an Arconic company.
 3. Trulite Glass & Aluminum Solutions, LLC.
 4. Tubelite Inc.
 5. Pittco Architectural Metals
- B. Basis of Design: Pittco Architectural Metals Entrances
- C. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.
 1. Door Construction: 2-inch overall thickness, with minimum 0.188-inch, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.
 2. Door Design: As indicated Medium stile; 3-1/2-inch nominal width.
 3. Glazing Stops and Gaskets: Beveled Square Insert description, snap-on,

extruded-aluminum stops and preformed gaskets.

- a. Provide nonremovable glazing stops on outside of door.
4. Finish: Match adjacent storefront framing finish.

2.05 ENTRANCE DOOR HARDWARE

- A. Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

2.06 GLAZING

- A. Glazing: Comply with Section 08 80 00 "Glazing."
- B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers. Comply with Section 08 80 00 "Glazing."
- C. Glazing Sealants: As recommended by manufacturer. Comply with Section 08 80 00 "Glazing."
1. Sealant shall have a VOC content of 250 g/L or less.
 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Structural Glazing Sealants: ASTM C1184 chemically curing silicone formulation that is compatible with system components with which it comes in contact; specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in storefront system indicated.
1. Color: Black As selected by Architect from manufacturer's full range of colors
Insert color.
- E. Weather seal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes in contact; recommended by structural-sealant, weather seal-sealant, and structural- sealant-glazed storefront manufacturers for this use.
1. Color: Match structural sealant.

2.07 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:
1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
 2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
 3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- H. Regional Materials: Products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

2.08 ACCESSORIES

- A. Automatic Door Operators: Section 08 71 13 "Automatic Door Operators."
- B. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
 - 1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 - 2. Reinforce members as required to receive fastener threads.
 - 3. Use exposed fasteners with countersunk Phillips screw head, finished to match framing system, fabricated from 300 series stainless steel.
- C. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
 - 1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- D. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials Dead-soft, 0.018-inch-thick stainless steel, complying with ASTM A240/A240M, of type recommended by manufacturer.
- E. Drip Caps: To be installed above all doors that are not protected by a canopy.
- F. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.
- G. Rigid PVC filler.

2.09 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
 - 1. Profiles that are sharp, straight, and free of defects or deformations.
 - 2. Accurately fitted joints with ends coped or mitered.
 - 3. Physical and thermal isolation of glazing from framing members.
 - 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 - 5. Provisions for field replacement of glazing from [exterior] [interior] [interior for vision glass and exterior for spandrel glazing or metal panels].
 - 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
- D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.
- E. Structural-Sealant-Glazed Framing Members: Include accommodations for using temporary support device to retain glazing in place while structural sealant cures.
- F. Storefront Framing: Fabricate components for assembly using screw-spline system.
- G. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.
 - 1. At interior and exterior doors, provide compression weather stripping at fixed stops.
- H. Entrance Doors: Reinforce doors as required for installing entrance door hardware.
 - 1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
 - 2. At exterior doors, provide weather sweeps applied to door bottoms.
- I. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.
- J. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.10 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm AA-

M12C22A31 for Exterior conditions, Class II, 0.010 mm or thicker for Interior conditions.

2.11 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Seal perimeter and other joints watertight unless otherwise indicated.
- G. Metal Protection:
 - 1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
 - 2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.
- H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.
- I. Install joint filler behind sealant as recommended by sealant manufacturer.
- J. Install components plumb and true in alignment with established lines and grades.

3.03 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without

distortion. Adjust weather- stripping contact and hardware movement to produce proper operation.

3.04 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 08 80 00 "Glazing."

3.05 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass as recommended by sealant manufacturer.
- B. Install weather seal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.06 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE DOORS

- A. Install entrance doors to produce smooth operation and tight fit at contact points.
 - 1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
 - 2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

3.07 ERECTION TOLERANCES

- A. Install aluminum-framed entrances and storefronts to comply with the following maximum tolerances:
 - 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
 - 2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
 - 3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
 - 4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.08 FIELD QUALITY CONTROL

- A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

- B. Field Quality-Control Testing: Air infiltration and water penetration testing be performed on at least one of the storefront systems on the building as part of the field quality control program. This should include the perimeter sealant conditions. Additional storefronts to be tested with a spray rack in accordance with ASTM E1105 without an applied air pressure for 2 hours:
1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 - b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.
 - c. Air leakage testing to use the same chambers as the water-spray test outlined herein and would be performed first, before the water test.
 3. Water Penetration: ASTM E1105 at a minimum [uniform] [and] [cyclic] static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 6.24 lbf/sq. ft., and shall not evidence water penetration.
- C. Aluminum-framed entrances and storefronts will be considered defective if they do not pass tests and inspections.
- D. Prepare test and inspection reports.

3.09 MAINTENANCE SERVICE

- A. Entrance Door Hardware Maintenance:
1. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of entrance door hardware.
 2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Use parts and supplies that are the same as those used in the manufacture and installation of original equipment.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Glazed aluminum curtain wall systems set as window wall:
 - a. Conventionally glazed.
 - b. One-sided, structural-sealant-glazed.
- B. Related Requirements:
 - 1. Section 01 43 39 "Mockups" for preconstruction laboratory mockup testing.
 - 2. Section 01 91 19.43 "Exterior Enclosure Commissioning."
 - 3. Section 07 92 00 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
 - 4. Section 08 80 00 "Glazing" for curtain wall glazing.

1.03 ALLOWANCES

- A. Preconstruction laboratory mockup and field testing is part of testing and inspecting allowance.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include test data (air infiltration and water penetration resistance and thermal performance).
- B. Sustainable Design Submittals:
 - 1. Product Data: For sealants, indicating VOC content.
 - 2. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
 - 3. Environmental Product Declaration (EPD): For each product.
 - 4. Environmental Product Declaration: For each product.
 - 5. Health Product Declaration: For each product.
 - 6. Sourcing of Raw Materials: Corporate sustainability report for each manufacturer.
- C. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-sized details, and attachments to other work.
 - 1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
 - 2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed

- aluminum curtain walls, showing the following:
 - a. Joinery, including concealed welds.
 - b. Anchorage.
 - c. Expansion provisions.
 - d. Glazing.
 - e. Flashing and drainage.
 - 3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
- D. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.
- E. Fabrication Sample: Of each vertical-to-horizontal intersection of assemblies, made from 12-inch lengths of full-size components and showing details of the following:
 - 1. Joinery, including concealed welds.
 - 2. Anchorage.
 - 3. Expansion provisions.
 - 4. Glazing.
 - 5. Flashing and drainage.
- F. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

- A. Mockup Testing Submittals:
 - 1. Testing Program: Developed specifically for Project.
 - 2. Test Reports: Prepared by a qualified preconstruction testing agency for each mockup test.
 - 3. Record Drawings: As-built drawings of preconstruction laboratory mockups showing changes made during preconstruction laboratory mockup testing.
- B. Energy Performance Certificates: For glazed aluminum curtain walls, accessories, and components from manufacturer.
 - 1. Basis for Certification: NFRC-certified energy performance values for each glazed aluminum curtain wall.
- C. Product Test Reports: For glazed aluminum curtain walls, for tests performed by a qualified testing agency.
- D. Quality-Control Program: Developed specifically for Project, including fabrication and installation, in accordance with recommendations in ASTM C1401. Include periodic quality-control reports.
- E. Performance Testing:
 - 1. THERM analysis of the typical storefront head, jamb, and sill details (including the surrounding construction) to illustrate whether condensation should be expected.
- F. Field quality-control reports.

1.07 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.
- B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.08 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors and that employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- B. Laboratory Mockup Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025.
- C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.
- D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.
 - 1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.
- E. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain wall assemblies.

1.09 MOCKUPS

- A. Select location and build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.
 - 1. Build mockup of typical wall area as approved by Owner and Architect.
 - 2. Testing shall be performed on mockups in accordance with requirements in "Field Quality Control" Article.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.10 WARRANTY

- A. Special Assembly Warranty: Manufacturer and Installer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures including, but not limited to, excessive deflection.
 - b. Noise or vibration created by wind and thermal and structural movements.
 - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
 - d. Water penetration through fixed glazing and framing areas.
 - e. Failure of operating components.
 - 2. Warranty Period: Two years from date of Substantial Completion.
- B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:
 - a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
 - b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
 - c. Cracking, peeling, or chipping.
2. Warranty Period: 5 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls.
- B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project, without failure due to defective manufacture, fabrication, installation, or other defects in construction.
 1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
 2. Failure also includes the following:
 - a. Thermal stresses transferring to building structure.
 - b. Air leakage.
 - c. Glass breakage.
 - d. Noise or vibration created by wind and thermal and structural movements.
 - e. Loosening or weakening of fasteners, attachments, and other components.
 - f. Failure of operating units.
- C. Structural Loads:
 1. Wind Loads: As indicated on structural drawings, S001.
 2. Other Design Loads: As indicated on structural drawings, S001.
- D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:
 1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans of greater than 13 feet 6 inches.
 2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
 3. Cantilever Deflection: Limited to 1/175 at unsupported cantilevers.
- E. Structural: Test in accordance with ASTM E330/E330M as follows:
 1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.
 2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
 3. Test Durations: As required by design wind velocity, but not less than 10 seconds.
- F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.
- G. Water Penetration under Dynamic Pressure: Test in accordance with AAMA 501.1 as follows:
 1. No evidence of water penetration through fixed glazing and framing areas when tested at dynamic pressure equal to 20 percent of positive wind-load design pressure, but not less than 15 lbf/sq. ft.

- 2. Maximum Water Leakage: In accordance with AAMA 501.1. Water leakage does not include water controlled by flashing and gutters or water that is drained to exterior. Leakage is defined as any water penetration on interior exposed surface or any uncontrolled water at the perimeter or the system being tested.

- H. Seismic Performance: Glazed aluminum curtain walls shall withstand the effects of earthquake motions determined in accordance with [ASCE/SEI 7].
 - 1. Seismic Drift Causing Glass Fallout: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.6 at design displacement and 1.5 times the design displacement.
 - 2. Vertical Interstory Movement: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.7 at design displacement and 1.5 times the design displacement.

- I. Energy Performance: Certified and labelled by manufacturer for energy performance as indicated in "Glazing" specification.

- J. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows:
 - 1. Outdoor-Indoor Transmission Class: Minimum 26.
 - 2. Sound Transmission Class: Minimum 32.

- K. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:
 - 1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
 - 2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.
 - a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
 - b. Low Exterior Ambient-Air Temperature: 0 deg F.

- L. Structural-Sealant Joints:
 - 1. Designed to carry gravity loads of glazing.

- M. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.
 - 1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
 - 2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.02 SOURCE LIMITATIONS

- A. Obtain all components of curtain-wall system, including framing entrances and accessories, from single manufacturer.

2.03 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following, or an Architect approved equivalent:
 - 1. EFCO Corporation.
 - 2. Kawneer North America, an Arconic company.
 - 3. Tubelite Inc.
 - 4. Pittco Architectural Metals (Basis of Design), 2 ½" x minimum 6"

depth

- B. Framing Members: Manufacturer's extruded aluminum framing members of thickness required and reinforced as required to support imposed loads.
 - 1. Construction: Thermally improved.
 - 2. Glazing System: Retained mechanically with gaskets on four sides and retained mechanically with gaskets on three sides and structural sealant on one side.
 - 3. Glazing Plane: Front.
 - 4. Finish: Clear anodic finish.
 - 5. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
 - 6. Steel Reinforcement: As required by manufacturer.
- C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.
 - 1. Include snap-on aluminum trim that conceals fasteners.
- D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.
- E. Entrance Door Systems: Comply with Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" Section 08 42 13 "Aluminum-Framed Entrances".

2.04 GLAZING

- A. Glazing: Comply with Section 08 80 00 "Glazing."
- B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard Compression-type, replaceable EPDM Extruded silicone Comply with Section 08 80 00 "Glazing." Insert type.
 - 1. Color: Black.
- C. Glazing Sealants: As recommended by manufacturer. Comply with Section 08 80 00 "Glazing."
 - 1. Sealant shall have a VOC content of 250 g/L or less.
 - 2. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.
 - 1. Color: Black.
- E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.
 - 1. Color: Match structural sealant.

2.05 MATERIALS

- A. Sheet and Plate: ASTM B209.
- B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.
- C. Structural Profiles: ASTM B308/B308M.
- D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

- E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.
- F. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- G. Recycled Content of Aluminum Components: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.
- H. Regional Materials: Products shall be manufactured within 100 miles of Project site from materials that have been extracted, harvested, or recovered, as well as manufactured, within 100 miles of Project site.

2.06 ACCESSORIES

- A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.
1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
 2. Reinforce members as required to receive fastener threads.
 3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system.
- B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.
1. Concrete and Masonry Inserts: Hot-dip galvanized cast-iron, malleable-iron, or steel inserts complying with ASTM A123/A123M or ASTM A153/A153M requirements.
- C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials Dead-soft, 0.018-inch- thick stainless steel, ASTM A240/A240M of type recommended by manufacturer.
- D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.07 FABRICATION

- A. Form or extrude aluminum shapes before finishing.
- B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.
- C. Fabricate components that, when assembled, have the following characteristics:
1. Profiles that are sharp, straight, and free of defects or deformations.
 2. Accurately fitted joints with ends coped or mitered.
 3. Physical and thermal isolation of glazing from framing members.
 4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
 5. Provisions for field replacement of glazing from exterior.
 6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

- D. Fabricate components to resist water penetration as follows:
1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
 2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.
- E. Curtain-Wall Framing: Fabricate components for assembly using manufacturer's standard assembly method.
- F. Factory-Assembled Frame Units:
1. Rigidly secure nonmovement joints.
 2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
 3. Seal joints watertight unless otherwise indicated.
 4. Install glazing to comply with requirements in Section 08 80 00 "Glazing."
 5. Install structural glazing.
 - a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
 - b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
 - c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions with the framing and glazing in a fully supported position.
 - d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's recommendations.
 - e. After structural sealant has completely cured, insert backer rod between lites of glass as recommended by sealant manufacturer.
 - f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
 - g. Clean and protect glass as indicated in Section 08 80 00 "Glazing."
 - h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.
- G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.08 ALUMINUM FINISHES

- A. Clear Anodic Finish: AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

2.09 SOURCE QUALITY CONTROL

- A. Structural Sealant: Perform quality-control procedures complying with ASTM C1401 recommendations, including, but not limited to, assembly material qualification procedures, sealant testing, and assembly fabrication reviews and checks.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION, GENERAL

- A. Comply with manufacturer's written instructions.
- B. Do not install damaged components.
- C. Fit joints to produce hairline joints free of burrs and distortion.
- D. Rigidly secure nonmovement joints.
- E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.
- F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.
- G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

- I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

- J. Install components plumb and true in alignment with established lines and grades.

3.03 INSTALLATION OF OPERABLE UNITS

- A. Install operable units level and plumb, securely anchored, and without distortion. Adjust weatherstripping contact and hardware movement to produce proper operation.

3.04 INSTALLATION OF GLAZING

- A. Install glazing as specified in Section 08 80 00 "Glazing."

3.05 INSTALLATION OF WEATHERSEAL SEALANT

- A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.
- B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.06 ERECTION TOLERANCES

- A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:
 1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.

2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:
 - a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
 - b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
 - c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.
4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.07 FIELD QUALITY CONTROL

- A. Testing Agency: a qualified testing agency to perform tests and inspections.
- B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.
- C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.
 1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 6.24 lbf/sq. ft.
 - a. Perform a minimum of three tests in areas as directed by Architect.
 3. Water Penetration: ASTM E1105 at a minimum uniform and cyclic static-air-pressure differential of 0.67 times the static-air-pressure differential specified for laboratory testing in "Performance Requirements" Article, but not less than 8 lbf/sq. ft., and shall not evidence water penetration or leakage. Leakage is defined as any water penetration on interior exposed surface or any uncontrolled water at the perimeter or the system being tested.
- D. Structural-Sealant Adhesion: Test structural sealant in accordance with recommendations in ASTM C1401, Destructive Test Method A, "Hand Pull Tab (Destructive)," Appendix X2.
 1. Test a minimum of two areas on each building facade.
 2. Repair installation areas damaged by testing.
- E. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports.

END OF SECTION 08 44 13

SECTION 08 71 00 - DOOR HARDWARE**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes commercial door hardware for the following:
 - 1. Swinging doors.
 - 2. Sliding doors.
 - 3. Other doors to the extent indicated.
- B. Door hardware includes, but is not necessarily limited to, the following:
 - 1. Mechanical door hardware.
 - 2. Electromechanical door hardware.
 - 3. Cylinders specified for doors in other sections.
- C. Related Sections:
 - 1. Division 08 Section "Hollow Metal Doors and Frames".
 - 2. Division 08 Section "Flush Wood Doors".
 - 3. Division 08 Section "Stile and Rail Wood Doors".
 - 4. Division 08 Section "Sound Control Hollow Metal Door Assemblies".
 - 5. Division 08 Section "Sound Control Wood Door Assemblies".
 - 6. Division 08 Section "Aluminum-Framed Entrances and Storefronts".
 - 7. Division 08 Section "All-Glass Entrances".
- D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.
 - 1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
 - 2. ICC/IBC - International Building Code.
 - 3. NFPA 70 - National Electrical Code.
 - 4. NFPA 80 - Fire Doors and Windows.
 - 5. NFPA 101 - Life Safety Code.
 - 6. NFPA 105 - Installation of Smoke Door Assemblies.
 - 7. State Building Codes, Local Amendments.
- E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.
4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

- A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.
- B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing, fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.
 1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."
 2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.
 3. Content: Include the following information:
 - a. Type, style, function, size, label, hand, and finish of each door hardware item.
 - b. Manufacturer of each item.
 - c. Fastenings and other pertinent information.
 - d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
 - e. Explanation of abbreviations, symbols, and codes contained in schedule.
 - f. Mounting locations for door hardware.
 - g. Door and frame sizes and materials.
 - h. Warranty information for each product.
 4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.
- C. Shop Drawings: Details of electrified access control hardware indicating the following:
 1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of

the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

- a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
 - b. Complete (risers, point-to-point) access control system block wiring diagrams.
 - c. Wiring instructions for each electronic component scheduled herein.
2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.
- D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.
- E. Sustainable Design Submittals:
1. Refer to Section 01 81 13 – Sustainable Design Requirements
- F. Informational Submittals:
1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.
- G. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.
- 1.4 QUALITY ASSURANCE
- A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.
 - B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).
 - C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

- D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.
- E. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.
1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.
 2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.
- F. Each unit to bear third party permanent label indicating compliance with the referenced testing standards.
- G. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:
1. Function of building, purpose of each area and degree of security required.
 2. Plans for existing and future key system expansion.
 3. Requirements for key control storage and software.
 4. Installation of permanent keys, cylinder cores and software.
 5. Address and requirements for delivery of keys.
- H. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.
1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
 2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
 3. Review sequence of operation narratives for each unique access controlled opening.
 4. Review and finalize construction schedule and verify availability of materials.
 5. Review the required inspecting, testing, commissioning, and demonstration procedures

- I. At completion of installation, provide written documentation that components were applied according to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.
- B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.
- C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

- A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.
- B. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

- A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.
- B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:
 1. Structural failures including excessive deflection, cracking, or breakage.
 2. Faulty operation of the hardware.
 3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

4. Electrical component defects and failures within the systems operation.
- C. Warranty Period: Unless otherwise indicated, warranty shall be one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

- A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.
- B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:
1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.
- C. Please note that ASSA ABLOY is transitioning the Yale Commercial brand to ASSA ABLOY ACCENTRA. This affects only the brand name; the products and product numbers will remain unchanged. The brand transition is expected to be complete in or about May of 2024, and products shipping after that time will be branded ASSA ABLOY ACCENTRA.
- D. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 BUTT HINGES

- A. Hinges: ANSI/BHMA A156.1 butt hinges with number of hinge knuckles and other options as specified in the Door Hardware Sets.
1. Quantity: Provide the following hinge quantity:
 - a. Two Hinges: For doors with heights up to 60 inches.
 - b. Three Hinges: For doors with heights 61 to 90 inches.
 - c. Four Hinges: For doors with heights 91 to 120 inches.
 - d. For doors with heights more than 120 inches, provide 4 hinges, plus 1 hinge for every 30 inches of door height greater than 120 inches.
 2. Hinge Size: Provide the following, unless otherwise indicated, with hinge widths sized for door thickness and clearances required:

- a. Widths up to 3'0": 4-1/2" standard or heavy weight as specified.
 - b. Sizes from 3'1" to 4'0": 5" standard or heavy weight as specified.
3. Hinge Weight and Base Material: Unless otherwise indicated, provide the following:
- a. Exterior Doors: Heavy weight, non-ferrous, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate standard weight.
 - b. Interior Doors: Standard weight, steel, ball bearing or oil impregnated bearing hinges unless Hardware Sets indicate heavy weight.
4. Hinge Options: Comply with the following:
- a. Non-removable Pins: With the exception of electric through wire hinges, provide set screw in hinge barrel that, when tightened into a groove in hinge pin, prevents removal of pin while door is closed; for the all out-swinging lockable doors.
5. Manufacturers:
- a. McKinney (MK) - TA/T4A Series, 5-knuckle.

2.3 CONTINUOUS HINGES

- A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 continuous geared hinge with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Manufacturers:
- a. Pemko (PE).
- B. Pin and Barrel Continuous Hinges: ANSI/BHMA A156.26 Grade 1-600 pin and barrel continuous hinges with minimum 14 gauge Type 304 stainless steel hinge leaves, concealed stainless pin, and twin self-lubricated nylon bearings at each knuckle separation. Factory trim hinges to suit door height and prepare for electrical cut-outs.
1. Manufacturers:
- a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR).
 - b. Pemko (PE).

2.4 POWER TRANSFER DEVICES

- A. Electrified Quick Connect Transfer Hinges: Provide electrified transfer hinges with Molex™ standardized plug connectors and sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets with

a 1-year warranty. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. McKinney (MK) - QC (# wires) Option.

B. Electrified Quick Connect Stainless Steel Continuous Transfer Hinges: Provide electrified transfer stainless steel continuous hinges with electrical transfer access prep accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

- a. Markar Products; ASSA ABLOY Architectural Door Accessories (MR) - MP-ETAP-EL (# wires) Option.

C. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

- a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

- a. McKinney (MK) - QC-C Series.

2.5 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: Provide products conforming to ANSI/BHMA A156.3 and A156.16, Grade 1.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.

3. Surface bolts to be minimum 8" in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.
 4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.
 5. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).
- B. Coordinators: ANSI/BHMA A156.3 door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.
1. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).
- C. Door Push Plates and Pulls: ANSI/BHMA A156.6 door pushes and pull units of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.
1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
 2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
 3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
 4. Pulls, where applicable, shall be provided with a 10" clearance from the finished floor on the push side to accommodate wheelchair accessibility.
 5. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.
 6. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).

2.6 CYLINDERS AND KEYING

- A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.
1. Manufacturers:
 - a. dormakaba Best (BE).
 - b. No Substitution.

- B. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:
1. Threaded mortise cylinders with rings and cams to suit hardware application.
 2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
 3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
 4. Tubular deadlocks and other auxiliary locks.
 5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
 6. Keyway: Match existing
- C. Small Format Interchangeable Cores: Provide small format interchangeable cores (SFIC) as specified, core insert, removable by use of a special key; usable with other manufacturers' cylinders.
- D. Keying System: Each type of lock and cylinders to be factory keyed.
1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
 2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
 3. Existing System: Field verify and key cylinders to match Owner's existing system.
- E. Key Quantity: Provide the following minimum number of keys:
1. Change Keys per Cylinder: Two (2)
 2. Master Keys (per Master Key Level/Group): Five (5).
 3. Construction Keys (where required): Ten (10).
- F. Construction Keying: Provide temporary keyed construction cores.
- G. Key Registration List (Bitting List):
1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
 2. Provide transcript list in writing or electronic file as directed by the Owner.

2.7 KEY CONTROL

- A. Key Control Cabinet: Provide a key control system including envelopes, labels, and tags with self-locking key clips, receipt forms, 3-way visible card index, temporary markers, permanent markers, and standard metal cabinet. Key control cabinet shall have expansion capacity of 150% of the number of locks required for the project.
1. Manufacturers:
 - a. Lund Equipment (LU).
 - b. MMF Industries (MM).

- c. Telkee (TK).

2.8 MORTISE LOCKS AND LATCHING DEVICES

- A. Mortise Locksets, Grade 1 (Heavy Duty): Provide ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed mortise locksets. Listed manufacturers shall meet all functions and features as specified herein.

- 1. Manufacturers:

- a. Sargent Manufacturing (SA) - 8200 Series.
- b. No Substitution.

2.9 CYLINDRICAL LOCKS AND LATCHING DEVICES

- A. Cylindrical Locksets, Grade 2 (Standard Duty): ANSI/BHMA A156.2, Series 4000, Grade 2 Certified Products Directory (CPD) listed. Locks are to be non-handed and fully field reversible.

- 1. Provide locksets with functions and features as follows:

- a. Meets ANSI/BHMA A156.41 for single motion egress.
- b. Where required by code, provide knurling or abrasive coating on all levers leading to hazardous areas.
- c. Meets UL and CUL Standard 10C Positive Pressure, Fire Test of Door Assemblies with levers that meet A117.1 Accessibility Code.
- d. Meets Florida Building Code FL2998 and UL Certification Directory ZHEM.R21744 for latching hardware for hurricane requirements.
- e. Five-year limited warranty for mechanical functions.

- 2. Manufacturers:

- a. Sargent Manufacturing (SA) - 7 Line.

2.10 AUXILIARY LOCKS

2.11 LOCK AND LATCH STRIKES

- A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

- 1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
- 2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
- 3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.

4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.12 ELECTRIC STRIKES

- A. Standard Electric Strikes: Electric strikes conforming to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Manufacturers:

- a. HES (HS) - 1500/1600 Series.

- B. Surface Mounted Rim Electric Strikes: Surface mounted rim exit device electric strikes conforming to ANSI/BHMA A156.31, Grade 1, and UL Listed for both Burglary Resistance and for use on fire rated door assemblies. Construction includes internally mounted solenoid with two heavy-duty, stainless steel locking mechanisms operating independently to provide tamper resistance. Strikes tested for a minimum of 500,000 operating cycles. Provide strikes with 12 or 24 VDC capability supplied standard as fail-secure unless otherwise specified. Option available for latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike. Strike requires no cutting to the jamb prior to installation.

1. Manufacturers:

- a. HES (HS) - 9400/9500/9600/9700/9800 Series.

- C. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.13 CONVENTIONAL EXIT DEVICES

- A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. Exit devices shall have a five-year warranty.
2. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper

- fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.
3. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer's catalog and template book for specific requirements.
 4. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.
 5. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.
 6. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.
 - a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
 - b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.
 7. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.
 8. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2" wide stiles.
 9. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.
 10. Rail Sizing: Provide exit device rails factory sized for proper door width application.
 11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.
- B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed exit devices. Listed manufacturers shall meet all functions and features as specified herein.
1. Electromechanical exit devices shall have the following functions and features:
 - a. Universal Molex plug-in connectors that have standardized color-coded wiring and are field configurable in fail safe or fail secure and operate from 12vdc to 24vdc regulated.
 - b. EcoFlex or equivalent technology that reduces energy consumption up to 92% as certified by GreenCircle.
 - c. Options to be available for request-to-exit or enter signaling, latchbolt and touchbar monitoring.
 - d. Field configurable electrified trim to fail-safe or fail-secure that operates from 12-24VDC.
 - e. Five-year limited warranty for electromechanical features.
 2. Manufacturers:

- a. Sargent Manufacturing (SA) - 80 Series.
 - b. No Substitution.
- C. Steel Removable Mullions: ANSI/BHMA A156.3 steel removable mullions with options for fire rating, locking, through-wire electrification and hurricane compliance as specified.
1. Manufacturers:
 - a. Same as exit device manufacturer.

2.14 DOOR CLOSERS

- A. All door closers specified herein shall meet or exceed the following criteria:
1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.
 2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.
 3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.
 4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.
 5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.
 6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.
- B. Door Closers, Surface Mounted (Heavy Duty): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron or aluminum alloy body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control. Provide non-handed units standard.
1. Heavy duty surface mounted door closers shall have a 30-year warranty.
 2. Manufacturers:
 - a. Norton Rixson (NO) - 7500 Series.

- C. Door Closers, Surface Mounted (Unitrol): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted closers with door stop mechanism to absorb dead stop shock on arm and top hinge. Hold-open arms to have a spring loaded mechanism in addition to shock absorber assembly. Arms to be provided with rigid steel main arm and secondary arm lengths proportional to the door width.

1. Manufacturers:

- a. Norton Rixson (NO) - Unitrol Series.

- D. Door Closers, Overhead Concealed (Narrow Profile): ANSI/BHMA 156.4 Grade 1 Certified Products Directory (CPD) listed door closers designed for narrow profile frames and doors. Closers to have fully concealed body in the frame head for offset hung applications, with separate and independent valves for closing speed and backcheck adjustments and a decorative cover plate.

1. Manufacturers:

- a. Norton Rixson (RF) - 91DCP Series.

2.15 SURFACE MOUNTED CLOSER HOLDERS

- A. Electromagnetic Door Holders: ANSI A156.15 electromagnetic door holder/releases with a minimum 20 to 40 pounds holding power and single coil construction able to accommodate 12VDC, 24VAC, 24VDC and 120VAC. Coils to be independently wound, employing an integral fuse and armatures to include a positive release button.

1. Manufacturers:

- a. Norton Rixson (RF) - 980/990 Series.
b. Sargent Manufacturing (SA) - 1560 Series.

2.16 ARCHITECTURAL TRIM

- A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.
2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.
3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 protection plates (kick, armor, or mop), fabricated from the following:
 - a. Stainless Steel: 300 grade, 050-inch thick.
5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.
6. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).

2.17 DOOR STOPS AND HOLDERS

- A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.
- B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.
 1. Manufacturers:
 - a. Rockwood (RO).
 - b. Trimco (TC).
- C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.
 1. Manufacturers:
 - a. Norton Rixson (RF).
 - b. Rockwood (RO).
 - c. Sargent Manufacturing (SA).

2.18 ARCHITECTURAL SEALS

- A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

- B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.
 - 1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.
- C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.
 - 1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.
- D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.
- E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.
- F. Manufacturers:
 - 1. Pemko (PE).
 - 2. Reese Enterprises, Inc. (RE).

2.19 FABRICATION

- A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.20 FINISHES

- A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.
- B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware
- C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.
- B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

- A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.
- B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

- A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.
 - 1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.
- B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:
 - 1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
 - 2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
 - 3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
 - 4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.
- C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.
- D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

- E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 ADJUSTING

- A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.5 CLEANING AND PROTECTION

- A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.
- B. Clean adjacent surfaces soiled by door hardware installation.
- C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.6 DEMONSTRATION

- A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.7 DOOR HARDWARE SETS

- A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.
 - 1. Quantities listed are for each pair of doors, or for each single door.
 - 2. The supplier is responsible for handing and sizing all products.
 - 3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.
- B. Manufacturer's Abbreviations:

- 1. GS - ASSA ABLOY Glass Solutions
- 2. MK - McKinney

- 3. MR - Markar
- 4. PE - Pemko
- 5. OT - Other
- 6. RO - Rockwood
- 7. SA - SARGENT
- 8. AD - Adams Rite
- 9. SU - Securitron
- 10. BE - BEST Locks & Closers
- 11. HS - HES
- 12. RF - Rixson
- 13. NO - Norton

Hardware Sets

Set: 1.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE

Set: 1.01

1 Continuous Hinge	FM300	630	MR
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	PRO 7500 (par arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 1.02

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock w/knurling	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE

Set: 2.00

8 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
2 Exit Device (CVR-LBR, Passage)	NB 19 43 MD8615 ETMB	US32D	SA

2 Surface Closer	7500 (reg. arm)	689	NO
2 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
2 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 2.01

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Exit Device (Rim, Clssrm. Sec.) w/ Ind.		12 19 43 49 8816	ETMB
US32D	SA		
1 Best Mortise Cylinder	1E-74	626	BE
1 Best Rim Cylinder	12E-62	626	BE
1 Surface Closer w/ Stop arm	UNIJ7500 (Top Jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 2.02

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Exit Device (Rim, Exit Only)	12 19 43 8810 EO	US32D	SA
1 Surface Closer w/ Stop arm	UNIJ7500 (Top Jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 2.03

1 Continuous Hinge	FM300	630	MR
1 Exit Device w/ Knurling (Rim, NL)	19 43 8804 ETMB	US32D	SA
1 Best Rim Cylinder	12E-62	626	BE
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	PRO 7500 (par arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Threshold	273x292AFGPK		PE
1 Head Gasketing	2891AS		PE
1 Jamb Gasketing Set	290AS		PE
1 Sweep w/ Drip cap	345APK		PE
1 Drip Cap	346C		PE
1 Door Contact	By Security Contractor		OT

Set: 2.04

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Exit Device (Rim, Passage)	12 19 43 8815 ETMB	US32D	SA
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 2.05

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Exit Device (Rim, Clssrm. Sec.) w/ Ind.		12 19 43 49 8816	ETMB
US32D	SA		
1 Best Mortise Cylinder	1E-74	626	BE
1 Best Rim Cylinder	12E-62	626	BE
1 Surface Closer w/ Stop arm	UNIJ7500 (Top Jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 H & J Smoke Seal	S88D		PE

Set: 3.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Push Plate	70F (8" x 16")	US32D	RO
1 Offset Pull	RM301	US32D	RO
1 Surface Closer	P7500 (par. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
3 Silencer	608		RO

Set: 3.01

1 Continuous Hinge	CFM SLF-HD1	Clr.	PE
1 Mortise Deadlock	MS1850S	628	AD
1 Best Mortise Cylinder	1E-74	626	BE
1 Thumbturn Cylinder	4066	130	AD
1 Offset Door Pull-1-1/4" dia.	RM3311-48"	US32D	RO
1 Offset Push-1-1/4" dia.	RM3312	US32D	RO
1 Wall Stop	400	US26D	RO

Set: 4.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Privacy Lock	V21 8265 LNMB	US26D	SA
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Mop Plate	K1050 4" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
3 Silencer	608		RO

Set: 5.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Office/Entry Lock	8205 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	7500 (reg. arm)	689	NO

1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE

Set: 6.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Classroom Lock	8237 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer w/ Stop arm	CPS7500	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 H & J Smoke Seal	S88D		PE

Set: 7.00

3 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Passage Latch	65U15 KL	US26D	SA
1 Hinge Pin Stop	528	NP	RO
3 Silencer	608		RO

Notes: Provide hinge pin or floor stop at conditions where a wall stop won't work

Set: 7.01

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Passage Latch	8215 LNMB	US26D	SA
1 Surface Closer w/ Stop arm	UNIJ7500 (Top Jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 7.02

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Passage Latch	8215 LNMB	US26D	SA
1 Surface Closer	J7500 (Top jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 7.03

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Passage Latch	65U15 KL	US26D	SA
1 Wall Stop	400	US26D	RO
3 Silencer	608		RO

Notes: Provide hinge pin or floor stop at conditions where a wall stop won't work

Set: 7.04

3 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Passage Latch	8215 LNMB	US26D	SA
1 Surface Closer w/ Stop arm	UNIJ7500 (Top Jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 8.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Classrm. Sec. Intruder Lock w/ Ind.	V21 8238 LNMB	US26D	SA
2 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	J7500 (Top jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE

Set: 8.01

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Classrm. Sec. Intruder Lock w/ Ind.	V21 8238 LNMB	US26D	SA
2 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	J7500 (Top jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: 8.02

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Classrm. Sec. Intruder Lock w/ Ind.	V21 8238 LNMB	US26D	SA
2 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	P7500 (par. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE

Set: 8.03

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
-----------------------	------------------	-------	----

1 Classrm. Sec. Intruder Lock w/ Ind.	V21 8238 LNMB	US26D	SA
2 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT

Set: AC1.00

2 Electric Continuous Hinge	FM300 EL12 ETAP	630	MR
1 Elec. Exit Device w/REX (CVR, NL)	19 43 55 56 MD8606 ETMB	US32D	SA
1 Elec. Exit Device w/REX (CVR, Exit Only)		19 43 55 MD8610 EO	
US32D	SA		
1 Best Mortise Cylinder	1E-74	626	BE
2 Surf Overhead Stop	9-X36	630	RF
2 Surface Closer	PRO 7500 (par arm)	689	NO
2 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Threshold	253x3AFG		PE
1 Head Gasketing	2891AS		PE
1 Jamb Gasketing Set	290AS		PE
1 Meeting Stile Seal (2-pc's)	303ASTST		PE
2 Sweep w/ Drip cap	345APK		PE
1 Drip Cap	346C		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
2 ElectroLynx Harness	QC-C006 (hinge to exit)		MK
1 ElectroLynx Adaptor	52-2946		SA
2 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
2 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically operated opening: Door normally closed and locked. Entry by mechanical key or by presenting a valid card to card reader. Presenting valid card to card reader will temporarily retract the latchbolt of the exit device on the active leaf allowing the door to be pulled open. Upon loss of power, device is locked. Fail Secure

Set: AC2.00

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock w/knurling	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO

1 H & J Smoke Seal	S88D	PE
1 Card Reader	By Security Contractor	OT
1 Wiring Diagram	By Security Contractor	SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)	MK
1 Door Contact	By Security Contractor	OT
1 Power Supply	By Security Contractor	OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.01

5 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Electric Hinge	TA2714 4.5 x 4.5 QC12	US26D	MK
2 Hinge (spring)	1502 4-1/2" x 4-1/2"	US26D	MK
1 Self Latching Flushbolt Set	2845-24" rod	US32D	RO
1 Dust Proof Strike	570	US26D	RO
1 Coordinator	2600 Series	US28	RO
1 Storeroom Lock w/knurling	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	7500 (reg. arm)	689	NO
2 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
2 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-Cxxx (hinge to lock/exit trim)		MK
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
2 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.02

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock w/knurling	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	7500 (reg. arm)	689	NO

1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.03

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.04

1 Continuous Hinge	FM300	630	MR
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	PRO 7500 (par arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 Threshold	253x3AFG		PE
1 Head Gasketing	2891AS		PE
1 Jamb Gasketing Set	290AS		PE

1 Sweep w/ Drip cap	345APK	PE
1 Drip Cap	346C	PE
1 Card Reader	By Security Contractor	OT
1 Wiring Diagram	By Security Contractor	SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)	MK
1 Door Contact	By Security Contractor	OT
1 Power Supply	By Security Contractor	OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Ballistic door

Set: AC2.05

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.06

1 Continuous Hinge	FM300	630	MR
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	PRO 7500 (par arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Drip Cap	346C		PE
1 STC seals & threshold	By acoustical door mfr.		OT

1 Card Reader	By Security Contractor	OT
1 Wiring Diagram	By Security Contractor	SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)	MK
1 Door Contact	By Security Contractor	OT
1 Power Supply	By Security Contractor	OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.07

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Office/Entry Lock	8205 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and selectively locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.08

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Classrm. Sec. Intruder Lock w/ Ind.	V21 8238 LNMB	US26D	SA
2 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	J7500 (Top jamb)	689	NO
1 Drop Plate	7787	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 STC seals & threshold	By acoustical door mfr.		OT
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK

1 Door Contact	By Security Contractor	OT
1 Power Supply	By Security Contractor	OT

Notes: Electrically controlled opening. Door normally closed and selectively locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC2.09

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Classrm. Sec. Intruder Lock w/ Ind.	V21 8238 LNMB	US26D	SA
2 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer w/ Stop arm	CPS7500	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 H & J Smoke Seal	S88D		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and selectively locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC3.00

5 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Electric Hinge	TA2714 4.5 x 4.5 QC12	US26D	MK
2 Hinge (spring)	1502 4-1/2" x 4-1/2"	US26D	MK
1 Self Latching Flushbolt Set	2845-24" rod	US32D	RO
1 Dust Proof Strike	570	US26D	RO
1 Coordinator	2600 Series	US28	RO
1 Coordinator Mtg. Bracket	2601 Series	US28	RO
1 Exit Device w/knurling (Mortise, NL)	12 19 43 8904 ETMB	US32D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer w/ Stop arm	CPS7500	689	NO
2 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO

1 H & J Smoke Seal	S88D	PE
1 Mtg. Stile Smoke Seal	S772D	PE
1 Card Reader	By Security Contractor	OT
1 Wiring Diagram	By Security Contractor	SA
1 ElectroLynx Harness	QC-Cxxx (hinge to lock/exit trim)	MK
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)	MK
2 Door Contact	By Security Contractor	OT
1 Power Supply	By Security Contractor	OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC3.01

5 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Electric Hinge	TA2714 4.5 x 4.5 QC12	US26D	MK
2 Hinge (spring)	1502 4-1/2" x 4-1/2"	US26D	MK
1 Self Latching Flushbolt Set	2845-24" rod	US32D	RO
1 Dust Proof Strike	570	US26D	RO
1 Coordinator	2600 Series	US28	RO
1 Coordinator Mtg. Bracket	2601 Series	US28	RO
1 Exit Device w/knurling (Mortise, NL)	12 19 43 8904 ETMB	US32D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	1500C-LM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	P7500 (par. arm)	689	NO
2 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
2 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE
1 Mtg. Stile Smoke Seal	S772D		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-Cxxx (hinge to lock/exit trim)		MK
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
2 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC3.02

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Alarmed Exit Device (Rim, NL)	AL 19 43 8804 ETMB	US32D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Best Rim Cylinder	12E-62	626	BE
1 Electric Strike	9400-LBM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surface Closer	P7500 (par. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Wall Stop	400	US26D	RO
1 H & J Smoke Seal	S88D		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Alarmed panic device (AL option). Monitored opening. Door is also equipped with a local alarm within push rail of panic device. Unauthorized egress will set off local alarm until reset my mechanical key. Authorized egress by mechanical key.

Set: AC3.03

1 Continuous Hinge	FM300	630	MR
1 Exit Device w/ Knurling (Rim, NL)	19 43 8804 ETMB	US32D	SA
1 Best Rim Cylinder	12E-62	626	BE
1 Electric Strike	9400-LBM	630	HS
1 SMART Pac Bridge Rectifier	2005M3		HS
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	PRO 7500 (par arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Threshold	253x3AFG		PE
1 Head Gasketing	2891AS		PE
1 Jamb Gasketing Set	290AS		PE
1 Sweep w/ Drip cap	345APK		PE
1 Drip Cap	346C		PE
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
1 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: AC4.00

2 Continuous Hinge	CFM SLF-HD1	Clr.	PE
2 Electric Continuous Hinge	CFM SLF-HD1 SER12	Clr.	PE
1 Manual Flushbolt Set	555-rod size as req'd.	US26D	RO
1 Dust Proof Strike	570	US26D	RO
1 Narrow Stile Deadlatch	4900	628	AD
1 Lever Operator	4600 (deadlatches)	US32D	AD
1 Best Mortise Cylinder	1E-74	626	BE
1 Electric Strike	7101 9 ELX	628	AD
1 SMART Pac Bridge Rectifier	2005M3		HS
2 Offset Door Pull-1-1/4" dia.	RM3311-48"	US32D	RO
2 Offset Push-1-1/4" dia.	RM3312	US32D	RO
2 Concealed Closer	91N 90N	689	RF
2 Floor Stop	446	US26D	RO
1 Card Reader	By Security Contractor		OT
1 Wiring Diagram	By Security Contractor		SA
1 ElectroLynx Harness	QC-C1500P (hinge/magnet/strike to power)		MK
2 Door Contact	By Security Contractor		OT
1 Power Supply	By Security Contractor		OT

Notes: Electrically controlled opening. Door normally closed and locked. Egress allowed at all times. Entry by mechanical key or by presenting valid proximity card to card reader which will temporarily disengage the electric strike. Upon loss of power, door will remain locked. FAIL SECURE

Set: E1.00

2 Continuous Hinge	FM300	630	MR
2 Recessed Exit	D3676 MEC	US32D	RI
2 Passage Exit Trim	D3080-MI M	US32D	RI
2 Surface Closer	D-DCN-7500	689	RI
2 Kick Plate	D-KP 8" high 4BE CSK	US32D	RI
2 Electromagnetic Holder	D-MDH-310	689	RI
1 Seal Kit	D-SS-STK-DBZ	Dk Brz	RI

Notes: Doors tied to fire alarm and electrically held open with wall magnets. Upon activation of fire alarm or loss of power, magnets release and door(s) close. Provide extension brackets if req'd. to suit wall conditions.

Provide Warnock Hersey 'A' rated steel stiffened hollow metal doors that do not require an overlapping astragal to achieve the 'A' rating.

Set: E1.01

4 Hinge, Full Mortise	TA2714 4.5 x 4.5	US26D	MK
1 Storeroom Lock	8204 LNMB	US26D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surface Closer	7500 (reg. arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Electromagnetic Holder	998M	689	RF
1 H & J Smoke Seal	S88D		PE

Notes: Doors tied to fire alarm and electrically held open with wall magnets. Upon activation of fire alarm or loss of power, magnets release and door(s) close. Provide extension brackets if req'd. to suit wall conditions.

Set: E2.00

2 Continuous Hinge	FM300	630	MR
2 Alarmed Exit Device (CVR, Exit Only)	AL 19 43 MD8610 EO		
US32D	SA		
2 Best Mortise Cylinder	1E-74	626	BE
2 Surf Overhead Stop	9-X36	630	RF
2 Surface Closer	PRO 7500 (par arm)	689	NO
2 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Threshold	253x3AFG		PE
1 Head Gasketing	2891AS		PE
1 Jamb Gasketing Set	290AS		PE
1 Meeting Stile Seal (2-pc's)	303ASTST		PE
2 Sweep w/ Drip cap	345APK		PE
1 Drip Cap	346C		PE

Notes: Monitored opening. Door is equipped with a battery operated alarm built into exit hardware . Unauthorized egress will set off local alarm until reset my mechanical key. Authorized egress by mechanical key.

Set: E2.01

1 Continuous Hinge	FM300	630	MR
1 Alarmed Exit Device (Rim, Exit Only)	AL 19 43 8810 EO	US32D	SA
1 Best Mortise Cylinder	1E-74	626	BE
1 Surf Overhead Stop	9-X36	630	RF
1 Surface Closer	PRO 7500 (par arm)	689	NO
1 Kick Plate	K1050 8" high 4BE CSK	US32D	RO
1 Threshold	273x292AFGPK		PE
1 Head Gasketing	2891AS		PE
1 Jamb Gasketing Set	290AS		PE

1 Sweep w/ Drip cap	345APK	PE
1 Drip Cap	346C	PE
1 Door Contact	By Security Contractor	OT

Notes: Monitored opening. Door is equipped with a battery operated alarm built into exit hardware . Unauthorized egress will set off local alarm until reset my mechanical key. Authorized egress by mechanical key.

Set: b/o

1 Hardware by others	.	OT
----------------------	---	----

END OF SECTION 08 71 00

SECTION 08 80 00 - GLAZING**PART 1 - GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Glass products.
 - 2. Laminated glass.
 - 3. Insulating glass.
 - 4. Glazing sealants.
 - 5. Glazing tapes.
 - 6. Miscellaneous glazing materials.

- B. Related Requirements:
 - 1. Section 08 41 13 "Aluminum Framed Entrances and Storefronts" for glazing.
 - 2. Section 04 44 13 "Glazed Aluminum Curtain Walls" for glazing.

1.02 DEFINITIONS

- A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

- B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

- C. Interspace: Space between lites of an insulating-glass unit.

1.03 COORDINATION

- A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.04 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 - 2. Review temporary protection requirements for glazing during and after installation.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Submittals
- C. Glass Samples: For each type of glass product other than clear monolithic vision glass including the following products; 12 inches square.
 - 1. Tinted glass.
 - 2. Coated glass.
 - 3. Laminated glass.
 - 4. Insulating glass.
 - 5. Insulating glass one way vision.
 - 6. Ballistic glass.
- D. Glazing Accessory Samples: For sealants and colored spacers, in 12-inch lengths. Install sealant Samples between two strips of material representative in color of adjoining framing system.
- E. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.
- F. Delegated Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by qualified professional engineer responsible for their preparation.

1.06 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For glass.
- B. Product Test Reports: For fabricated glass and glazing sealants, for tests performed by a qualified testing agency.
 - 1. For glazing sealants, provide test reports based on testing current sealant formulations within previous 36-month period.
- C. Preconstruction adhesion and compatibility test report.

1.07 QUALITY ASSURANCE

- A. Fabricated-Glass Manufacturer Qualifications: A qualified manufacturer of fabricated glass units who is approved and certified by primary glass manufacturer.
- B. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.
- C. Glass Testing Agency Qualifications: A qualified independent testing agency accredited according to the NFRC CAP 1 Certification Agency Program.
- D. Sealant Testing Agency Qualifications: An independent testing agency qualified according to ASTM C1021 to conduct the testing indicated.

- E. Mockups: Build mockups to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Install glazing in mockups specified in Section 08 41 13 "Aluminum-Framed Entrances and Storefronts" Section 08 44 13 "Glazed Aluminum Curtain Walls" to match glazing systems required for Project, including glazing methods.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 PRECONSTRUCTION TESTING

- A. Preconstruction Adhesion and Compatibility Testing: Test each glass product, tape sealant, gasket, glazing accessory, and glass-framing member for adhesion to and compatibility with elastomeric glazing sealants.
 - 1. Testing is not required if data are submitted based on previous testing of current sealant products and glazing materials matching those submitted.
 - 2. Use ASTM C1087 to determine whether priming and other specific joint-preparation techniques are required to obtain rapid, optimum adhesion of glazing sealants to glass, tape sealants, gaskets, and glazing channel substrates.
 - 3. Test no fewer than [eight]. Samples of each type of material, including joint substrates, shims, sealant backings, secondary seals, and miscellaneous materials.
 - 4. Schedule enough time for testing and analyzing results to prevent delaying the Work.
 - 5. For materials failing tests, submit sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.
- B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.
 - 1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.11 WARRANTY

- A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated- glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

- D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent within specified warranty period. Coverage for any other cause is excluded.
 - 1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Source Limitations for Glass: Obtain tinted and coated glass from single source from single manufacturer.

- B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

- B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.
- C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with local code requirements and ASTM E1300:
 - 1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.
 - a. Wind Design Data: As indicated on S001.
 - b. Basic Wind Speed: 107 mph
 - c. Importance Factor: 1.0
 - d. Exposure Category: C.
 - 2. Design Snow Loads: As indicated on Drawings.
 - 3. Probability of Breakage for Sloped Glazing: For glass sloped more than 15 degrees from vertical, design glass for a probability of breakage not greater than 0.001.
 - 4. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.
 - 5. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.
- D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.
- E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:
 - 1. For monolithic-glass lites, properties are based on units with lites of thickness indicated.
 - 2. For laminated-glass lites, properties are based on products of construction indicated.
 - 3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
 - 4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
 - 5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
 - 6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.03 GLASS PRODUCTS, GENERAL

- A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. NGA Publications: "Glazing Manual."
 2. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
 3. IGMA Publication for Sloped Glazing: IGMA TB-3001, "Guidelines for Sloped Glazing."
 4. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."
- B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC the SGCC or another certification agency acceptable to authorities having jurisdiction or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
- C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.
1. Minimum Glass Thickness for Exterior Lites: 6 mm.
 2. Thickness of Tinted Glass: Provide same thickness for each tint color indicated throughout Project.
- E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.04 GLASS PRODUCTS

- A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Guardian Glass; SunGuard.
 - b. Pilkington North America.
 - c. Vitro Architectural Glass.
- B. Low-Iron Annealed Float Glass: ASTM C1036, Type I, Class I (clear), Quality-Q3; and with visible light transmission of not less than 91 percent and SHGC of not less than 0.87.
1. Manufacturers: Subject to compliance with requirements, [provide products by one of the following]:
 - a. Guardian Glass; SunGuard.
 - b. Pilkington North America.
 - c. Vitro Architectural Glass.

- C. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- D. Heat-Strengthened Float Glass: ASTM C1048, Kind HS (heat strengthened), Type I, Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality- Q3.
 - 1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.

- E. Low-E-Coated Vision Glass: ASTM C1376.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Guardian Glass; SunGuard.
 - b. Pilkington North America.
 - c. Viracon, Inc.
 - d. Vitro Architectural Glass.

- F. One way Vision Glass
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis of Design: Viracon, Inc. Digital Distinctions
 - b. Approved equal.
 - 2. Digital Printing:
 - a. Standard printing with ceramic enamel, single-color.
 - b. Repetitive pattern with dots or holes as selected by Architect from stock manufacturer patterns.
 - c. Printing on the second (#2) glass surface of insulated glass unit.
 - 3. Submittal: Provide 12"x12" samples of a minimum 6 patterns for review.

- G. Ballistic Safety Glass:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Basis of Design: Oldcastle Building Envelope Armor Resist Plus #223000
 - b. Approved equal.
 - 2. Security Glass Type: Level 3 (.44 Magnum), 1.22", UL 752
 - 3. Nominal, glass clad polycarbonate, clear, attack face shall be 3mm heat strengthened glass.
 - 4. Laminated to a multiply glass core. Interior face shall be an exposed polycarbonate with a mar resistant coating. Product shall be UL labeled.

2.05 INSULATING GLASS

- A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.
1. Sealing System: Dual seal, with manufacturer's standard polyisobutylene and polysulfide polyisobutylene and silicone polyisobutylene and hot-melt butyl polyisobutylene and polyurethane Insert description primary and secondary sealants.
 2. Perimeter Spacer: Manufacturer's standard spacer material and construction Aluminum with mill or clear anodic finish Aluminum with black, color anodic finish Aluminum with bronze, color anodic finish Aluminum with powdered metal paint finish in color selected by Architect Galvanized steel Stainless steel Polypropylene-covered stainless steel in color selected by Architect Thermally broken aluminum Nonmetallic laminate Nonmetallic tube Silicone with integral desiccant and vapor barrier Insert material.
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Technoform.
 - 2) Thermix; a brand of Ensinger USA.
 3. Desiccant: Molecular sieve or silica gel, or a blend of both.

2.06 GLAZING SEALANTS

- A. General:
1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.
 2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
 3. Sealant shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
 4. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.
- B. Neutral-Curing Silicone Glazing Sealant, Class 100/50: Complying with ASTM C920, Type S, Grade NS, Use NT.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - c. Pecora Corporation.
 - d. Sika Corporation.
 - e. The Dow Chemical Company.
 - f. Tremco Incorporated.
 2. Applications: Describe types of glazing applications where sealant is required.
- C. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920,

Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Adfast.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d. Pecora Corporation.
 - e. Polymeric Systems, Inc.
 - f. Sika Corporation.
 - g. The Dow Chemical Company.
 - h. Tremco Incorporated.
2. Applications: Describe types of glazing applications where sealant is required.

D. Neutral-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Bostik, Inc.
 - b. GE Construction Sealants; Momentive Performance Materials Inc.
 - c. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - d. Pecora Corporation.
 - e. Permthane®/Acryl-R®; ITW Polymers Sealants North America.
 - f. Polymeric Systems, Inc.
 - g. Sika Corporation.
 - h. The Dow Chemical Company.
 - i. Tremco Incorporated.
 - j. Insert manufacturer's name.
2. Applications: Describe types of glazing applications where sealant is required.

E. Acid-Curing Silicone Glazing Sealant, Class 25: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Adfast.
 - b. Bostik, Inc.
 - c. GE Construction Sealants; Momentive Performance Materials Inc.
 - d. May National Associates, Inc.; a subsidiary of Sika Corporation.
 - e. Pecora Corporation.
 - f. Permthane®/Acryl-R®; ITW Polymers Sealants North America.
 - g. Polymeric Systems, Inc.
 - h. Sika Corporation.
 - i. The Dow Chemical Company.
 - j. Tremco Incorporated.
 - k. Insert manufacturer's name.
2. Applications: Describe types of glazing applications where sealant is required.

2.07 GLAZING TAPES

- A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids

elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 804.3 tape, where indicated.
 2. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
 3. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.
- B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:
1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
 2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.08 MISCELLANEOUS GLAZING MATERIALS

- A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.
- B. Setting Blocks:
1. EPDM Silicone with Shore A durometer hardness of 85, plus or minus 5.
 2. Type recommended in writing by sealant or glass manufacturer.
- C. Spacers:
1. Neoprene blocks or continuous extrusions of hardness required by glass manufacturer to maintain glass lites in place for installation indicated.
 2. Type recommended in writing by sealant or glass manufacturer.
- D. Edge Blocks:
1. EPDM, Silicone, with Shore A durometer hardness per manufacturer's written instructions.
 2. Type recommended in writing by sealant or glass manufacturer.
- E. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

- A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.
1. Allow for thermal movements from ambient and surface temperature

changes acting on glass framing members and glazing components.
a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

- B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.
- C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:
 - 1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
 - 2. Presence and functioning of weep systems.
 - 3. Minimum required face and edge clearances.
 - 4. Effective sealing between joints of glass-framing members.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

- A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.
- B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.03 GLAZING, GENERAL

- A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.
- B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.
- C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.
- D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.
- E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass

lites.

- F. Provide spacers for glass lites where length plus width is larger than 50 inches.
 - 1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
 - 2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.
- G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.
- H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.
- I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.
- J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.
- K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.04 TAPE GLAZING

- A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.
- B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.
- C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.
- D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.
- E. Do not remove release paper from tape until right before each glazing unit is installed.
- F. Apply heel bead of elastomeric sealant.

- G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.
- H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.05 GASKET GLAZING (DRY)

- A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.
- B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.
- C. Installation with Drive-in Wedge Gaskets: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- D. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.
- E. Install gaskets so they protrude past face of glazing stops.

3.06 SEALANT GLAZING (WET)

- A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.
- B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.
- C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.07 CLEANING AND PROTECTION

- A. Immediately after installation, remove nonpermanent labels and clean surfaces.

- B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.
 - 1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.
- C. Remove and replace glass that is damaged during construction period.
- D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.08 MONOLITHIC GLASS SCHEDULE

- A. Low-Iron Glass Type (Interior Glazing Type GL-1): Fully tempered float glass (heat soaked).
 - 1. Basis-of-Design Product: Vitro Starphire.
 - 2. Minimum Thickness: 6 mm or as indicated on drawings.
 - 3. Safety glazing required.

3.10 INSULATING GLASS SCHEDULE

- A. Low-Iron, Low-E, Insulating Glass Type IG-1:
 - 1. Basis-of-Design Product: Vitro Solarban 90 on Starphire.
 - 2. Overall Unit Thickness: 1 inch.
 - 3. Minimum Thickness of each Glass Lite: 6 mm.
 - 4. Outdoor Lite: Low-iron (Starphire), Low-E Solarban 90 on (2), fully tempered float glass (heat soaked).
 - 5. Interspace Content: Air.
 - 6. Indoor Lite: Low-iron (Starphire), fully tempered float glass (heat soaked).
 - 7. Winter Nighttime U-Factor: 0.29 maximum.
 - 8. Summer Daytime U-Factor: 0.27 maximum.
 - 9. Safety glazing required.
- B. Low-Iron Low-E, One-way Vision Insulating Glass Type IG-2:
 - 1. Outer glazing unit: Glass type IG-1 with one-way vision glass set in factory assembled insulated glass unit.
 - 2. Inner glazing unit: Ballistic safety glazing unit GL-3, separate glazing layer.

END OF SECTION 08 80 00

SECTION 08 91 19 - FIXED LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Extruded aluminum stationary louvers with non-drainable blades.

1.2 RELATED SECTIONS

- A. Section 01 81 13 – USGBC LEED® Requirements.
- B. Section 05 10 00 - Structural Metal Framing.
- C. Section 06 10 53 – Miscellaneous Rough Carpentry
- D. Section 07 62 00 – Sheet Metal Flashing and Trim
- E. Section 07 92 00 - Joint Sealants.

1.3 REFERENCES

- A. AAMA 2604 – High Performance Organic Coatings on Architectural Extrusions and Panels.
- B. AAMA 2605 - High Performance Organic Coatings on Architectural Extrusions and Panels.
- C. AAMA 611 – Voluntary Specification for Anodized Architectural Aluminum.
- D. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.
- E. AMCA 511 - Certified Ratings Program for Air Control Devices.
- F. ASCE 7 - Minimum Design Loads for Buildings and Other Structures.
- G. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
- H. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
- I. ASTM D822 - Standard Practice for Filtered Open-Flame Carbon-Arc Exposures of Paint and Related Coatings

- J. ASTM D2244 - Standard Test Method for Calculation of Color Differences From Instrumentally Measured Color Coordinates.
- K. ASTM D4214 - Standard Test Methods for Evaluating the Degree of Chalking of Exterior Paint Films.
- L. USGBC: U.S. Green Building Council LEED® Rating System.

1.4 DEFINITIONS

- A. Louver Terminology: Definitions of terms for metal louvers contained in AMCA 501 apply to this Section unless otherwise defined in this Section or in referenced standards.
- B. Horizontal Louver: Louver with horizontal blades; i.e., the axes of the blades are horizontal.
- C. Vertical Louver: Louver with vertical blades; i.e., the axes of the blades are vertical.
- D. Drainable-Blade Louver: Louver with blades having gutters that collect water and drain it to channels in jambs and mullions, which carry it to bottom of unit and away from opening.
- E. Rain-Resistant Louver: Louver that provides specified wind-driven rain performance, as determined by testing according to AMCA 500-L.

1.5 ACTION SUBMITTALS

- A. Submit under provisions of Section 01 30 00.
- B. Product Data: For each product to be used, including:
 - 1. Manufacturer's product data including performance data.
 - 2. Preparation instructions and recommendations.
 - 3. Storage and handling requirements and recommendations.
 - 4. Installation methods.
- C. Sustainable Documentation Submittals: LEED Rating System.
 - a. Refer to Section 01 81 13 – Sustainable Design Requirements
- D. Shop Drawings:
 - 1. Submit shop drawings indicating materials, construction, dimensions, accessories, and installation details.
- E. Product Schedule: For louvers. Use same designations indicated on Drawings.
- F. Samples: Submit sample of louver to show frame, blades, bird screen, gutters, downspouts, vertical supports, sill, accessories, finish, and color.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For manufacturer and Installer.
- B. Product Test Reports: For each type of louver, for tests performed by a qualified testing agency.
- C. Field quality-control reports.
- D. Sample Warranties: For manufacturer's warranties.

1.7 QUALITY ASSURANCE

- A. Manufacturer Qualifications:
 - 1. The manufacturer shall have implemented the management of quality objectives, continual improvement, and monitoring of customer satisfaction to assure that customer needs and expectations are met.
 - 2. Manufacturer shall be International Organization for Standardization (ISO) 9001 accredited.
- B. Installer Qualifications:
 - 1. USGBC LEED Compliance: The Work of this section shall be in accordance with applicable portions of the U.S. Green Building Council's LEED Green Building Rating System. Refer to Divisions 23 and 26 Sections and other related documents bound herein for purposes of complying with this requirement.
- C. Product Qualifications:
 - 1. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.
 - 2. Louvers shall be factory engineered to withstand the specified seismic loads.
 - a. Minimum design loads shall be calculated to comply with ASCE – 7, or local requirements of Authority Having Jurisdiction (AHJ).
 - 3. Recycled Content: Provide louver that incorporate recycled content materials. The louver shall consist of the following recycled content:
 - a. Fabricated aluminum recycled content 73% by weight. 18% post-consumer, 55 % pre-consumer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.
- C. Handling: Protect materials and finishes during handling and installation to prevent damage.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

1.10 WARRANTY

- A. Manufacturer shall provide standard limited warranty for louver systems for a period of five years (60 months) from date of installation, no more than 60 months after shipment from manufacturing plant. When notified in writing from the Owner of a manufacturing defect, manufacturer shall promptly correct deficiencies without direct financial cost to the Owner.
- B. Manufacturer shall provide 20 year limited warranty for fluoropolymer-based finish on extruded aluminum substrates.
 - 1. Finish coating shall not peel, blister, chip, crack or check.
 - 2. Chalking, fading or erosion of finish when measured by the following tests:
 - a. Finish coating shall not chalk in excess of 8 numerical ratings when measured in accordance with ASTM D4214.
 - b. Finish coating shall not change color or fade in excess of 5 NBS units as determined by ASTM D2244 and ASTM D822.
 - c. Finish coating shall not erode at a rate in excess of 10%/ 5 year as determined by Florida test sample.
- C. Manufacturer shall provide a 5 year limited warranty for Class I and a 3 year limited warranty for Class II anodized finish on extruded aluminum substrates.
 - 1. Seller warrants the Finish under normal atmospheric conditions.
 - a. Will not crack, craze, flake or blister
 - b. Will not change or fade more than (5) Delta-E Hunter units as determined by ASTM method D-2244
 - c. Will not chalk in excess of ASTM D-4214-07 number (8) rating, determined by the procedure outlined in ASTM D-4214-07 specification test.
 - 2. Any forming or welding must be done prior to finishing. Post forming or welding will void the warranty.
 - 3. This Warranty applies only if the anodized aluminum product is installed in strict accordance with Seller's recommended practices and maintained in accordance with AAMA (American Architectural Manufacturers Association) publication number 609 and 610-09 ("Cleaning and Maintenance Guide for Architecturally Finished Aluminum").

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Products: Subject to compliance with requirements, provide one of the following:
 - 1. Construction Specialties, Inc.

- 2. Greenheck Fan Corporation
- 3. Ruskin Company

2.2 STATIONARY BLADE LOUVER

- A. Model: ET125 as manufactured by Ruskin Company.
- B. Fabrication:
 - 1. Design: Stationary thin line louver type with hidden vertical supports to allow unlimited continuous line appearance. Primarily used for decorative and PTAC (Packaged Terminal Air-conditioning) applications.
 - 2. Frame:
 - a. Frame Depth: 1-1/8 inches (28 mm).
 - b. Wall Thickness: 0.050 inch (1.3 mm), nominal.
 - c. Material: Extruded aluminum, Alloy 6063-T6.
 - 3. Blades:
 - a. Style: non-drainable blades positioned 42° angle on .775” inches (19 mm), center to center, nominal.
 - b. Blade Thickness: 0.040 inch (1 mm) nominal.
 - c. Material: Extruded aluminum, Alloy 6063-T6.
 - 4. Minimum Assembly Size: 6 inches wide by 6 inches high (153 mm x 153 mm).
 - 5. Maximum Factory Assembly Size: Single sections shall not exceed 120 inches wide by 84 inches high (3048 mm x 2134 mm) or 84 inches wide by 120 inches high (2134 mm x 3048 mm). Louvers larger than the maximum single size shall be require field assembly of smaller sections.
 - 6. Recycled Content: 18% post-consumer. 55% pre-consumer, (post-industrial), total 73% by weight.
- C. Performance Data:
 - 1. Based on testing 48 inch x 48 inch (1,219 mm x 1,219 mm) size unit in accordance with AMCA 500.
 - 2. Free Area: 52 percent, nominal.
 - 3. Free Area Size: 8.29 square feet (0.75 m²).
 - 4. Maximum Recommended Air Flow through Free Area: 127 feet per minute (39 m/min).
 - 5. Air Flow: 1039 cubic feet per minute (29 cu. m/min).
 - 6. Maximum Pressure Drop (Intake): 0.01 inches w.g. (0.002 kPa).
 - 7. Water Penetration: not rated.
- D. Design Wind-load: Incorporate structural supports required to withstand uniform wind load of 30 pounds per square foot (1436 kPa).
- E. Louvers shall be factory engineered to withstand the specified seismic loads.
 - 1. Minimum design loads shall be calculated to comply with ASCE – 7, or local requirements of Authority Having Jurisdiction (AHJ).

2.3 ACCESSORIES

- A. Insulated Blank-Off Panels: 0.040 (1 mm) aluminum sheet, 1 inch (25 mm) and 2 inches (51 mm) as scheduled or indicated, aluminum skin insulated core.
- B. Hinged Frame: Continuous piano hinge attached to channel sub frame.

- C. Aluminum Filter Racks: Formed channel racks to accept standard thick filters. Unused bottom portion blanked off with 0.040 inch (1 mm) aluminum sheet.
 - 1. Filter: 2 inch (51 mm) thick.

- D. Security Bars:
 - 1. Location: Front.
 - 2. Location: Rear.
 - 3. Construction: Aluminum, 3/4 inch x 1/2 inch (19 mm x 13 mm), welded to louver.
 - a. Frame Thickness: 0.081"
 - b. Blades Thickness: 0.081"
 - c. Blade Positioning: 37-1/2 degree angle with 3-1/2" spacing c.c.
 - d. Fasteners: 3/16" plated steel screw
 - e. Fasteners: 3/16" plated steel screw

- E. Bird Screen:
 - 1. Aluminum: Aluminum, 1/2 inches by 0.063 inch (16 mm by 1 mm), expanded and flattened.
 - 2. Frame: Removable. Re-wireable.

- F. Extended Sills:
 - 1. Extruded aluminum, Alloy 6063-T5. Minimum nominal thickness 0.081 inch (1.5 mm).

- G. Visible Mullions: Manufacturer's standard horizontal or vertical visible mullions for architectural accent as indicated on drawings.

2.4 FINISHES

- A. Kynar 500
 - a. Number of Coats: 2

PART 3 EXECUTION

3.1 EXAMINATION

- A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

- B. If opening preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

- A. Clean opening thoroughly prior to installation.

- B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

- A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.
- B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.
- C. The supporting structure shall be designed to accommodate the point loads transferred by the louvers when subject to the design wind loads.
- D. Install joint sealants as specified in Section 07 92 00.
- E. Coordinate the installation of membrane air barrier with installation of louvers to ensure continuity of airtight seal for work specified in Section 07 27 15.
- F. Apply field topcoat within 6 months of application of shop prime coat. Apply field topcoat as specified in Section 09 91 00.

3.4 CLEANING

- A. Clean louver surfaces in accordance with manufacturer's instructions.
- B. Touch-up, repair or replace damaged products before Substantial Completion.

END OF SECTION 08 19 19

SECTION 09 21 16.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Gypsum board shaft wall assemblies.

1.2 ACTION SUBMITTALS

- A. Product Data: For each component of gypsum board shaft wall assembly.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements

1.3 DELIVERY, STORAGE, AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

- A. Environmental Limitations: Comply with gypsum-shaft liner-board manufacturer's written instructions.
- B. Do not install finish panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide

materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

- B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

- A. Fire-Resistance Rating: As indicated on Drawings.
- B. STC Rating: As indicated on Drawings.
- C. Gypsum Shaftliner Board:
 - 1. Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with paper faces, 1 inch thick, with double beveled long edges.
 - 2. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.
 - 3. Moisture- and Mold-Resistant, Fiberglass-Mat Faced: ASTM C1658/C1658M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.
- D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.
 - 1. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40 unless otherwise indicated.
- E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:
 - 1. Depth: As indicated.
 - 2. Minimum Base-Metal Thickness: 0.018 inch.
- F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.
 - 1. Minimum Base-Metal Thickness: Matching steel studs.
- G. Firestop Tracks: Top runner manufactured to allow partition heads to expand and contract with movement of the structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- H. Elevator-Hoist Way-Entrance Struts: Manufacturer's standard J-profile jamb strut with long-leg length of 3 inches, matching studs in depth, and not less than 0.033 inch thick.
- I. Finish Panels: As indicated.
- J. Sound Attenuation Blankets: As specified in Section 09 29 00 "Gypsum Board."

2.3 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.
- B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
- D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.
 - 1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
 - 2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.
- E. Reinforcing: Galvanized-steel reinforcing strips with 0.033-inch minimum thickness of base metal (uncoated).
- F. Acoustical Sealant: Section 07 92 19 "Acoustical Joint Sealants."
- G. Gypsum Board Cants:
 - 1. Gypsum Board Panels: As specified in Section 09 29 00 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.
 - 2. Adhesive: Laminating adhesive as specified in Section 09 29 00 "Gypsum Board."
 - 3. Non-Load-Bearing Steel Framing: As specified in Section 09 22 16 "Non-Structural Metal Framing."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Sprayed Fire-Resistive Materials: Coordinate with gypsum board shaft wall assemblies so both elements of Work remain complete and undamaged. Patch or replace sprayed fire-resistive materials removed or damaged during installation of shaft wall assemblies to comply with requirements specified in Section 07 81 00 "Applied Fire Protection."
- B. After sprayed fire-resistive materials are applied, remove only to extent necessary for installation of gypsum board shaft wall assemblies and without reducing the fire-resistive material thickness below that which is required to obtain fire-resistance rating indicated. Protect remaining fire-resistive materials from damage.

3.3 INSTALLATION

- A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.
- B. Do not bridge building expansion joints with shaft wall assemblies, frame both sides of expansion joints with furring and other support.
- C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.
 - 1. Elevator Hoist way: At elevator hoist way entrance door frames, provide jamb stops on each side of door frame.
 - 2. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.
- D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor

indicators, and similar items.

- E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.
- F. Firestop Tracks: Where indicated, install to maintain continuity of fire-resistance-rated assembly indicated.
- G. Control Joints: Install control joints at locations indicated on Drawings while maintaining fire - resistance rating of gypsum board shaft wall assemblies.
- H. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.
- I. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.
 - 1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
 - 2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.
- J. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.4 PROTECTION

- A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.
- B. Remove and replace panels that are wet, moisture damaged, or mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16.23

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Non-load-bearing steel framing systems for interior partitions.
2. Suspension systems for interior ceilings and soffits.
3. Grid suspension systems for gypsum board ceilings.

B. Related Requirements:

1. Section 05 40 00 "Cold-Formed Metal Framing" for exterior and interior load-bearing and exterior non-load-bearing wall studs; floor joists; and roof rafters and ceiling joists.

1.2 ACTION SUBMITTALS**A. Product Data:** For each type of product.**B. Sustainable Design Submittals:**

1. Refer to Section 01 81 13 – Sustainable Design Requirements

1.3 INFORMATIONAL SUBMITTALS**A. Product Certificates:** For each type of code-compliance certification for studs and tracks.**B. Evaluation Reports:** For embossed, high-strength steel studs and tracks fires top tracks post- installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to authorities having jurisdiction.**1.4 QUALITY ASSURANCE****A. Code-Compliance Certification of Studs and Tracks:** Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association the Steel Framing Industry Association or the Steel Stud Manufacturers Association.**PART 2 - PRODUCTS****2.1 PERFORMANCE REQUIREMENTS**

- A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate nonload-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, according to ASTM E119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.
- C. Horizontal Deflection: For composite wall assemblies, limited to 1/360 of the wall height based on horizontal loading of 10 lbf/sq. ft.

2.2 FRAMING SYSTEMS

- A. Framing Members, General: Comply with ASTM C754 for conditions indicated.
 - 1. Steel Sheet Components: Comply with ASTM C645 requirements for steel unless otherwise indicated.
 - 2. Protective Coating: Coating with equivalent corrosion resistance of ASTM A653/A653M, G40, hot-dip galvanized unless otherwise indicated.
- B. Studs and Tracks: ASTM C645.
 - 1. Steel Studs and Tracks:
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 - 2. Embossed, High Strength Steel Studs and Tracks: Roll-formed and embossed with surface deformations to stiffen the framing members so that they are structurally comparable to conventional ASTM C645 steel studs and tracks.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
- C. Slip-Type Head Joints: Where indicated, provide one of the following:
 - 1. Clip System: Clips designed for use in head-of-wall deflection conditions that provide a positive attachment of studs to tracks while allowing 1-1/2-inch minimum vertical movement.
 - 2. Double-Track System: ASTM C645 top outer tracks, inside track with 2-inch-deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
 - 3. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.
- D. Firestop Tracks: Top track manufactured to allow partition heads to expand and

contract with movement of structure while maintaining continuity of fire-resistance-rated assembly indicated; in thickness not less than indicated for studs and in width to accommodate depth of studs.

- E. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.
 - 1. Minimum Base-Steel Thickness: As indicated on Drawings.
- F. Cold-Rolled Channel Bridging: Steel, 0.0538-inch minimum base-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: 1-1/2 inches.
 - 2. Clip Angle: Not less than 1-1/2 by 1-1/2 inches, 0.068-inch-thick, galvanized steel.
- G. Hat-Shaped, Rigid Furring Channels: ASTM C645.
 - 1. Minimum Base-Steel Thickness: 0.0296 inch.
 - 2. Depth: As indicated on Drawings.
- H. Resilient Furring Channels: 1/2-inch-deep, steel sheet members designed to reduce sound transmission.
 - 1. Configuration: Asymmetrical or hat shaped.
- I. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch-wide flanges.
 - 1. Depth: As indicated on Drawings.
 - 2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
 - 3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- J. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 7/8 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 SUSPENSION SYSTEMS

- A. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch-diameter wire.
- B. Hanger Attachments to Concrete:
 - 1. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC58 or AC308 as appropriate for the substrate.
 - a. Uses: Securing hangers to structure.
 - b. Type: torque-controlled, adhesive anchor or adhesive anchor.
 - c. Material for Interior Locations: Carbon-steel components zinc-plated to comply with ASTM B633 or ASTM F1941, Class Fe/Zn 5, unless otherwise indicated.

- d. Material for Exterior or Interior Locations and Where Stainless Steel Is Indicated: Alloy Group 1 stainless-steel bolts, ASTM F593, and nuts, ASTM F594.
2. Power-Actuated Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.
- C. Wire Hangers: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.16 inch in diameter.
- D. Flat Hangers: Steel sheet, 1 by 3/16 inch by length indicated.
- E. Carrying Channels (Main Runners): Cold-rolled, commercial-steel sheet with a base-steel thickness of 0.0538 inch and minimum 1/2-inch-wide flanges.
 1. Depth: 2-1/2 inches.
- F. Furring Channels (Furring Members):
 1. Cold-Rolled Channels: 0.0538-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges, 3/4 inch deep.
 2. Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 3. Embossed, High-Strength Steel Studs and Tracks: ASTM C645.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 - b. Depth: As indicated on Drawings.
 4. Hat-shaped, Rigid Furring Channels: ASTM C645, 7/8 inch deep.
 - a. Minimum Base-Steel Thickness: As indicated on Drawings.
 5. Resilient Furring Channels: 1/2-inch-deep members designed to reduce sound transmission.
 - a. Configuration: Asymmetrical or hat shaped.
- G. Grid Suspension System for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

2.4 AUXILIARY MATERIALS

- A. General: Provide auxiliary materials that comply with referenced installation standards.
 1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

- B. Isolation Strip at Exterior Walls: Provide one of the following:
 - 1. Asphalt-Saturated Organic Felt: ASTM D226/D226M, Type I (No. 15 asphalt felt), nonperforated.
 - 2. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.
 - 1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.
- B. Coordination with Sprayed Fire-Resistive Materials:
 - 1. Before sprayed fire-resistive materials are applied, attach offset anchor plates or ceiling tracks to surfaces indicated to receive sprayed fire-resistive materials. Where offset anchor plates are required, provide continuous plates fastened to building structure not more than 24 inches o.c.
 - 2. After sprayed fire-resistive materials are applied, remove them only to extent necessary for installation of non-load-bearing steel framing. Do not reduce thickness of fire-resistive materials below that are required for fire-resistance ratings indicated. Protect adjacent fire-resistive materials from damage.

3.3 INSTALLATION, GENERAL

- A. Installation Standard: ASTM C754.
 - 1. Gypsum Plaster Assemblies: Also comply with requirements in ASTM C841 that

2. apply to framing installation.
 2. Portland Cement Plaster Assemblies: Also comply with requirements in ASTM C1063 that apply to framing installation.
 3. Gypsum Veneer Plaster Assemblies: Also comply with requirements in ASTM C844 that apply to framing installation.
 4. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.
- B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.
- C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.
- D. Install bracing at terminations in assemblies.
- E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLING FRAMED ASSEMBLIES

- A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
 2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
 3. Tile Backing Panels: 16 inches o.c. unless otherwise indicated.
- B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.
- C. Install studs so flanges within framing system point in same direction.
- D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.
1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
 2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.
 - a. Install two studs at each jamb unless otherwise indicated.
 - b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
 - c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
 4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
 - a. Firestop Track: Where indicated, install to maintain continuity of fire-resistance- rated assembly indicated.
 5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
 6. Curved Partitions:
 - a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
 - b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.
- E. Direct Furring:
1. Screw to wood framing.
 2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
- F. Z-Shaped Furring Members:
1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
 2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
 3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.
- G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLING CEILING SUSPENSION SYSTEMS

- A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
1. Hangers: 48 inches o.c.
 2. Carrying Channels (Main Runners): 48 inches o.c.
 3. Furring Channels (Furring Members): 24 inches o.c.

- B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.
- C. Suspend hangers from building structure as follows:
 - 1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
 - a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter splaying, or other equally effective means.
 - 2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
 - a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
 - 3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
 - 5. Do not attach hangers to steel roof deck.
 - 6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
 - 7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
 - 8. Do not connect or suspend steel framing from ducts, pipes, or conduit.
- D. Fire-Resistance-Rated Assemblies: Wire tie furring channels to supports.
- E. Seismic Bracing: Sway-brace suspension systems with hangers used for support.
- F. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
- G. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Interior gypsum board.
2. Exterior gypsum board for ceilings and soffits.
3. Texture finishes.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for gypsum sheathing for exterior walls.
2. Section 07 92 19 "Acoustical Joint Sealants" for acoustical joint sealants installed in gypsum board assemblies.
3. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
4. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.
5. Section 09 30 13 "Ceramic Tiling" for cementitious backer units installed as substrates for ceramic tile.

1.2 ACTION SUBMITTALS**A. Product Data: For the following:**

1. Gypsum wallboard.
2. Gypsum board, Type X.
3. Gypsum ceiling board.
4. Abuse-resistant gypsum board.
5. Impact-resistant gypsum board.
6. Mold-resistant gypsum board.
7. Glass-mat interior gypsum board.
8. Exterior gypsum soffit board.
9. Glass-mat gypsum sheathing board.
10. Water-resistant gypsum backing board.
11. Interior trim.
12. Exterior trim.
13. Aluminum trim.
14. Joint treatment materials.
15. Laminating adhesive.
16. Sound-attenuation blankets.
17. Acoustical sealant.

- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Samples: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length f or each trim accessory indicated.
- D. Samples for Initial Selection: For each type of trim accessory indicated.
- E. Samples for Verification: For the following products:
 - 1. Trim Accessories: Full-size Sample in 12-inch-long length f or each trim accessory indicated.

1.3 QUALITY ASSURANCE

- A. Mockups: Build mockups of at least 100 sq. ft. in surface area to demonstrate aesthetic effects and to set quality standards for materials and execution.
 - 1. Build mockups for the following:
 - a. Each level of gypsum board finish indicated for use in exposed locations.
 - b. Each texture finish indicated.
 - 2. Apply or install final decoration indicated, including painting and wallcoverings, on exposed surfaces for review of mockups.
 - 3. Simulate finished lighting conditions for review of mockups.
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.4 DELIVERY, STORAGE AND HANDLING

- A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

- A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.
- B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.
- C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.
- B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 90 and classified according to ASTM E413 by an independent testing agency.

2.2 GYPSUM BOARD, GENERAL

- A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.3 INTERIOR GYPSUM BOARD

- A. Gypsum Wallboard: ASTM C1396/C1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- B. Gypsum Board, Type X: ASTM C1396/C1396M.
 1. Thickness: 5/8 inch.
 2. Long Edges: Tapered and featured (rounded or beveled) for prefilling.
- C. Flexible Gypsum Board: ASTM C1396/C1396M. Manufactured to bend to fit radii and to be more flexible than standard regular-type gypsum board of same thickness.
 1. Thickness: 1/4 inch.
 2. Long Edges: Tapered.
- D. Gypsum Ceiling Board: ASTM C1396/C1396M.
 1. Thickness: 1/2 inch.
 2. Long Edges: Tapered.
- E. Foil-Backed Gypsum Board: ASTM C1396/C1396M.
 1. Core: As indicated on Drawings.
 2. Long Edges: Tapered.
- F. Abuse-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested

according to ASTM C1629/C1629M.

1. Core: As indicated on Drawings.
 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 5. Long Edges: Tapered.
 6. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- G. Impact-Resistant Gypsum Board: ASTM C1396/C1396M gypsum board, tested according to ASTM C1629/C1629M.
1. Core: As indicated on Drawings.
 2. Surface Abrasion: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 3. Indentation: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 4. Soft-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements.
 5. Hard-Body Impact: ASTM C1629/C1629M, meets or exceeds Level 1 requirements according to test in Annex A1.
 6. Long Edges: Tapered.
 7. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- H. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.
1. Core: As indicated.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.

2.4 SPECIALTY GYPSUM BOARD

- A. Gypsum Board, Type C: ASTM C1396/C1396M. Manufactured to have increased fire-resistant capability.
1. Thickness: As required by fire-resistance-rated assembly indicated on Drawings.
 2. Long Edges: Tapered.
- B. Glass-Mat Interior Gypsum Board: ASTM C1658/C1658M. With fiberglass mat laminated to both sides. Specifically designed for interior use.
1. Core: As indicated.
 2. Long Edges: Tapered.
 3. Mold Resistance: ASTM D3273, score of 10 as rated according to ASTM D3274.
- C. Acoustically Enhanced Gypsum Board: ASTM C1396/C1396M. Multilayer products constructed of two layers of gypsum boards sandwiching a viscoelastic sound-absorbing polymer core.
1. Core: As indicated.
 2. Long Edges: Tapered.

2.5 EXTERIOR GYPSUM BOARD FOR CEILINGS AND SOFFITS

- A. Exterior Gypsum Soffit Board: ASTM C1396/C1396M, with manufacturer's standard edges.
1. Core: As indicated.

- B. Glass-Mat Gypsum Sheathing Board: ASTM C1177/C1177M, with fiberglass mat laminated to both sides and with manufacturer's standard edges.
 - 1. Core: As indicated.

2.6 TRIM ACCESSORIES

- A. Interior Trim: ASTM C1047.

- 1. Material: Galvanized or aluminum-coated steel sheet or rolled zinc.
- 2. Shapes:
 - a. Cornerbead.
 - b. Bullnose bead.
 - c. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - d. L-Bead: L-shaped; exposed long flange receives joint compound.
 - e. U-Bead: J-shaped; exposed short flange does not receive joint compound.
 - f. Expansion (control) joint.
 - g. Curved-Edge Cornerbead: With notched or flexible flanges.
 - h. Base-of-Wall Galvanized Moisture Barrier Trim: Galvanized-steel sheet, 2 inches high.

 - i. Base-of-Wall PVC Moisture Barrier Trim: Extruded PVC, 1/2 inch high.

- B. Exterior Trim: ASTM C1047.

- 1. Material: Hot-dip galvanized-steel sheet, plastic, or rolled zinc.
- 2. Shapes:
 - a. Cornerbead.
 - b. LC-Bead: J-shaped; exposed long flange receives joint compound.
 - c. Expansion (Control) Joint: One-piece, rolled zinc with V-shaped slot and removable strip covering slot opening.

- C. Aluminum Trim: Extruded accessories of profiles and dimensions indicated.

- 1. Aluminum: Alloy and temper with not less than the strength and durability properties of ASTM B221, Alloy 6063-T5.
- 2. Finish: Corrosion-resistant primer compatible with joint compound and finish materials specified.

2.7 JOINT TREATMENT MATERIALS

- A. General: Comply with ASTM C475/C475M.

- B. Joint Tape:

- 1. Interior Gypsum Board: Paper.
- 2. Exterior Gypsum Soffit Board: Paper.
- 3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.

- C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is

compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
 2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.
 - a. Use setting-type compound for installing paper-faced metal trim accessories.
 3. Fill Coat: For second coat, use drying-type, all-purpose compound.
 4. Finish Coat: For third coat, use drying-type, all-purpose compound.
- D. Joint Compound for Exterior Applications:
1. Exterior Gypsum Soffit Board: Use setting-type taping compound and setting-type, sand-able topping compound.
 2. Glass-Mat Gypsum Sheathing Board: As recommended by sheathing board manufacturer.

2.8 AUXILIARY MATERIALS

- A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.
- B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.
- C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.
1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
- D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.
- E. Acoustical Sealant: As specified in Section 07 92 19 "Acoustical Joint Sealants."
- F. Thermal Insulation: As specified in Section 07 21 00 "Thermal Insulation."
- G. Vapor Retarder: As specified in Section 07 26 00 "Vapor Retarders."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.
- B. Examine panels before installation. Reject panels that are wet, moisture-damaged, and mold damaged.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

- A. Comply with ASTM C840.
- B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.
- C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.
- D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.
- E. Form control and expansion joints with space between edges of adjoining gypsum panels.
- F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.
 - 1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
 - 2. Fit gypsum panels around ducts, pipes, and conduits.
 - 3. Where partitions intersect structural members projecting below underside of floor/ roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch-wide joints to install sealant.
- G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch-wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.
- H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

- I. Wood Framing: Install gypsum panels over wood framing, with floating internal corner construction. Do not attach gypsum panels across the flat grain of wide-dimension lumber, including floor joists and headers. Float gypsum panels over these members or provide control joints to counteract wood shrinkage.
- J. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
- K. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

- A. Install interior gypsum board in the following locations:
 - 1. Wallboard Type: Vertical surfaces unless otherwise indicated.
 - 2. Type X: Where required for fire-resistance-rated assembly.
 - 3. Flexible Type: Apply in double layer at curved assemblies.
 - 4. Ceiling Type: Ceiling surfaces.
 - 5. Foil-Backed Type: As indicated on Drawings.
 - 6. Abuse-Resistant Type: As indicated on Drawings.
 - 7. Impact-Resistant Type: As indicated on Drawings.
 - 8. Mold-Resistant Type: As indicated on Drawings.
 - 9. Type C: As indicated on Drawings.
 - 10. Glass-Mat Interior Type: As indicated on Drawings.
 - 11. Acoustically Enhanced Type: As indicated on Drawings.
- B. Single-Layer Application:
 - 1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
 - 2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.
 - a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
 - b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.
 - 3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
 - 4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.
- C. Multilayer Application:
 - 1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing

- member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
 3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
 4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.
- D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.
- E. Curved Surfaces:
1. Install panels horizontally (perpendicular to supports) and unbroken, to extent possible, across curved surface plus 12-inch-long straight sections at ends of curves and tangent to them.
 2. For double-layer construction, fasten base layer to studs with screws 16 inches o.c.
Center gypsum board face layer over joints in base layer, and fasten to studs with screws spaced 12 inches o.c.

3.4 INSTALLATION OF EXTERIOR GYPSUM PANELS FOR CEILINGS AND SOFFITS

- A. Apply panels perpendicular to supports, with end joints staggered and located over supports.
1. Install with 1/4-inch open space where panels abut other construction or structural penetrations.
 2. Fasten with corrosion-resistant screws.

3.5 INSTALLATION OF TRIM ACCESSORIES

- A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to the manufacturer's written instructions.
- B. Control Joints: Install control joints at locations indicated on Drawings.
- C. Interior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners unless otherwise indicated.

2. Bullnose Bead: Use where indicated.
 3. LC-Bead: Use at exposed panel edges.
 4. L-Bead: Use where indicated.
 5. U-Bead: Use at exposed panel edges.
 6. Curved-Edge Cornerbead: Use at curved openings.
- D. Exterior Trim: Install in the following locations:
1. Cornerbead: Use at outside corners.
 2. LC-Bead: Use at exposed panel edges.
- E. Aluminum Trim: Install in locations indicated on Drawings.

3.6 FINISHING GYPSUM BOARD

- A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.
- B. Prefill open joints, rounded or beveled edges, and damaged surface areas.
- C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.
- D. Gypsum Board Finish Levels: Finish panels to levels indicated below and according to ASTM C840:
1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
 2. Level 2: Where indicated on Drawings.
 3. Level 3: Where indicated on Drawings.
 4. Level 4: At panel surfaces that will be exposed to view unless otherwise indicated.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
 5. Level 5: Where indicated on Drawings.
 - a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."
- E. Glass-Mat Gypsum Sheathing Board: Finish according to manufacturer's written instructions for use as exposed soffit board.
- F. Glass-Mat Faced Panels: Finish according to manufacturer's written instructions.

3.7 PROTECTION

- A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.
- B. Protect installed products from damage from weather, condensation, direct sunlight,

construction, and other causes during remainder of the construction period.

- C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
 - 1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
 - 2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 30 13 – CERAMIC TILING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Glazed wall tile.
 - 2. Tile backing panels.
 - 3. Waterproof membranes.
 - 4. Crack isolation membranes.
 - 5. Grout materials.
 - 6. Corner and edging details.

1.2 DEFINITIONS

- A. General: Definitions in the ANSI A108 series of tile installation standards and in ANSI A137.1 apply to Work of this Section unless otherwise specified.
- B. Face Size: Actual tile size, excluding spacer lugs.
- C. Module Size: Actual tile size plus joint width indicated.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review requirements in ANSI A108.01 for substrates and for preparation by other trades.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: Show locations of each type of tile and tile pattern. Show widths, details, and locations of expansion, contraction, control, and isolation joints in tile substrates and finished tile surfaces.
- C. Samples for Initial Selection: For tile, grout, and accessories involving color selection.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.
2. Assembled samples mounted on a rigid panel, with grouted joints, for each type and composition of tile and for each color and finish required. Make samples at least 12 inches square, but not fewer than four tiles. Use grout of type and in color or colors approved for completed Work.
3. Full-size units of each type of trim and accessory for each color and finish required.

E. Sustainable Design Submittals:

1. Refer to Section 01 81 13 – Sustainable Design Requirements

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Master Grade Certificates: For each shipment, type, and composition of tile, signed by tile manufacturer and Installer.
- C. Product Certificates: For each type of product.
- D. Product Test Reports: For tile-setting and -grouting products.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match and are from same production runs as products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed for each type, composition, color, pattern, and size indicated.
 2. Grout: Furnish quantity of grout equal to 3 percent of amount installed for each type, composition, and color indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications:
 1. Installer is a Five-Star member of the National Tile Contractors Association or a Trowel of Excellence member of the Tile Contractors' Association of America.

- B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Section 01 40 00 "Quality Requirements" states "build mockups in location and of size indicated or, if not indicated, as directed."
 - 2. Build mockup of each type of wall tile installation, no less than 48" x 48," including end conditions.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirements in ANSI A137.1 for labeling tile packages.
- B. Store tile and cementitious materials on elevated platforms, under cover, and in a dry location.
- C. Store aggregates where grading and other required characteristics can be maintained, and contamination can be avoided.
- D. Store liquid materials in unopened containers and protected from freezing.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install tile until construction in spaces is complete and ambient temperature and humidity conditions are maintained at the levels indicated in referenced standards and manufacturer's written instructions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations for Tile: Obtain tile of each type and color or finish from single source or producer.
 - 1. Obtain tile of each type and color or finish from same production run and of consistent quality in appearance and physical properties for each contiguous area.
- B. Source Limitations for Setting and Grouting Materials: Obtain ingredients of a uniform quality for each mortar, adhesive, and grout component from single manufacturer and each aggregate from single source or producer.

1. Obtain setting and grouting materials, except for unmodified Portland cement and aggregate, from single manufacturer.
 2. Obtain waterproof membrane and crack isolation membrane, except for sheet products, from manufacturer of setting and grouting materials.
- C. Source Limitations for Other Products: Obtain each of the following products specified in this Section from a single manufacturer:
1. Waterproof membrane.
 2. Crack isolation membrane.

2.2 PRODUCTS, GENERAL

- A. ANSI Ceramic Tile Standard: Provide tile that complies with ANSI A137.1 for types, compositions, and other characteristics indicated.
1. Provide tile complying with Standard grade requirements unless otherwise indicated.
- B. ANSI Standards for Tile Installation Materials: Provide materials complying with ANSI A108.02, ANSI standards referenced in other Part 2 articles, ANSI standards referenced by TCNA installation methods specified in tile installation schedules, and other requirements specified.
- C. Mounting: For factory-mounted tile, provide back- or edge-mounted tile assemblies as standard with manufacturer unless otherwise indicated.
1. Where tile is indicated for installation in wet areas, do not use back- or edge-mounted tile assemblies unless tile manufacturer specifies in writing that this type of mounting is suitable for installation indicated and has a record of successful in- service performance.

2.3 GLAZED WALL TILE

- A. Glazed Wall Tile Type: CT-1
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Olean, Color Story Wheel Linear
 - b. Approved Equal by Architect
 2. Module Size: As indicated on drawings; 2” x 8”.
 3. Face Size Variation: Rectified.
 4. Thickness: 5/16 inch.
 5. Face: Plain with modified square edges or cushion edges.
 6. Finish: Semi-gloss.
 7. Tile Color and Pattern: 0025 – Ice White, as shown on interior elevations. Horizontal stack bond.
 8. Grout Color: Mapei, Color #19 Pearl Gray
- B. Glazed Wall Tile Type: CT-2

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. American Olean, Color Story Wheel Linear
 - b. Approved Equal by Architect
2. Module Size: As indicated on drawings; 4" x 8".
3. Face Size Variation: Rectified.
4. Thickness: 5/16 inch.
5. Face: Plain with modified square edges or cushion edges.
6. Finish: Semi-gloss.
7. Tile Color and Pattern: 0025 – Ice White, as shown in the interior elevations;
8. Grout Color: Mapei, Color #19 Pearl Gray.
9. Trim Units: Coordinated with sizes and coursing of adjoining flat tile where applicable and matching characteristics of adjoining flat tile. Provide shapes as samples, selected from manufacturer's standard shapes.
 - a. Product: Schluter trim edge

2.4 TILE BACKING PANELS

- A. Cementitious Backer Units: ANSI A118.9 or ASTM C1325, Type A, in maximum lengths available to minimize end-to-end butt joints.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. USG Corporation (Durock Brand Cement Board with Edgeguard)
 - b. James Hardie (HardieBacker Cement Board)
 2. Thickness: 5/8"
 3. Board Size: 4' x 8'
 4. Location: reference wall tags on plans; all shower locations.
- B. Moisture Resistant Gypsum Board: ASTM C 1396/C 1396M. With moisture- and mold- resistant core and paper surfaces.
 1. Thickness: 5/8"
 2. Long Edges: Tapered.
 3. Board Size: 4' x 8'
 4. Mold Resistance: ASTM D 3273, score of 10.
 5. Location: reference wall tags on plans.

2.5 WATERPROOF MEMBRANES

- A. Basis of Design:
 1. Schluter® -KERDI 1
 - a. Description: 0.008" (8 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides, which meets or exceeds the requirements of the "American national standard specifications for load bearing, bonded, waterproof membranes for thin-set ceramic tile and dimension stone installation A118.10," and is listed by cUPC®, and is evaluated by ICC-ES (see Report No. ESR-2467 and PMG 1204).

- b. Waterproofing seaming membrane: Provide Schluter® -KERDI-BAND Seams and Corners material 0.004" (4 mil) thick, orange polyethylene membrane, with polypropylene fleece laminated on both sides.
- c. Waterproofing Accessories:
 - 1) Provide Schluter® -KERD-SEAL Mixing Valve seals
 - 2) Provide Schluter® -KERD-SEAL pipe Seals 1

2.6 CRACK ISOLATION MEMBRANES

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for high performance and is recommended by the manufacturer for the application indicated. Include reinforcement and accessories recommended by manufacturer.

2.7 SETTING MATERIALS

- A. Standard Dry-Set Mortar (Thinset): ANSI A118.1.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Laticrete International, Inc.
 - b. Custom Building Products.
 - c. MAPEI Corporation.
 - 2. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.1.
 - 3. Color: Architect to select from manufactures standard range.
- B. Modified Dry-Set Mortar (Thinset): ANSI A118.4.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Bostik, Inc.
 - b. Custom Building Products.
 - c. MAPEI Corporation.
 - 2. Provide prepackaged, dry-mortar mix containing dry, redispersible, vinyl acetate or acrylic additive to which only water must be added at Project site.
 - 3. For wall applications, provide mortar that complies with requirements for nonsagging mortar in addition to the other requirements in ANSI A118.4.

2.8 GROUT MATERIALS

- A. High-Performance Tile Grout: ANSI A118.7.
 - 1. Basis of Design: Subject to compliance with requirements, provide product by one of the following, or equal:
 - a. Laticrete International, Inc.; Permacolor Grout; 45 Raven
 - b. Custom Building Products; Prism Sure Color Grout #60 Charcoal

2.9 CORNER AND EDGING DETAILS**A. Basis of Design:**

1. Schluter® -QUADEC
 - a. Description: Profile with square visible surface, integrated trapezoid perforated anchoring leg, and integrated grout joint spacer.
 - b. Corners:
 - 1) Provide with matching inside corners.
 - 2) Provide with matching outside corner.
 - c. Material and Finish: Zinc, Bright White.

2.10 MISCELLANEOUS MATERIALS

- A. Trowelable Underlayments and Patching Compounds: Latex-modified, portland cement-based formulation provided or approved by manufacturer of tile-setting materials for installations indicated.
- B. Vapor-Retarder Membrane: Polyethylene sheeting, ASTM D4397, 4.0 mils thick.
- C. Tile Cleaner: A neutral cleaner capable of removing soil and residue without harming tile and grout surfaces, specifically approved for materials and installations indicated by tile and grout manufacturers.
- D. Floor Sealer: Manufacturer's standard product for sealing grout joints and that does not change color or appearance of grout.

2.11 MIXING MORTARS AND GROUT

- A. Mix mortars and grouts to comply with referenced standards and mortar and grout manufacturers' written instructions.
- B. Add materials, water, and additives in accurate proportions.
- C. Obtain and use type of mixing equipment, mixer speeds, mixing containers, mixing time, and other procedures to produce mortars and grouts of uniform quality with optimum performance characteristics for installations indicated.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine substrates, areas, and conditions where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
 1. Verify that substrates for setting tile are firm; dry; clean; free of coatings that

- are incompatible with tile-setting materials, including curing compounds and other substances that contain soap, wax, oil, or silicone; and comply with flatness tolerances required by ANSI A108.01 for installations indicated.
2. Verify that concrete substrates for tile floors comply with surface finish requirements in ANSI A108.01 for installations indicated.
 - a. Verify that surfaces that received a steel trowel finish have been mechanically scarified.
 - b. Verify that protrusions, bumps, and ridges have been removed by sanding or grinding.
 3. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed.
 4. Verify that joints and cracks in tile substrates are coordinated with tile joint locations; if not coordinated, adjust joint locations in consultation with Architect.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Blending: For tile exhibiting color variations, verify that tile has been factory blended and packaged so tile units taken from one package show same range of colors as those taken from other packages and match approved Samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION OF CERAMIC TILE

- A. Comply with TCNA's "Handbook for Ceramic, Glass, and Stone Tile Installation" for TCNA installation methods specified in tile installation schedules. Comply with parts of the ANSI A108 series "Specifications for Installation of Ceramic Tile" that are referenced in TCNA installation methods, specified in tile installation schedules, and apply to types of setting and grouting materials used.
- B. Extend tile work into recesses and under or behind equipment and fixtures to form complete covering without interruptions unless otherwise indicated. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.
- C. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so plates, collars, or covers overlap tile.
- D. Provide manufacturer's standard trim shapes where necessary to eliminate exposed tile edges.
- E. Jointing Pattern: Lay tile in stacked bond pattern unless otherwise indicated. Refer to interior elevations for lay out of tile field, if not specified confirm with Architect. Lay out tile work to minimize the use of pieces that are less than half of a tile. Provide uniform joint widths unless otherwise indicated.

1. For tile mounted in sheets, make joints between tile sheets same width as joints within tile sheets so joints between sheets are not apparent in finished work.
 2. Where adjoining tiles on floor, base, walls, or trim are specified or indicated to be same size, align joints.
 3. Where tiles are specified or indicated to be whole integer multiples of adjoining tiles on floor, base, walls, or trim, align joints unless otherwise indicated.
- F. Lay out tile wainscots to dimensions indicated or to next full tile beyond dimensions indicated.
- G. Expansion Joints: Provide expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated. Form joints during installation of setting materials, mortar beds, and tile. Do not saw-cut joints after installing tiles.
1. Where joints occur in concrete substrates, locate joints in tile surfaces directly above them.

3.4 INSTALLATION OF TILE BACKING PANELS

- A. Install panels and treat joints according to ANSI A108.11 and manufacturer's written instructions for type of application indicated. Use modified dry-set mortar for bonding material unless otherwise directed in manufacturer's written instructions.

3.5 INSTALLATION OF WATERPROOF MEMBRANES

- A. Install waterproof membrane to comply with ANSI A108.13 and manufacturer's written instructions to produce waterproof membrane of uniform thickness that is bonded securely to substrate.
- B. Allow waterproof membrane to cure and verify by testing that it is watertight before installing tile or setting materials over it.

3.6 INSTALLATION OF CRACK ISOLATION MEMBRANES

- A. Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions to produce membrane of uniform thickness that is bonded securely to substrate.
- B. Allow crack isolation membrane to cure before installing tile or setting materials over it.

3.7 ADJUSTING AND CLEANING

- A. Remove and replace tile that is damaged or that does not match adjoining tile. Provide new matching units, installed as specified and in a manner to eliminate

evidence of replacement.

- B. Cleaning: On completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
 - 1. Remove grout residue from tile as soon as possible.
 - 2. Clean grout smears and haze from tile according to tile and grout manufacturer's written instructions but no sooner than 10 days after installation. Use only cleaners recommended by tile and grout manufacturers and only after determining that cleaners are safe to use by testing on samples of tile and other surfaces to be cleaned. Protect metal surfaces and plumbing fixtures from effects of cleaning. Flush surfaces with clean water before and after cleaning.

3.8 PROTECTION

- A. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear. If recommended by tile manufacturer, apply coat of neutral protective cleaner to completed tile walls and floors.
- B. Before final inspection, remove protective coverings and rinse neutral protective cleaner from tile surfaces.

END OF SECTION 09 30 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Thermoset-rubber base.
 - 2. Rubber stair accessories.
 - 3. Rubber molding accessories.
 - 4. Vinyl molding accessories.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Requirements
 - 1. Refer Section 01 81 13 – Sustainable Design Requirements
- C. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.
- D. Samples for Initial Selection: For each type of product indicated.
- E. Samples for Verification: For each type of product indicated and for each color, texture, and pattern required in manufacturer's standard-size Samples, but not less than 12 inches long.
- F. Product Schedule: For resilient base and accessory products. Use same designations indicated on Drawings.

1.3 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.4 QUALITY ASSURANCE

- A. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Coordinate mockups in this Section with mockups specified in other Sections.
 - 2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

- A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:
 - 1. 48 hours before installation.
 - 2. During installation.
 - 3. 48 hours after installation.
- B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.
- C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE

- A. Basis of Design: Tarkett (Johnsonite)
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Burke Mercer Flooring Products; a division of Burke Industries Inc.
 - 2. Flexco; Roppe Holding Company.
 - 3. Roppe Corporation; Roppe Holding Company.

- C. Product Standard: ASTM F1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).
 - 1. Style and Location:
 - a. Style A, Straight: Provide in areas with carpet.
 - b. Style B, Cove: Provide in areas with concrete flooring.
- D. Thickness: 0.125 inch.
- E. Height: 4 inches (typical), 6 inches (corridors)
- F. Lengths: Coils in manufacturer's standard length.
- G. Outside Corners: Preformed.
- H. Inside Corners: Preformed.
- I. Colors: 38 Pewter

2.2 RUBBER MOLDING ACCESSORY

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Roppe Corporation; Roppe Holding Company.
 - 2. VPI Corporation.
- B. Description: Rubber carpet edge for glue-down applications and transition strips.
- C. Profile and Dimensions: As indicated.
- D. Locations: Provide rubber molding accessories in areas indicated.
- E. Colors and Patterns: Match Architect's sample.

2.3 INSTALLATION MATERIALS

- A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.
- B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that the finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

- A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.
- B. Concrete Substrates for Resilient Stair Accessories: Prepare horizontal surfaces according to ASTM F710.
 - 1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
 - 2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
 - 3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
 - 4. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
- C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.
- D. Do not install resilient products until materials are the same temperature as space where they are to be installed.
 - 1. At least 48 hours in advance of installation, move resilient products and

installation materials into spaces where they will be installed.

- E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient base.
- B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces and other permanent fixtures in rooms and areas where base is required.
- C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.
- D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.
- E. Do not stretch resilient base during installation.
- F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.
- G. Preformed Corners: Install preformed corners before installing straight pieces.

3.4 RESILIENT ACCESSORY INSTALLATION

- A. Comply with manufacturer's written instructions for installing resilient accessories.
- B. Resilient Stair Accessories:
 - 1. Use stair-tread-nose filler to fill nosing substrates that do not conform to tread contours.
 - 2. Tightly adhere to substrates throughout length of each piece.
- C. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

- A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.
- B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
 2. Sweep and vacuum horizontal surfaces thoroughly.
 3. Damp-mop horizontal surfaces to remove marks and soil.
- C. Protect resilient products from marks, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.
- D. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 67 23 - RESINOUS FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Resinous flooring.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review manufacturer's written instructions for substrate preparation and environmental conditions affecting resinous flooring installation.
 - 2. Review manufacturer's written instructions for installing resinous flooring systems.
 - 3. Review protection measures for adjacent construction and installed flooring, floor drainage requirements, curbs, base details, and so forth.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's technical data, installation instructions, and recommendations for each resinous flooring component required.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Samples: For each resinous floor system required and for each color and texture specified, 6 inches (150 mm) square in size, applied to a rigid backing by Installer for this Project.
- D. Samples for Initial Selection: For each type of exposed finish required.
- E. Samples for Verification: For each resinous flooring system required and for each color and texture specified, 6 inches (150 mm) square, applied to a rigid backing by

Installer for this Project.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Material Certificates: For each resinous flooring component.
- C. Material Test Reports: For each resinous flooring system, by a qualified testing agency.
- D. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For resinous flooring to include in maintenance manuals.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.
 - 1. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring installation. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring installation.
- B. Close spaces to traffic during resinous flooring installation and for 24 hours after installation unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Verify flooring products comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."
- B. Flammability: Self-extinguishing in accordance with ASTM D635.

2.2 RESINOUS FLOORING

- A. Resinous Flooring System: Abrasion-, impact-, and chemical-resistant, aggregate-filled, resin-based monolithic floor surfacing designed to produce a seamless floor and integral cove base.
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Duraflex, Inc.
 - b. Laticrete International, Inc.
 - c. Sherwin-Williams Company, General Polymers.
 - d. Sika Corporation; Flooring.
 - 2. Basis of Design Duraflex, Inc. Dur-A-Gard
- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Obtain secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from manufacturer recommended in writing by manufacturer of primary materials.
- C. System Characteristics:
 - 1. Color and Pattern: As selected by Architect from manufacturer's full range.
 - 2. Wearing Surface: Textured for slip resistance.
 - 3. Overall System Thickness: 20 mils (0.5 mm).
- D. System Physical Properties: Provide resinous flooring system with the following minimum physical property requirements when tested in accordance with test methods indicated:
- E. Primer: Type recommended in writing by resinous flooring manufacturer for substrate and resinous flooring system indicated.
- F. Topcoats: Sealing or finish coats.
 - 1. Adhesives: Use adhesives that meet the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.
 - 1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resinous flooring systems.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Prepare and clean substrates in accordance with resinous flooring manufacturer's written instructions for substrate indicated to ensure adhesion.
- B. Concrete Substrates: Provide sound concrete surfaces free of laitance, glaze, efflorescence, curing compounds, form-release agents, dust, dirt, grease, oil, and other contaminants incompatible with resinous flooring.
 - 1. Roughen concrete substrates as follows:
 - a. Shot-blast surfaces with an apparatus that abrades the concrete surface, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
 - b. Comply with requirements in SSPC-SP 13/NACE No. 6, with a Concrete Surface Profile of 3 or greater in accordance with ICRI Technical Guideline No. 310.2R, unless manufacturer's written instructions are more stringent.
 - 2. Repair damaged and deteriorated concrete in accordance with resinous flooring manufacturer's written instructions.
 - 3. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft. (18.6 sq. m) and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. (1.36 kg of water/92.9 sq. m) in 24 hours.
 - b. Relative Humidity Test: Using in-situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - 4. Alkalinity and Adhesion Testing: Perform tests recommended in writing by resinous flooring manufacturer. Proceed with installation only after substrate alkalinity is not less than 6 or more than 8 pH unless otherwise recommended in writing by flooring manufacturer,
- C. Patching and Filling: Use patching and fill material to fill holes and depressions in substrates in accordance with manufacturer's written instructions.

1. Control Joint Treatment: Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring in accordance with manufacturer's written instructions.
- D. Resinous Materials: Mix components and prepare materials in accordance with resinous flooring manufacturer's written instructions.

3.3 INSTALLATION

- A. Apply components of resinous flooring system in accordance with manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness specified.
1. Coordinate installation of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
 2. Cure resinous flooring components in accordance with manufacturer's written instructions. Prevent contamination during installation and curing processes.
 3. Expansion and Isolation Joint Treatment: At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
- B. Primer: Apply primer over prepared substrate at spreading rate recommended in writing by manufacturer.
- C. Waterproofing Membrane: Apply waterproofing membrane where indicated on Drawings, in thickness recommended in writing by manufacturer.
- D. Reinforcing Membrane: Apply reinforcing membrane to substrate cracks.
- E. Self-Leveling Body Coats: Apply self-leveling slurry body coats in thickness specified for flooring system.
1. Aggregates: Broadcast aggregates at rate recommended in writing by manufacturer. After resin is cured, remove excess aggregates to provide surface texture indicated.
- F. Troweled or Screeded Body Coats: Apply troweled or screeded body coats in thickness specified for flooring system. Hand or power trowel and grout to fill voids. When body coats are cured, remove trowel marks and roughness using method recommended in writing by manufacturer.
- G. Grout Coat: Apply grout coat to fill voids in surface of final body coat.
- H. Topcoats: Apply topcoats in number indicated for flooring system specified, at spreading rates recommended in writing by manufacturer, and to produce wearing surface specified.

3.4 FIELD QUALITY CONTROL

- A. Material Sampling: Owner may, at any time and any number of times during resinous flooring installation, require material samples for testing for compliance with requirements.
1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified, sealed, and certified in presence of Contractor.
 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in the manufacturer's product data.
 3. If test results show applied materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reinstall flooring materials to comply with requirements.
- B. Core Sampling: At Owner's direction and at locations designated by Owner, take one core sample per 1000 sq. ft. (92.9 sq. m) of resinous flooring, or portion of, to verify thickness. For each sample that fails to comply with requirements, take two additional samples. Repair damage caused by coring. Correct deficiencies in installed flooring as indicated by testing.

3.5 PROTECTION

1. Protect resinous flooring from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.

END OF SECTION 09 67 23

SECTION 09 68 13 - TILE CARPETING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Modular carpet tile.
- B. Related Requirements:
 - 1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to carpet tile installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures.
 - b. Review ambient conditions and ventilation procedures.
 - c. Review subfloor preparation procedures.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
 - 2. Include manufacturer's written installation recommendations for each type of substrate.
- B. Sustainable Design Requirements:
 - 1. Refer Section 01 81 13 – Sustainable Design Requirements
- C. Shop Drawings: For carpet tile installation, plans showing the following:
 - 1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
 - 2. Carpet tile type, color, and dye lot.
 - 3. Type of subfloor.
 - 4. Type of installation.
 - 5. Pattern of installation.
 - 6. Pattern type, location, and direction.
 - 7. Pile direction.

8. Type, color, and location of insets and borders.
 9. Type, color, and location of edge, transition, and other accessory strips.
 10. Transition details to other flooring materials.
- D. Samples: For each of the following products and for each color and texture required. Label each Sample with the manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- E. Samples for Initial Selection: For each type of carpet tile.
1. Include Samples of exposed edge, transition, and other accessory stripping involving color or finish selection.
- F. Samples for Verification: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.
1. Carpet Tile: Full-size Sample.
 2. Exposed Edge, Transition, and Other Accessory Stripping: 12-inch-long Samples.
- G. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Test Reports: For carpet tile, for tests performed by a qualified testing agency.
- C. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For carpet tiles to include in maintenance manuals. Include the following:
 1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
 2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels

describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but not less than 10 sq. yd..

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 1. Build mockups at locations and in sizes shown on Drawings.
 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Comply with the Carpet and Rug Institute's CRI 104.

1.9 FIELD CONDITIONS

- A. Comply with the Carpet and Rug Institute's CRI 104 for temperature, humidity, and ventilation limitations.
- B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.
- C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended by carpet tile manufacturer.
- D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.10 WARRANTY

- A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.
 1. Warranty does not include deterioration or failure of carpet tile due to unusual

- traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:
 - a. More than 10 percent edge raveling, snags, and runs.
 - b. Dimensional instability.
 - c. Excess static discharge.
 - d. Loss of tuft-bind strength.
 - e. Loss of face fiber.
 - f. Delamination.

 3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Interface, LLC.
 - a. Human Nature 840- 104221 Flint

- B. Performance Characteristics:
 1. Appearance Retention Rating: Heavy traffic, 3.0 minimum according to ASTM D7330.
 2. Critical Radiant Flux Classification: Not less than 0.45 W/sq. cm according to NFPA 253.
 3. Dry Breaking Strength: Not less than 100 lbf according to ASTM D2646.
 4. Dimensional Tolerance: Within 1/32 inch of specified size dimensions, as determined by physical measurement.
 5. Dimensional Stability: 0.2 percent or less according to ISO 2551 (Aachen Test).
 6. Colorfastness to Crocking: Not less than 4, wet and dry, according to AATCC 165.
 7. Colorfastness to Light: Not less than 4 after 40 AFU (AATCC fading units) according to AATCC 16, Option E.
 8. Electrostatic Propensity: Less than 3.5 kV according to AATCC 134.

2.2 WALKOFF TILE

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 1. Amarco Products
 - a. Buffalo Tile

- B. Performance Characteristics:
 1. Rubberized fabric strips with chenille – like surface cut from recycled tires

- bonded to a non-flammable base
- 2. Thickness: 3/8 inch (9.52 mm) plus or minus 1/8 inch
- 3. Recycled Content: 95 percent
- 4. Color: Earthtone
- 5. Flammability: Meets or exceeds Federal flammability regulations CPSC-FF 1-70, 16 CFE, and ASTM D 2859.
- 6. Delamination Test of Backing: Meets or exceeds ASTM D 3936.
- 7. Size: 12 inches by 12 inches.

2.3 INSTALLATION ACCESSORIES

- A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended by carpet tile manufacturer.
- B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive type to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and are recommended by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.
- B. Examine carpet tile for type, color, pattern, and potential defects.
- C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.
 - 1. Moisture Testing: Perform tests so that each test area does not exceed 200 sq. ft and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.
 - a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
 - b. Relative Humidity Test: Using in situ probes, ASTM F2170. Proceed with installation only after substrates have a maximum 75 percent relative humidity level measurement.
 - c. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates indicated to receive carpet tile.
- B. Use trowelable leveling and patching compounds, according to manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.
- C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.
- D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

- A. General: Comply with the Carpet and Rug Institute's CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.
- B. Installation Method: As recommended in writing by carpet tile manufacturer.
- C. Maintain dye-lot integrity. Do not mix dye lots in same area.
- D. Maintain pile-direction patterns recommended in writing by carpet tile manufacturer.
- E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.
- F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.
- G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.
- H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

- A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended by carpet tile manufacturer.
 2. Remove yarns that protrude from carpet tile surface.
 3. Vacuum carpet tile using commercial machine with face-beater element.
- B. Protect installed carpet tile to comply with the Carpet and Rug Institute's CRI 104, Section 13.7.
- C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 91 23 – INTERIOR PAINTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes surface preparation and the application of paint systems on interior and substrates.
- B. Related Requirements:
 - 1. Division 05 Sections for shop priming of metal substrates.

1.3 DEFINITIONS

- A. Gloss Level 2: Flat refers to a lusterless or matte finish with a gloss range below 15 at 85 degrees, according to ASTM D 523.
- B. Gloss Level 4: Eggshell refers to low-sheen finish with a gloss range between 20 and 35 at 85 degrees, according to ASTM D 523.
- C. Gloss Level 5: Semigloss refers to medium-sheen finish with a gloss range between 35 and 70 at 60 degrees, according to ASTM D 523.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include preparation requirements and application instructions.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Samples for Initial Selection: For each type of topcoat product.
- D. Samples for Verification: For each type of paint system and in each color and gloss of topcoat indicated.
 - 1. Submit Samples on rigid backing, 8 inches square.
 - 2. Step coats on Samples to show each coat required for system.

3. Label each coat of each Sample.
4. Label each Sample for location and application area.

E. Product List: For each product indicated, include the following:

1. Cross-reference to finish system and locations of application areas. Use same designations indicated on Drawings and in schedules.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Paint, Stains, and Transparent Finishes: 5 percent, but not less than 1 gal. of each material and color applied.

1.6 QUALITY ASSURANCE

A. Mockups: Apply benchmark samples of each paint system indicated and each color and finish selected to verify preliminary selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Architect will select one surface to represent surfaces and conditions for application of each paint system specified in Part 3.
 - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.
 - b. Other Items: Architect will designate items or areas required.
2. Final approval of color selections will be based on benchmark samples.
 - a. If preliminary color selections are not approved, apply additional benchmark samples of additional colors selected by Architect at no added cost to Owner.
3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.

2. Remove rags and waste from storage areas daily.

1.8 FIELD CONDITIONS

- A. Apply paints and finishes only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.
- B. Do not apply paints and finishes when relative humidity exceeds 85 percent; at temperatures less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Benjamin Moore & Co. (BM)
 2. Glidden Professional Paints. (GP)
 3. PPG Architectural Finishes, Inc. (PPG)

2.2 MATERIALS, GENERAL

- A. Material Compatibility:
 1. Provide materials for use within each paint system that are compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 2. For each coat in a paint system, provide products recommended in writing by manufacturers of topcoat for use in finish system and on substrate indicated.
- B. Low-Emitting Materials: Interior paints and coatings used inside the waterproofing system shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
- C. Colors: As indicated in color schedules on Drawings, or if not indicated, as selected by Architect from manufacturer's full premium and custom range.
 1. Allow for deep-tone accent colors in main entry areas. Deep-tone accent colors require tinted deep-tone primers and additional finish coats necessary for complete coverage.
- D. Material Quality: Provide manufacturer's best-quality paint material of the various coating types specified that are factory formulated and recommended by manufacturer for application indicated. Paint-material containers not displaying manufacturer's product identification will not be acceptable.

1. Proprietary Names: Use of manufacturer's proprietary product names to designate colors or materials is not intended to imply that products named are required to be used to the exclusion of equivalent products of other manufacturers. Furnish manufacturer's material data and certificates of performance for proposed substitutions.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of work.
- B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:
 1. Concrete: 12 percent.
 2. Masonry (Clay and CMU): 12 percent.
 3. Gypsum Board: 12 percent.
 4. Wood: 15 percent.
 5. Plaster: 12 percent.
- C. Gypsum Board Substrates: Do not begin paint application until finishing compound is dry and sanded smooth.
- D. Proceed with coating application only after unsatisfactory conditions have been corrected.
 1. Application of coating indicates acceptance of surfaces and conditions.
- E. Spray Textured Ceiling Substrates: Verify that surfaces are dry.
 1. Verify suitability of substrates, including surface conditions and compatibility with existing finishes and primers.
 2. Proceed with coating application only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Comply with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual" applicable to substrates indicated.
- B. Remove plates, machined surfaces, and similar items already in place that are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 1. After completing painting operations, use workers skilled in the trades involved

- to reinstall items that were removed. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of paints, including dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers as required to produce paint systems indicated.
 - D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - 1. Abrasive blast clean surfaces to comply with SSPC-SP 7/NACE No. 4, "Brush-Off Blast Cleaning."
 - E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.
 - F. Non-Shop-Primed Steel Substrates: Remove rust and loose mill scale. Clean using methods recommended in writing by paint manufacturer, but not less than the following:
 - 1. SSPC-SP 3, "Power Tool Cleaning."
 - G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.
 - H. Galvanized-Metal Substrates: Remove grease and oil residue from galvanized sheet metal fabricated from coil stock by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied paints.

3.3 APPLICATION

- A. Apply paints and finishes according to manufacturer's written instructions and to recommendations in "MPI Architectural Painting Specification Manual."
 - 1. Use applicators and techniques suited for paint and substrate indicated.
 - 2. Finish surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat but provide sufficient difference in shade of undercoats to distinguish each separate coat.

- C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.
- D. Apply paints and finishes to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.
- E. Painting Fire Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:
 - 1. Paint the following work where exposed in equipment rooms:
 - a. Equipment, including panelboards and switch gear.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Tanks that do not have factory-applied final finishes.
 - h. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - 2. Paint the following work where exposed in occupied spaces:
 - a. Equipment, including panelboards.
 - b. Uninsulated metal piping.
 - c. Uninsulated plastic piping.
 - d. Pipe hangers and supports.
 - e. Metal conduit.
 - f. Plastic conduit.
 - g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
 - h. Other items as directed by Architect.
 - 3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Contractor may engage the services of a qualified testing and inspecting agency to inspect and test paint for dry film thickness.
 - 1. Contractor shall touch up and restore painted surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied paint does not comply with paint manufacturer's written recommendations, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with paint manufacturer's written recommendations.

3.5 CLEANING AND PROTECTION

- A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.
- B. After completing paint and finish application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.
- D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.6 INTERIOR PAINTING SCHEDULE

- A. Concrete Substrates (Walls and Ceilings, Poured Concrete, Precast Concrete – Interior Only):
 - 1. Semi-Gloss Finish:
 - a. 1st Coat: Benjamin Moore Super Spec® Interior/Exterior Acrylic High Build Masonry Primer N068 (97 g/L), MPI # 3, LEED 2009.
 - b. 2nd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540 (0 g/L), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141, LEED 2009, LEED V4.
 - c. 3rd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540 (0 g/L), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141, LEED 2009, LEED V4.
- B. CMU Substrates:
 - 1. Semi-Gloss Finish:
 - a. 1st Coat: Benjamin Moore Super Spec® Masonry Interior/Exterior Hi-Build Block Filler 206 (45 g/L), MPI # 4, X-Green 4, LEED 2009, LEED V4, CHPS Certified.
 - b. 2nd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Semi-Gloss N539 (0 g/L), MPI # 43, X-Green 43, 146, X-Green 146, 140, X-Green 140, LEED 2009, LEED V4, CHPS Certified.
 - c. 3rd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Semi-Gloss N539 (0 g/L), MPI # 43, X-Green 43, 146, X-Green 146, 140, X-Green 140, LEED 2009, LEED V4, CHPS Certified.
- C. Steel Substrates (Structural Steel Columns, Joists, Trusses, Beams, Misc Iron, Structural Iron and Ferrous Metal):
 - 1. Semi-Gloss High Performance Finish:
 - a. 1st Coat: Corotech Acrylic Metal Primer V110 (199 g/L), LEED Credit.
 - b. 2nd Coat: Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341 (71 g/L), LEED 2009.
 - c. 3rd Coat Corotech Pre-Catalyzed Waterborne Epoxy Semi-Gloss V341 (71 g/L), LEED 2009.

D. Galvanized-Metal Substrates:

1. Semi-Gloss Finish High Performance:
 - a. 1st Coat: Benjamin Moore Super Spec® HP Acrylic Metal Primer P04 (47 g/L), MPI # 107, X-Green 107, 134, LEED 2009, CHPS Certified.
 - b. 2nd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540 (0 g/L), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141, LEED 2009, LEED V4.
 - c. 3rd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Gloss N540 (0 g/L), MPI # 54, X-Green 54, 147, X-Green 147, 141, X-Green 141, LEED 2009, LEED V4.

E. Metal Galvanized (Ceilings, Ductwork and Piping):

1. Dryfall Waterborne Topcoat Flat Finish:
 - a. 1st Coat: Coronado Super Kote 5000 Dry Fall Latex Flat N110 (46 g/L), MPI # 118.
 - b. 2nd Coat: Coronado Super Kote 5000 Dry Fall Latex Flat N110 (46 g/L), MPI # 118.

F. Gypsum Board Substrates:

2. Ceilings – Flat Acrylic Finish:
 - a. 1st Coat: Benjamin Moore Ultra Spec 500 Interior Latex Primer N534 (0 g/L), MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
 - b. 2nd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Flat N536 (0 g/L), MPI # 53, X-Green 53, 143, X-Green 143, LEED 2009, LEED V4, CHPS Certified.
 - c. 3rd Coat: Benjamin Moore Ultra Spec 500 Interior Latex Flat N536 (0 g/L), MPI # 53, X-Green 53, 143, X-Green 143, LEED 2009, LEED V4, CHPS Certified.
3. Walls – Low-Sheen (Eggshell) Finish:
 - a. 1st Coat: Benjamin Moore Ultra Spec 500 Interior Latex Primer N534 (0 g/L), MPI # 50, X-Green 50, 149, X-Green 149, LEED 2009, LEED V4, CHPS Certified.
 - b. 2nd Coat: Benjamin Moore Ultra Spec 500 Latex Eggshell N538 (0 g/L), MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139, LEED 2009 LEED V4, CHPS Certified.
 - c. 3rd Coat: Benjamin Moore Ultra Spec 500 Latex Eggshell N538 (0 g/L), MPI # 52, X-Green 52, 145, X-Green 145, 139, X-Green 139, LEED 2009, LEED V4, CHPS Certified.
4. Walls (In Corridors to 4'-0" AFF Only) – Semi Gloss Finish:
 - a. 1st Coat: Benjamin Moore Eco Spec WB Primer N372 (0 g/L) MPI # 50,

- X- Green 50, 149, X-Green 149, LEED V4 CHPS Certified.
- b. 2nd Coat: Benjamin Moore Eco Spec WB Semi-Gloss N376 (0 g/L) MPI # 54, X-Green 54, LEED V4, CHPS Certified.
 - c. 3rd Coat: Benjamin Moore Eco Spec WB Semi-Gloss N376 (0 g/L) MPI # 54, X-Green 54, LEED V4, CHPS Certified.

END OF SECTION 09 91 23

SECTION 09 96 11 - HIGH-PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes surface preparation and application of high-performance coating systems on the following substrates:
 - 1. Exterior Substrates:
 - a. Exterior HM Doors and Frames.
 - b. Steel.
 - c. Galvanized steel.
- B. Related Requirements:
 - 1. Section 05 12 00 "Structural Steel Framing" for shop priming of structural steel with primers specified in this Section.
 - 2. Section 05 52 13 "Pipe and Tube Railings" for shop priming and painting pipe and tube railings with coatings specified in this Section.
 - 3. Section 09 91 23 "Interior Painting" for general field painting.

1.03 ACTION SUBMITTALS

- A. General: Make submittals in accordance with provisions of Section 013300 – Submittal Procedures
- B. Product Data: For each type of product. Include preparation requirements and application instructions.
 - 1. Indicate VOC content.
- C. Samples for Initial Selection: For each type of topcoat product indicated.
- D. Samples for Verification: For each type of coating system and each color and gloss of topcoat indicated.
 - 1. Submit two samples on 8 inches square hardboard, illustrating colors and textures available for selection.
 - 2. Apply coats on Samples in steps to show each coat required for system.
 - 3. Label each coat of each Sample.
 - 4. Label each Sample for location and application area.
- E. Product List: Use same designations indicated on Drawings and in Exterior High-Performance Coating Schedule and Interior High-Performance Coating Schedule. Include color designations and product runs (batch numbers).

- F. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements

- 1.04 CLOSEOUT SUBMITTALS
 - 1. Warranty Documentation: Submit copies of written warranty, as signed by the applicator, agreeing to repair or replace defective coating work during the warranty period.

- 1.05 MAINTENANCE MATERIAL SUBMITTALS
 - A. Furnish extra materials from the same production run, (batch number) that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.

- 1.06 QUALITY ASSURANCE
 - A. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - a. Wall and Ceiling Surfaces: Provide samples of at least 100 sq. ft..
 - b. Other Items: Architect will designate items or areas required.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing
 - 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

- 1.07 DELIVERY, STORAGE, AND HANDLING
 - A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 - 1. Maintain containers in clean condition, free of foreign materials and residue.
 - 2. Remove rags and waste from storage areas daily.

- 1.08 FIELD CONDITIONS
 - A. Some manufacturers' products may require higher temperatures for proper curing. Consult manufacturers and revise first paragraph below to suit requirements for specific products if necessary.

 - B. Apply coatings only when temperature of surfaces to be coated and ambient air temperatures are between 50 and 95 deg F.

- C. Do not apply coatings when relative humidity exceeds 85 percent; at temperatures less than 5 degF above the dew point; or to damp or wet surfaces.
- D. Do not apply exterior coatings in snow, rain, fog, or mist.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - 1. DuPont Co. Maintenance Finishes.
 - 2. Tnemec Inc.
 - 3. Benjamin Moore & Co.
 - 4. PPG Protective & Marine Coatings
 - 5. Sherwin-Williams Company (The).

2.02 HIGH-PERFORMANCE COATINGS

A. Materials

System Description: Provide high performance coating system of urethane over epoxy primer as indicated, including surface preparation, priming and high-performance coating application.

B. Material Compatibility:

- 1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
 - 2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated
 - 3. If retaining subparagraph below, coordinate products retained, if any, in other Part 2 articles, to ensure that one manufacturer can provide products for an entire system.
 - 4. Products shall be of same manufacturer for each coat in a coating system.
 - 5. Shellacs, Pigmented: 550 g/L.
- C. Colors: As selected by Architect from manufacturer's full range Match Architect's samples as indicated in color schedule.

2.03 SUSTAINABLE REQUIREMENTS

A. LEED Goals for Material & Resources:

- 1. MR Credit 2.1 and MR Credit 2.2 Construction Waste Management: Recycle and/or salvage at least 75 percent of non-hazardous construction and demolition debris.

2. MR Credit 4.1 - Recycled Content: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes 10 percent of the total value of the materials in the project.
3. MR Credit 5.1 - Regional Materials: Use building materials or products that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10 percent of the total materials value.
4. EQ Credit 4.2: Paints and coatings used on the interior shall comply with criteria laid out in the LEED Reference Guide.

2.04 MATERIALS - BASIS OF DESIGN

- A. Coatings - General: Provide complete multi-coat systems formulated and recommended by manufacturer for the applications indicated, in the thicknesses indicated; number of coats specified does not include primer or filler coat.
- B. Type A Substrates (Applied over Standard Shop Primer)
 1. System A-1:
 - a. Field Primer: Tnemec Series 135 Chembuild two-part catalyzed epoxy coating.
 - b. Finish: Tnemec Series E185 Low VOC Acrylic Polyurethane semi-gloss enamel.
 2. System A-2:
 - a. Field Primer: PPG Pitt-Tech Plus DTM 100% Acrylic Formula 90-912 Series Industrial Primer.
 - b. Finish: PPG Pitthane High Build Semi-Gloss Urethane Enamel 95-8800 Series.
 3. System A-3:
 - a. Field Primer: Sherwin Williams Maxropoxy 646-100, B58W620
 - b. Finish: Sherwin-Williams Acrolon 100 Water Based Urethane, B65W Series Semi-Gloss
- C. Type B Substrates (Applied Over Ferrous Metals):
 1. System B-1:
 - a. Primer: Tnemec Series 90-97 Tneme-Zinc (shop-applied) two-part moisture-cured zinc-rich urethane coating.
 - b. Spot Prime (field-applied, if required): Tnemec Series 94 H20 Hydro-Zinc two-part moisture-cured zinc-rich urethane coating.
 - c. Intermediate Coat: Tnemec Hi-Build Epoxoline II Series L69 two-part catalyzed epoxy.
 - d. Solid Color Finish Coat: Tnemec Endura-Shield II Series 1080 waterborne polyurethane coating.
 - e. Clear Coat: Tnemec Series 750 UVX.

2. System B-2:
 - a. Primer: PPG Moisture Cure Urethane Zinc Rich Primer UC 65147.
 - b. Intermediate Coat: PPG Polyamide Epoxy 97-130/139 Series.
 - c. Finish: PPG Pitthane High Build Semi-Gloss Urethane Enamel 95- 8800 Series
 3. System B-3: Equal product by Carboline for application.
 - a. Primer: Sherwin-Williams Corthane I Galva Pack Primer 100 2K, B65G10
 - b. Intermediate Coat: Sherwin-Williams Macropoxy 646-100, B58W620
 - c. Finish: Sherwin-Williams Acrolon 100 Water Based Urethane, B65W Series Semi-gloss
 - d. Clear Coat: TBD
- D. Type C Substrates (Applied Over Galvanized or Aluminum Materials):
1. System C-1:
 - a. Primer: Tnemec Hi-Build Epoxoline II Series L69 (field-applied) two-part catalyzed epoxy coating.
 - b. Finish: Tnemec Series 1E85 Low VOC Acrylic Polyurethane semi-gloss enamel
 - 1) Where eggshell finish is specified, provide Tnemec Endura-Shield Series 175 aliphatic acrylic polyurethane enamel.
 2. System C-2:
 - a. Primer (Option 1): PPG Aquapon High Build Semi-Gloss Polyamide Epoxy Coating 97- 130/139 Series.
 - b. Primer (Option 2): PPG Pitt-Guard D-T-R Epoxy Mastic Coating 97-148 Series.
 - c. Finish: PPG Pitthane High Build Semi-Gloss Urethane Enamel 95- 8800 Series.
 3. System C-3:
 - a. Primer: Sherwin-Williams DTM Wash Primer B71Y1
 - b. Finish: Sherwin-Williams Acrolon 100 Water Based Urethane, B65W Series Semi-Gloss E. Reflectivity: Provide semi-gloss finish, unless noted otherwise.
 4. Reflectivity: Provide semi-gloss finish, unless noted otherwise.

2.05 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
1. Owner will engage services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 2. Testing agency will perform tests for compliance with product requirements.
 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for

testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, both coatings are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates and conditions, with Applicator present, for conditions affecting performance of the Work.
- B. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.
- C. Proceed with coating application only after unsatisfactory conditions have been corrected.
 - 1. Application of coating indicates acceptance of surfaces and conditions.

3.02 PREPARATION

- A. Comply with manufacturer's written instructions applicable to substrates and coating systems indicated.
- B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted.
 - 1. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.
 - 2. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed.
 - 3. Remove surface-applied protection if any.
- C. Clean substrates of substances that could impair bond of coatings, including dust, dirt, oil, grease, and incompatible paints and encapsulants.
 - 1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce coating systems indicated.
- D. Steel Substrates: Remove rust, loose mill scale, and shop primer if any. Clean using methods recommended in writing by manufacturer, but not less one of than the following:
 - a. SSPC-SP 7/NACE No. 4
 - b. SSPC-SP 11
 - c. SSPC-SP 6/NACE
 - d. SSPC-SP 10/NACE No. 2
 - e. SSPC-SP 5/NACE No. 1
- E. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC- PA 1 for touching up shop-primed surfaces.
- F. Galvanized-Steel Substrates: Remove grease and oil residue from galvanized

sheet metal by mechanical methods to produce clean, lightly etched surfaces that promote adhesion of subsequently applied coatings.

- G. Construction Indoor Air Quality Management: If building is enclosed at time of application, temporarily seal penetrations and cover roof openings to the building interior to protect indoor air quality by blocking entry of externally applied coatings with VOC pollutants in accordance with Division 1 Requirements or General Conditions.

3.03 APPLICATION

- A. Apply high-performance coatings in accordance with manufacturer's written instructions.
 - 1. Use applicators and techniques suited for coating and substrate indicated.
 - 2. Coat surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, coat surfaces behind permanently fixed equipment or furniture with prime coat only.
 - 3. Coat backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
 - 4. Do not apply coatings over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
- B. If tinting is not required, delete first paragraph below. Different tints will show through as topcoat erodes.
- C. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of the same material are to be applied. Tint undercoats to match color of finish coat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.
- D. If undercoats or other conditions show through final coat, apply additional coats until cured film has a uniform coating finish, color, and appearance.
- E. Apply coatings to produce surface films without cloudiness, spotting, holidays, laps, brush marks, runs, sags, ropiness, or other surface imperfections. Produce sharp glass lines and color breaks.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written instructions.

3.05 CLEANING AND PROTECTION

- A. After completing coating application, clean spattered surfaces. Remove spattered coatings by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.
- B. Protect work of other trades against damage from coating operation. Correct damage to work of other trades by cleaning, repairing, replacing, and recoating, as approved by Architect, and leave in an undamaged condition.
- C. At completion of construction activities of other trades, touch up and restore damaged or defaced coated surfaces.

3.06 SCHEDULE

- A. Colors: As selected by Architect for manufacturer's full range.
 - 1. Type A Substrates (Applied over Standard Shop Primer): Benjamin Moore OC 64 Pure White
 - 2. Type B Substrates (Applied Over Ferrous Metals): Benjamin Moore OC 64 Pure White
 - 3. Type C Substrates (Applied Over Galvanized or Aluminum Materials): Benjamin Moore OC 64 Pure White

END OF SECTION 09 96 11

SECTION 09 96 53 – SILICONE ELASTOMERIC COATINGS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section includes surface preparation and application of silicone elastomeric coatings to the following substrates:
 - 1. Cast concrete.
- B. Related Requirements:
 - 1. Section 07 92 00 "Joint Sealants" for elastomeric joint sealants applied in conjunction with work of this section.
 - 2. Section 09 96 11 "High Performance Coatings" for special use coatings and general fieldpainting other than elastomeric coatings.

1.03 ACTION SUBMITTALS

- A. General: Make submittals in accordance with provisions of Section 013300 – Submittal Procedures
- B. Product Data: For specified products, including:
 - 1. Preparation instructions and recommendations.
 - 2. Recommended primers and accessories.
- C. Samples for Verification: For each elastomeric coating indicated, for each color and texture required. Submit on step- coated sample cards with each coat labeled.
- D. Product Schedule: For each product, color, and finish indicated. Provide cross reference to application areas, utilizing designations indicated on Drawings and in specifications.
- E. Sustainable Design Submittals:
 - a. Refer to Section 01 81 13 - Sustainable Design Requirements

1.04 INFORMATION SUBMITTALS

- A. Qualification Data: For qualified applicator.

- B. Preconstruction compatibility and adhesion test reports.
 - C. Manufacturer's instructions for installation and field quality control testing.
 - D. Sealant, Waterproofing, and Restoration Institute (SWRI) Validation Certificate: For each coating specified to be validated by SWRI's Coating Validation Program.
 - E. Field quality control adhesion test reports.
 - F. Warranty: Sample of special warranty.
- 1.05 CLOSEOUT SUBMITTALS
- A. Warranty Documentation: Submit copies of written warranty, as signed by the applicator, agreeing to repair or replace defective coating work during the warranty period.
 - 1. Warranty Period: Ten years from date of Substantial Completion.
- 1.06 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials from the same production run, (batch number) that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Coatings: 5 percent, but not less than 1 gal. of each material and color applied.
- 1.07 QUALITY ASSURANCE
- A. Applicator Qualifications: Employer of experienced applicators equipped and trained for application of elastomeric coatings required for this Project with record of successful completion of projects of similar scope.
 - B. Single Source Responsibility: Provide elastomeric coatings and related silicone joint sealants by a single manufacturer through a single source.
 - C. Mockups: Apply mockups of each coating system indicated to verify preliminary selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for materials and execution.
 - 1. Architect will select one surface to represent surfaces and conditions for application of each coating system.
 - 2. Final approval of color selections will be based on mockups.
 - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
 - 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically

- approves such deviations in writing.
4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.
 1. Maintain containers in clean condition, free of foreign materials and residue.
 2. Remove rags and waste from storage areas daily.

1.09 FIELD CONDITIONS

- A. Do not install elastomeric coatings when temperature is above 100 deg F (38 deg C) or below 20 deg F (-6 deg C).
- B. Do not install elastomeric coatings during inclement weather or when such conditions are expected. Allow wet surfaces to dry.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Basis-of-Design Product: Provide elastomeric coatings manufactured by Dow Chemical Company, Midland MI; (877) SEALANT, (877) 732-5268; email: construction@dow.com; website: dow.com/construction, or comparable products of other manufacturer approved by Architect in accordance with Instructions to Bidders and Division 01 General Requirements.
- B. EXTERIOR FLAT WATERBORNE, PIGMENTED SILICONE ELASTOMERIC COATINGS
 1. Silicone Elastomeric Coating: Single-component, fluid-applied, water-based, pigmented silicone elastomer.
 - a. Basis of Design Product: DOWSIL™ AllGuard Silicone Elastomeric Coating.
 - b. Color: As selected by Architect from manufacturer's full line.
 - c. Surface Profile: Smooth surface.
 - d. Volatile Organic Compound (VOC) Content: 4 g/L maximum.
 - e. Moisture-Vapor Transmission, ASTM D 1653: 43 perms, minimum.
 - f. Hardness, ASTM D 2240: 38 durometer Shore A.
 - g. Tensile Strength, ASTM D 412: 145 lbf/sq. in. (1.0 MPa), minimum.
 - h. Elongation, ASTM D 412: 600 percent, minimum.
 - i. Room Temperature Flexibility, ASTM D 522: 1/8 inch mandrel test; pass.
 - j. Low Temperature Flexibility, ASTM D 711: 1/4 inch mandrel test; pass.
 - k. Fungus Resistance, ASTM D 3274: No growth.
 - l. Mold Resistance, ASTM D 3273: No growth.
 - m. Solids Content, ASTM D 2369: Not less than 55 percent by weight.

2.02 ACCESSORY MATERIALS

- A. General: VOC content of primers and fillers, 107 g/L or less.
- B. Crack Fillers: Elastomeric coating manufacturer's recommended, factory-formulated crack fillers or sealants compatible with substrate and other materials.
- C. Primer: Elastomeric coating manufacturer's recommended, factory-formulated, alkali-resistant primer compatible with substrate and other materials indicated.
- D. Concrete Unit Masonry Block Filler: factory-formulated, high-performance latex block filler compatible with substrate and other materials indicated.

2.03 SUSTAINABLE REQUIREMENTS

- A. LEED Goals for Material & Resources:
 - 1. MR Credit 2.1 and MR Credit 2.2 Construction Waste Management: Recycle and/or salvage at least 75 percent of non-hazardous construction and demolition debris.
 - 2. MR Credit 4.1 - Recycled Content: Use materials with recycled content such that the sum of post-consumer recycled content plus one-half of the pre-consumer content constitutes 10 percent of the total value of the materials in the project.
 - 3. MR Credit 5.1 - Regional Materials: Use building materials or products that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of the project site for a minimum of 10 percent of the total materials value.

2.04 SOURCE QUALITY CONTROL

- A. Testing of Coating Materials: Owner reserves the right to invoke the following procedure:
 - 1. Owner will engage services of a qualified testing agency to sample coating materials. Contractor will be notified in advance and may be present when samples are taken. If coating materials have already been delivered to Project site, samples may be taken at Project site. Samples will be identified, sealed, and certified by testing agency.
 - 2. Testing agency will perform tests for compliance with product requirements.
 - 3. Owner may direct Contractor to stop applying coatings if test results show materials being used do not comply with product requirements. Contractor shall remove noncomplying coating materials from Project site, pay for testing, and recoat surfaces coated with rejected materials. Contractor will be required to remove rejected materials from previously coated surfaces if, on recoating with complying materials, both coatings are incompatible.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine substrates to determine if work is ready to receive elastomeric coatings. Verify that surfaces are clean, dry, and free of frost, dust, dirt, grease, oil, curing compounds, form release agents, laitance, efflorescence, mildew, excess alkalinity, and other conditions affecting performance of work.
- B. Verify that new concrete and mortar to receive coating application has cured adequately in accordance with substrate and coating manufacturer's instructions.
- C. Preinstallation Testing: Prior to application of elastomeric coatings, perform the following tests to verify condition of substrate in accordance with manufacturer's instructions:
 - 1. Adhesion: Perform substrate field adhesion tests on each substrate to determine if primer is required to satisfactorily adhere elastomeric coatings to substrates.
 - 2. Alkalinity: Verify substrate is within alkalinity range acceptable to manufacturer.
 - 3. Moisture Level: Verify substrate moisture content is acceptable to manufacturer.
 - 4. Proceed with coating work once conditions meet elastomeric coating manufacturer's recommendations.

3.02 PREPARATION

- A. General: Comply with elastomeric coating manufacturer's written instructions for preparation of substrates.
- B. Hardware Removal: Remove hardware, accessories, plates, fixtures, and similar items that are not to be coated. If removal is not practical, provide protection for installed items prior to cleaning and preparation activities.
- C. Cleaning: Clean substrates to remove contaminants and foreign material by pressure cleaning, wire brushing, grinding or other method recommended by elastomeric coatings manufacturer,
- D. Substrate Repair: Repair deteriorated or damaged substrates, repair masonry joints, and fill cracks, voids, honeycomb, and other defects using materials as recommended by manufacturer. Allow patching materials to cure.
- E. Protection: Protect adjacent surfaces not designated to receive coatings. Provide protection for pedestrians, vehicles, landscaping, and surrounding areas to prevent contact with coating materials.

3.03 APPLICATION

- A. Primer: Apply primer to substrates where required based upon preinstallation testing and elastomeric coating manufacturer's recommendations, using application methods and rate of application recommended by manufacturer. Allow to dry prior to application of elastomeric coating.
 - 1. Apply block filler as primer on concrete masonry unit substrates where required to fill pores and provide smooth, continuous water-resistant finish coat(s).

- B. Elastomeric Coating: Apply elastomeric coating using application methods and rate of application recommended by manufacturer. Apply using nap roller, nylon brush, or airless sprayer, as allowed by authorities having jurisdiction.
 - 1. Apply elastomeric coating from top to bottom of substrate. Work down vertical surface and cover rundown in process. Avoid excessive overlapping.
 - 2. Apply coating free of cloudiness, spotting, laps, brush marks, roller tracks, and other surface imperfections. Cut in color breaks and terminations with sharp lines.
 - 3. Apply additional coats as required to provide cured film with uniform finish, color, and appearance.
 - 4. Provide a minimum of two coats of not less than 20 mil total wet film thickness (10 mil wetfilm thickness per coat) to provide finished dry film thickness of not less than 10 mils.
- C. Cleaning: Remove overspray and excess material using materials and methods approved by manufacturer that will not damage adjacent materials.
- D. Curing and Protection: Allow coatings to cure before exposure to traffic. Use test specimens formed at time of coating application to verify curing time. Prevent damage to coatings resulting from construction operations or other causes. Replace damaged coatings at time of Substantial Completion.

3.04 FIELD QUALITY CONTROL

- A. Dry Film Thickness Testing: Owner may engage the services of a qualified testing and inspecting agency to inspect and test coatings for dry film thickness.
 - 1. Contractor shall touch up and restore coated surfaces damaged by testing.
 - 2. If test results show that dry film thickness of applied coating does not comply with coating manufacturer's written instructions, Contractor shall pay for testing and apply additional coats as needed to provide dry film thickness that complies with coating manufacturer's written instructions.

3.05 CLEANING AND PROTECTION

- A. Protect work of other trades against damage from application of elastomeric coatings.
- B. Remove rubbish and discarded materials from Project site daily. Clean overspray from adjacent surfaces as work progresses, using methods recommended by manufacturer.
- C. Remove temporary coverings and protection upon completion. Clean and repair adjacent surfaces damaged by water repellent application.
- D. Prior to substantial completion, touch up and restore damaged or defaced coated surface.

END OF SECTION 09 96 53

SECTION 10 14 23.16 - ROOM-IDENTIFICATION PANEL SIGNAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes room-identification signs that are directly attached to the building.

1.2 DEFINITIONS

- A. Accessible: In accordance with the accessibility standard.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Requirements
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements
- C. Shop Drawings: For room-identification signs.
 - 1. Include fabrication and installation details and attachments to other work.
 - 2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
 - 3. Show message list, typestyles, graphic elements, including raised characters and Braille, and layout for each sign at least half size.
- D. Samples for Initial Selection: For each type of sign assembly, exposed component, and exposed finish.
 - 1. Include representative Samples of available typestyles and graphic symbols.
- E. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:
 - 1. Room-Identification Signs: Full-size Sample.
 - 2. Variable Component Materials: Full-size Sample of each base material, character (letter, number, and graphic element) in each exposed color and finish not included in Samples above.
 - 3. Exposed Accessories: Full-size Sample of each accessory type.
 - 4. Full-size Samples, if approved, will be returned to Contractor for use in Project.
- F. Product Schedule: For room-identification signs. Use same designations indicated on

Drawings or specified.

1.4 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer and manufacturer.
- B. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Deterioration of finishes beyond normal weathering.
 - b. Deterioration of embedded graphic image.
 - c. Separation or delamination of sheet materials and components.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: Comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction, 2018 Illinois Accessibility Code and ICC A117.1.

2.2 ROOM-IDENTIFICATION SIGNS

- A. Room-Identification Sign: Sign with smooth, uniform surfaces; with message and characters having uniform faces, sharp corners, and precisely formed lines and profiles; and as follows:
 - 1. Manufacturers: Subject to compliance with requirements, available

manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

- a. ASI SignSystems, Inc.
- b. Nelson-Harkins Industries.
2. Laminated-Sheet Sign: Photopolymer face sheet with raised graphics laminated to acrylic backing sheet to produce composite sheet.
 - a. See drawings (G003) more details.
3. Sign-Panel Perimeter: Finished edges smooth.
 - a. Edge Condition: Squarecut.
 - b. Corner Condition in Elevation: Rounded to radius indicated.
4. Mounting: Manufacturer's standard method for substrates indicated with.
5. Text and Typeface: Accessible raised characters and Braille typeface as selected by Architect from manufacturer's full range. Finish raised characters to contrast with background color, and finish Braille to match background color.

2.3 SIGN MATERIALS

- A. Acrylic Sheet with chemetal: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

2.4 ACCESSORIES

- A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:
 1. Use concealed fasteners and anchors unless indicated to be exposed.
 2. For exterior exposure, furnish stainless-steel devices unless otherwise indicated.
 3. Exposed Metal-Fastener Components, General:
 - a. Fabricated from same basic metal and finish of fastened sign unless otherwise indicated.
 - b. Fastener Heads: Use oval countersunk screws and bolts with tamper-resistant spanner-head or one-way-head slots unless otherwise indicated.
 4. Sign Mounting Fasteners:
 - a. Concealed Studs: Concealed (blind), threaded studs welded or brazed to back of sign material or screwed into back of sign assembly unless otherwise indicated.
 - b. Through Fasteners: Exposed metal fasteners matching sign finish, with type of head indicated, and installed in predrilled holes.
- B. Adhesive: As recommended by sign manufacturer.

- C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

- A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.
 - 1. Preassemble signs and assemblies in the shop to the greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
 - 2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
 - 3. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
 - 4. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
- B. Subsurface-Applied Graphics: Apply graphics to backface of clear face-sheet material to produce precisely formed image. Image shall be free of rough edges.

2.6 GENERAL FINISH REQUIREMENTS

- A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.
- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.
 - 1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
 - 2. Install signs so they do not protrude or obstruct according to the accessibility standard.
 - 3. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.

- B. Accessibility: Install signs in locations on walls as indicated on Drawings and according to the accessibility standard.
- C. Mounting Methods:
 - 1. Concealed Studs: Using a template, drill holes in substrate aligning with studs on back of sign. Remove loose debris from hole and substrate surface.
 - a. Masonry Substrates: Fill holes with adhesive. Leave recess space in hole for displaced adhesive. Place sign in position and push until flush to surface, embedding studs in holes. Temporarily support sign in position until adhesive fully sets.
 - b. Thin or Hollow Surfaces: Place sign in position and flush to surface, install washers and nuts on studs projecting through opposite side of surface, and tighten.
 - 2. Through Fasteners: Drill holes in the substrate using predrilled holes in sign as template. Countersink holes in sign if required. Place sign in position and flush to surface. Install through fasteners and tighten.
 - 3. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.
 - 4. Two-Face Tape: Clean bond-breaking materials from substrate surface and remove loose debris. Apply tape strips symmetrically to back of sign and of suitable quantity to support weight of sign without slippage. Keep strips away from edges to prevent visibility at sign edges. Place sign in position, and push to engage tape adhesive.

3.2 ADJUSTING AND CLEANING

- A. Remove and replace damaged or deformed signs and signs that do not comply with specified requirements. Replace signs with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.
- B. Remove temporary protective coverings and strippable films as signs are installed.
- C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 23.16

SECTION 10 21 13.17 - PHENOLIC-CORE TOILET COMPARTMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Phenolic-core toilet compartments configured as toilet enclosures and urinal screens.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals

1. Refer to Section 01 81 13 – Sustainable Design Requirements

C. Shop Drawings: For toilet compartments. Include plans, elevations, sections, details, and attachment details.

D. Samples for each type of toilet compartment material indicated.

1.3 INFORMATIONAL SUBMITTALS

A. Product certificates.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance data.

1.5 WARRANTY

A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace toilet partition and accessories that fails in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; need for excessive maintenance; and similar unusual, unexpected, and unsatisfactory conditions.

2. Warranty Period: 25 year(s) from date of Substantial Completion

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1. Flame-Spread Index: 25 or less.
 - 2. Smoke-Developed Index: 450 or less.
- B. Regulatory Requirements: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines for Buildings and Facilities, 2018 Illinois Accessibility Code and ICC A117.1 for toilet compartments designated as accessible.

2.2 PHENOLIC-CORE TOILET COMPARTMENTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Basis of Design: ASI Accurate Partitions; ASI Group.
 - 2. Bobrick Washroom Equipment, Inc.
 - 3. Metpar Corp.
- B. Toilet-Enclosure Style: Floor anchored.
- C. Urinal-Screen Style: Wall hung.
- D. Door, Panel, and Pilaster Construction: Solid phenolic-core panel material with melamine facing on both sides fused to substrate during panel manufacture (not separately laminated), and with eased and polished edges and no-sightline system. Provide minimum 3/4-inch-thick doors and pilasters and minimum 1/2-inch-thick panels.
- E. Pilaster Shoes and Sleeves (Caps): Formed from stainless steel sheet, not less than 0.031-inch nominal thickness and 3 inches high, finished to match hardware.
- F. Brackets (Fittings):
 - 1. Full-Height (Continuous) Type: Manufacturer's standard design; stainless steel.
- G. Phenolic-Panel Finish:
 - 1. Facing Sheet Finish: Two colors and patterns in each room.
 - 2. Color and Pattern: Asi – Smoke 8450C
 - 3. Edge Color: Through-color matching facing sheet color.

2.3 HARDWARE AND ACCESSORIES

- A. Hardware and Accessories: Manufacturer's heavy-duty stainless steel operating hardware and accessories.
 - 1. Provide units that comply with regulatory requirements for accessibility at compartments designated as accessible.
- B. Anchorages and Fasteners: Manufacturer's standard exposed fasteners of stainless steel, finished to match the items they are securing, with theft-resistant-type heads. Provide sex-type bolts for through-bolt applications. For concealed anchors, use stainless steel, hot-dip galvanized-steel, or other rust-resistant, protective-coated steel compatible with related materials.
- C. Coat Hook: One per compartment, mounted on door.

2.4 FABRICATION

- A. Fabrication, General: Fabricate toilet compartment components to sizes indicated. Coordinate requirements and provide cutouts for through-partition toilet accessories where required for attachment of toilet accessories.
- B. Floor-Anchored Units: Provide manufacturer's standard corrosion-resistant anchoring assemblies with leveling adjustment nuts at pilasters for structural connection to floor. Provide shoes at pilasters to conceal anchorage.
- C. Door Size and Swings: Unless otherwise indicated, provide 24-inch-wide in-swinging doors for standard toilet compartments and 36-inch-wide out-swinging doors with a minimum 32-inch-wide clear opening for compartments designated as accessible.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine toilet partition areas for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Verify critical dimensions in field and examine supporting structure and other conditions under which toilet partition work is to be installed.

3.2 INSTALLATION

- A. General: Comply with manufacturer's written installation instructions. Install units rigid, straight, level, and plumb. Secure units in position with manufacturer's recommended anchoring devices.
 - 1. Maximum Clearances:
 - a. Pilasters and Panels: 1/2 inch.

- b. Panels and Walls: 1 inch.
2. Full-Height (Continuous) Brackets: Secure panels to walls and to pilasters with full-height brackets.
- a. Locate bracket fasteners so holes for wall anchors occur in masonry or tile joints.
 - b. Align brackets at pilasters with brackets at walls.

3.3 ADJUSTING

- A. Hardware Adjustment: Adjust and lubricate hardware according to hardware manufacturer's written instructions for proper operation. Set hinges on in-swinging doors to hold doors open approximately 30 degrees from closed position when unlatched. Set hinges on out-swinging doors to return doors to fully closed position.

END OF SECTION 10 21 13.17

SECTION 10 22 39 - FOLDING PANEL PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Manually operated, acoustical panel partitions.
- B. Related Requirements:
 - 1. Section 05 50 00 "Metal Fabrications" for supports that attach supporting tracks to overhead structural system.
 - 2. Section 09 29 00 "Gypsum Board" for fire-rated assemblies and sound barrier construction above the ceiling at track.
 - 3. Electrical and communications Sections for electrical service and connections for motor operators, controls, and limit switches and for system disconnect switches.

1.2 DEFINITIONS

- A. NIC: Noise Isolation Class.
- B. NRC: Noise Reduction Coefficient.
- C. STC: Sound Transmission Class.

1.3 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings: For operable panel partitions.
 - 1. Include plans, elevations, sections, attachment details, and numbered panel installation sequence.
 - 2. Indicate stacking and operating clearances. Indicate location and installation requirements for hardware and track, blocking, and direction of travel.
 - 3. Include diagrams for power, signal, and control wiring.
- C. Samples for Initial Selection: For each type of exposed material, finish, covering, or facing.
 - 1. Include Samples of accessories involving color selection.

- D. Samples for Verification: For each type of exposed material, finish, covering, or facing, prepared on Samples of size indicated below:
 - 1. Panel Facing Material: Manufacturer's standard-size unit, not less than 3 inches square.
 - 2. Panel Edge Material: Not less than 3 inches long.
 - 3. Hardware: One of each exposed door-operating device.
- E. Delegated-Design Submittal: For operable panel partitions.
- F. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Partition track, track supports and bracing, switches, turning space, and storage layout.
 - 2. Suspended ceiling components.
 - 3. Structural members to which suspension systems will be attached.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling including the following:
 - a. Lighting fixtures.
 - b. HVAC ductwork, outlets, and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Smoke detectors.
 - f. Access panels.
 - 6. Plenum acoustical barriers.
- B. Setting Drawings: For embedded items and cutouts required in other work, including support-beam, mounting-hole template.
- C. Qualification Data: For Installer.
- D. Product Certificates: For each type of operable panel partition.
- E. Product Test Reports: For each operable panel partition, for tests performed by a qualified testing agency.
- F. Field quality-control reports.
- G. Sample Warranty: For manufacturer's special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For operable panel partitions to include in maintenance manuals.
 - 1. In addition to items specified in Section 01 78 23 "Operation and Maintenance Data," include the following:
 - a. Panel finish facings and finishes for exposed trim and accessories. Include precautions for cleaning materials and methods that could be detrimental to finishes and performance.
 - b. Seals, hardware, track, track switches, carriers, and other operating components.
 - c. Electric operator and controls.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials, from the same production run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Panel Finish-Facing Material: Furnish full width in quantity to cover both sides of two panels when installed.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protectively package and sequence panels in order for installation. Clearly mark packages and panels with numbering system used on Shop Drawings. Do not use permanent markings on panels.

1.10 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of operable panel partitions that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Faulty operation of operable panel partitions.
 - b. Deterioration of metals, metal finishes, and other materials beyond normal use.
 - 2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Acoustical Performance: Provide operable panel partitions tested by a qualified testing agency for the following acoustical properties according to test methods indicated:
1. Sound-Transmission Requirements: Operable panel partition assembly tested for laboratory sound-transmission loss performance according to ASTM E90, determined by ASTM E413, and rated for not less than the STC indicated.
 2. Noise-Reduction Requirements: Operable panel partition assembly, identical to partition tested for STC, tested for sound-absorption performance according to ASTM C423, and rated for not less than the NRC indicated.
 3. Noise-Isolation Requirements: Installed operable panel partition assembly, identical to partition tested for STC, tested for NIC according to ASTM E336, determined by ASTM E413, and rated for 10 dB less than STC value indicated.
- B. Fire-Test-Response Characteristics: Provide panels with finishes complying with one of the following as determined by testing identical products by a testing and inspecting agency acceptable to authorities having jurisdiction:
1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - a. Flame-Spread Index: 25 or less.
 - b. Smoke-Developed Index: 450 or less.
 2. Fire Growth Contribution: Complying with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.2 OPERABLE ACOUSTICAL PANELS

- A. Operable Acoustical Panels: Partition system, including panels, seals, finish facing, suspension system, operators, and accessories.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. Basis of Design: Modernfold, Inc. (Acousti-Seal Encore)
 - b. Hufcor, Inc.(643E)
 - c. Moderco Inc. (743E / 843E)
- B. Panel Operation: Manually operated, continuously hinged panels.
- C. Panel Construction: As required to support panel from suspension components and with reinforcement for hardware attachment. Fabricate panels with tight hairline joints and concealed fasteners. Fabricate panels so finished in-place partition is rigid; level; plumb; aligned, with tight joints and uniform appearance; and free of bow, warp, twist, deformation, and surface and finish irregularities.

- D. Dimensions: Fabricate operable acoustical panel partitions to form an assembled system of dimensions indicated and verified by field measurements.
 - 1. Panel Width: Standard widths.
- E. STC: Not less than 55.
- F. NRC: Not less than 0.50.
- G. Panel Weight: 8 lb/sq. ft. maximum.
- H. Panel Thickness: Nominal dimension of.
 - 1. Steel Frame: Steel sheet, manufacturer's standard nominal minimum thickness for uncoated steel.
 - 2. Steel Face/Liner Sheets: Tension-leveled steel sheet, manufacturer's standard minimum nominal thickness for uncoated steel.
 - 3. Aluminum: Alloy and temper recommended by aluminum producer and finisher for type of use, corrosion resistance, and finish indicated; ASTM B221 for extrusions; manufacturer's standard strengths and thicknesses for type of use.
 - a. Frame Reinforcement: Manufacturer's standard steel or aluminum.
 - 4. Gypsum Board: ASTM C1396/C1396M.
 - 5. Cement Board: ASTM C1288.
 - 6. Particleboard: ANSI A208.1.
 - 7. Medium-Density Fiberboard: ANSI A208.2.
 - 8. Plywood: DOC PS 1.
- I. Panel Closure: Manufacturer's standard unless otherwise indicated.
 - 1. Initial Closure: Resilient, bulb-shaped acoustical seal.
 - 2. Final Closure: Constant-force, lever-operated mechanical closure expanding from panel edge to create a constant-pressure acoustical seal.
- J. Hardware: Manufacturer's standard as required to operate operable panel partition and accessories; with decorative, protective finish.
 - 1. Hinges: Manufacturer's standard.
- K. Finish Facing: High-pressure decorative laminate, Crisp Linen

2.3 SEALS

- A. Description: Seals that produce operable panel partitions complying with performance requirements and the following:
 - 1. Manufacturer's standard seals unless otherwise indicated.
 - 2. Seals made from materials and in profiles that minimize sound leakage.
 - 3. Seals fitting tight at contact surfaces and sealing continuously between adjacent panels and between operable panel partition perimeter and adjacent surfaces, when operable panel partition is extended and closed.

- B. Horizontal Top Seals: Continuous-contact, resilient seal exerting uniform constant pressure on track or resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on track when extended.
- C. Horizontal Bottom Seals: Resilient, mechanical, retractable, constant-force-contact seal exerting uniform constant pressure on floor when extended, ensuring horizontal and vertical sealing and resisting panel movement.
 - 1. Automatically Operated for Acoustical Panels: Extension and retraction of bottom seal automatically operated by movement of partition, with operating range not less than 1 inch between retracted seal and floor finish.

2.4 PANEL FINISH FACINGS

- A. Description: Finish facings for panels that comply with indicated fire-test-response characteristics and that are factory applied to operable panel partitions with appropriate backing, using mildew-resistant nonstaining adhesive as recommended by facing manufacturer's written instructions.
 - 1. Apply facings free of air bubbles, wrinkles, blisters, and other defects, with invisible seams complying with Shop Drawings for location, and with no gaps or overlaps. Horizontal seams are not permitted. Tightly secure and conceal raw and selvage edges of facing for finished appearance.
 - 2. Where facings with directional or repeating patterns or directional weave are indicated, mark facing top and attach facing in same direction.
 - 3. Match facing pattern 72 inches above finished floor.
- B. High-Pressure Decorative Laminate: NEMA LD 3, Horizontal grade.
 - 1. Color/Pattern: As selected by Architect from manufacturer's full range.
- C. Trimless Edges: Fabricate exposed panel edges so finish facing wraps uninterrupted around panel, covering edge and resulting in an installed partition with facing visible on vertical panel edges, without trim, for minimal sightlines at panel-to-panel joints.

2.5 SUSPENSION SYSTEMS

- A. Tracks: Steel or aluminum with adjustable steel hanger rods for overhead support, designed for operation, size, and weight of operable panel partition indicated. Size track to support partition operation and storage without damage to suspension system, operable panel partitions, or adjacent construction. Limit track deflection to no more than 0.10 inch between bracket supports. Provide a continuous system of track sections and accessories to accommodate configuration and layout indicated for partition operation and storage.
 - 1. Panel Guide: Aluminum guide on both sides of the track to facilitate straightening of the panels; finished with factory-applied, decorative, protective finish.
 - 2. Head Closure Trim: As required for acoustical performance; with factory-applied, decorative, protective finish.

- B. Carriers: Trolley system as required for configuration type, size, and weight of partition and for easy operation; with ball-bearing wheels.
- C. Track Intersections, Switches, and Accessories: As required for operation, storage, track configuration, and layout indicated for operable panel partitions, and compatible with partition assembly specified. Fabricate track intersections and switches from steel or aluminum.
- D. Aluminum Finish: Mill finish or manufacturer's standard, factory-applied, decorative finish unless otherwise indicated.
- E. Steel Finish: Manufacturer's standard, factory-applied, corrosion-resistant, protective coating unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine flooring, floor levelness, structural support, and opening, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of operable panel partitions.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install operable panel partitions and accessories after other finishing operations, including painting, have been completed in area of partition installation.
- B. Install panels in numbered sequence indicated on Shop Drawings.
- C. Broken, cracked, chipped, deformed, or unmatched panels are not acceptable.
- D. Broken, cracked, deformed, or unmatched gasketing or gasketing with gaps at butted ends is not acceptable.
- E. Light-Leakage Test: Illuminate one side of partition installation and observe vertical joints and top and bottom seals for voids. Adjust partitions for alignment and full closure of vertical joints and full closure along top and bottom seals. Perform test and make adjustments before NIC testing.

3.3 FIELD QUALITY CONTROL

- A. NIC Testing: Engage a qualified testing agency to perform tests and inspections.
 - 1. Testing Extent: Testing agency shall randomly select 2 operable panel partition installation(s) for testing.

2. Testing Methodology: Perform testing of installed operable panel partition for noise isolation according to ASTM E336, determined by ASTM E413, and rated for not less than NIC indicated. Adjust and fit partitions to comply with NIC test method requirements.
 - B. An operable panel partition installation will be considered defective if it does not pass tests and inspections.
 - C. Prepare test and inspection reports.

3.4 ADJUSTING

- A. Adjust operable panel partitions, hardware, and other moving parts to function smoothly, and lubricate as recommended by manufacturer.
- B. Verify that safety devices are properly functioning.

3.5 MAINTENANCE SERVICE

- A. Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper operable-partition operation. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.

3.6 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain operable panel partitions.

END OF SECTION 10 22 39

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

Section Includes:

1. Corner guards.
2. Wall rubstrips.
3. Crash rails.
4. Fiberglass reinforced wall panels.

Related Requirements:

5. Section 05 5000 "Metal Fabrications" for steel angle corner guards.
6. Section 08 7100 "Door Hardware" Section 08 7111 "Door Hardware (Descriptive Specification)" for metal protective trim units, according to BHMA A156.6, used for armor, kick, mop, and push plates.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.
- B. Revise subparagraph below to suit Project.
 1. Include fire ratings of units recessed in fire-rated walls and listings for door-protection items attached to fire-rated doors.
- C. Sustainable Design Submittals:
 1. Refer to Section 01 81 13 - Sustainable Design Requirements
- D. Shop Drawings: For each type of wall and door protection showing locations and extent.
- E. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:
 1. Corner and End-Wall Guards: 12 inches long.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
- B. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
 - 1.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain wall- and door-protection products from single source from single manufacturer.

2.2 CORNER GUARDS

- A. Surface-Mounted, Metal Corner Guards: Fabricated as one piece from formed or extruded metal with formed edges; with 90- or 135-degree turn to match wall condition.
- B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Babcock-Davis.
 - b. Balco, Inc.
 - c. Construction Specialties, Inc.
 - d. Hiawatha, Inc; a division of the Activar Construction Products Group.
 - e. InPro Corporation (IPC).
 - f. JL Industries, Inc.; a division of the Activar Construction Products Group.
 - g. Korogard Wall Protection Systems; a division of RJF International Corporation.
 - h. Nystrom, Inc.
 - i. Pawling Corporation.
 - j. WallGuard.com.
- C. Material: Stainless-steel sheet, Type 304.
 - a. Thickness: Minimum 0.0625 inch.
 - b. Finish: Directional satin, No. 4.
 - 2. Wing Size: Nominal 1-1/2 by 1-1/2 inches (38 by 38 mm).
 - 3. Corner Radius: 1/8 inch (3 mm).
 - 4. Mounting: Adhesive.

2.3 WALL RUBSTRIPS

- A. Manufacturer List: Wall protection products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 1. Construction Specialties Acrovyn Rubstrip
 - 2. Inpro
- B. Substitution Limitations: Refer to specification section 01 25 00 – SUBSTITUTION PROCEDURES
- C. Material: Engineered PVC Free
 - 1. Material shall be secured to wall with standard adhesive.
 - 2. UL class A/1 fire rated & labeled.
 - 3. Suede texture.
- D. Thickness: Nominal .060" thick sheet with tapered upper and lower edges.
- E. Height: 12".
- F. Color: Solid color, color as selected by architect from one of manufacturer's line.

2.4 FIBERGLASS REINFORCED WALL PANELS

- A. Manufacturer List: Solid Surface Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 1. Marlite
 - 2. Crane Composites
- B. Substitution Limitations: Refer to specification section 01 25 00 – SUBSTITUTION PROCEDURES
- C. Material: Class A prefinished polyester glass reinforced standard plastic sheets and adhered to unfinished gypsum wallboard.
- D. Trim: PVC.
- E. Exposed Finish: As indicated in drawings.
- F. Size: As indicated in drawings.
- G. Color: White.

2.5 CRASH RAILS

- A. Manufacturer List: Solid Surface Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:

1. Construction Specialties ECR-60S
 2. Inpro 56SS
- B. Substitution Limitations: Refer to specification section 01 25 00 – SUBSTITUTION PROCEDURES
- C. Material: Stainless-steel, Type 304.
- a. Height: 6"
 - b. Thickness: Minimum ¼ inch.
 - c. Finish: Directional satin, No. 4.
 - d. 2" radius cut ends.
 - e. All necessary fasteners to be supplied by manufacturer.
 - f. Wall anchors to stud construction.
- D. Provide blocking at walls as necessary for anchoring of crash rails.

2.6 MATERIALS

- A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.
- B. Adhesive: As recommended by protection product manufacturer.
- C. Adhesives shall have a VOC content of 70 g/L or less.
1. Adhesive shall comply with the testing and product requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

2.7 FABRICATION

- A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.
- B. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.8 FINISHES

- A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

- B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
- C. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Complete finishing operations, including painting, before installing wall and door protection.
- B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

- A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
- B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

3.4 CLEANING

- A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

- B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 28 00 - TOILET, BATH, AND LAUNDRY ACCESSORIES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Public-use washroom accessories.

1.2 COORDINATION

- A. Coordinate accessory locations with other work to prevent interference with clearances required for access by people with disabilities, and for proper installation, adjustment, operation, cleaning, and servicing of accessories.
- B. Deliver inserts and anchoring devices set into concrete or masonry as required to prevent delaying the Work.

1.3 ACTION SUBMITTALS

- A. Product Data Submittals: For each product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.
 - 2. Include anchoring and mounting requirements, including requirements for cutouts in other work and substrate preparation.
 - 3. Include electrical characteristics.
- B. Samples: For each exposed product and for each finish specified, full size.
 - 1. Approved full-size Samples will be returned and may be used in the Work.
- C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.
 - 1. Identify locations using room designations indicated.
 - 2. Identify accessories using designations indicated.

1.4 INFORMATIONAL SUBMITTALS

- A. Sample Warranty: For manufacturer's special warranties.

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For accessories to include in maintenance manuals.

1.6 WARRANTY

- A. Manufacturer's Special Warranty for Mirrors: Manufacturer agrees to repair or replace mirrors that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, visible silver spoilage defects.
 - 2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED MATERIALS

- A. Owner-Furnished Materials: Toilet Paper Dispenser, Paper Towel Dispenser, Soap Dispenser

2.2 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Design accessories and fasteners to comply with the following requirements:
 - 1. Grab Bars: Installed units are able to resist 250 lbf (1112 N) concentrated load applied in any direction and at any point.

2.3 PUBLIC-USE WASHROOM ACCESSORIES

- A. Source Limitations: Obtain each type of public-use washroom accessory from single source from single manufacturer.
- B. Toilet Tissue Dispenser, Paper Towel Dispenser, Soap Dispenser:
 - a. Owner provided toilet tissue dispenser. See drawings for manufacturer.
 - b. Contractor Installed.
- C. Grab Bar:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AJW Architectural Products.
 - b. ASI-American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
 - 2. Mounting: Flanges with concealed fasteners.
 - 3. Material: Stainless steel, 0.05 inch (1.3 mm) thick.
 - a. Finish: Smooth, ASTM A480/A480M No. 4 finish (satin).
 - 4. OD: 1-1/2 inches (38 mm).
 - 5. Configuration and Length: As indicated on Drawings.

- D. Mirror Unit:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AJW Architectural Products.
 - b. ASI-American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
 2. Frame: Stainless steel angle, 0.05 inch (1.3 mm) thick or stainless steel channel.
 - a. Corners: Welded and ground smooth.
 3. Size: 24" W x 48" H
 4. Hangers: Manufacturer's standard rigid, tamper and theft resistant.
- E. Towel Hook:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - a. AJW Architectural Products.
 - b. ASI-American Specialties, Inc.
 - c. Bobrick Washroom Equipment, Inc.
 - d. Bradley Corporation.
 - e. Gamco Commercial Restroom Accessories; Bobrick Washroom Equipment, Inc.
 2. Capacity: 300 lbs
 3. At each toilet partition door, install instead coat hook with rubber bumper per Section 10 2113.17 – Phenolic Core Toilet Compartments..

2.4 FABRICATION

- A. General: Fabricate units with tight seams and joints, and exposed edges rolled. Hang doors and access panels with full-length, continuous hinges. Equip units for concealed anchorage and with corrosion-resistant backing plates.
- B. Keys: Provide universal keys for internal access to accessories for servicing and resupplying. Provide minimum of six keys to Owner's representative.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install accessories in accordance with manufacturers' written instructions, using fasteners appropriate to substrate indicated and recommended by unit manufacturer. Install units level, plumb, and firmly anchored in locations and at heights indicated.
1. Remove temporary labels and protective coatings.
- B. Grab Bars: Install to comply with specified structural-performance requirements.

3.2 ADJUSTING AND CLEANING

- A. Adjust accessories for unencumbered, smooth operation. Replace damaged or defective items.
- B. Clean and polish exposed surfaces in accordance with manufacturer's written instructions.

END OF SECTION 10 28 00

SECTION 10 44 16 - FIRE EXTINGUISHERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

1.2 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to fire extinguishers including, but not limited to, the following:
 - a. Schedules and coordination requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.
- B. Product Schedule: For fire extinguishers. Coordinate final fire-extinguisher schedule with fire-protection cabinet schedule to ensure proper fit and function. Use same designations indicated on Drawings.
- C. Sustainable Design Submittals
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements

1.4 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.6 COORDINATION

- A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.7 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
 - b. Faulty operation of valves or release levers.
 - 2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."
- B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide fire extinguishers manufactured by Oval Fire Products or comparable product as approved by Architect.
- B. Fire extinguisher shall have maximum depth of 3 1/2". When wall or cabinet mounted, the extinguisher installation shall comply with the 4" maximum limit for protruding objects as required by the Americans with Disabilities Act (ADA), 2010 ADA Standards for Accessible Design, the International Building Code and ANSI/ICC ANSI A117.1.
- C. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet and mounting bracket indicated.
 - 1. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
 - 2. Valves: Manufacturer's standard.
 - 3. Handles and Levers: Manufacturer's standard.
 - 4. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B.
- D. Multipurpose Dry-Chemical Type in Aluminum Container: UL-rated 4A:80-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in aluminum body.

2.3 MOUNTING BRACKETS

- A. Mounting Brackets: Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or black baked-enamel finish.
 - 1. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.
- B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.
 - 1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.
 - a. Orientation: Vertical.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fire extinguishers for proper charging and tagging.
 - 1. Remove and replace damaged, defective, or undercharged fire extinguishers.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.
 - 1. Mounting Brackets: Top of fire extinguisher to be at 42 inches above finished floor.
- B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

END OF SECTION 10 44 16

SECTION 105113 - METAL LOCKERS

GENERAL

- .1 SUMMARY
 - A. Section Includes:
 - 1. Welded corridor lockers.
 - 2. GunPistol storage lockers.

- .2 ACTION SUBMITTALS
 - A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of metal locker and bench.
 - B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 - Sustainable Design Requirements
 - C. Shop Drawings: For metal lockers.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Show locker trim and accessories.
 - 3. Include locker identification system and numbering sequence.
 - D. Samples: For each color specified, in manufacturer's standard size.
 - E. Samples for Initial Selection: Manufacturer's color charts showing the full range of colors available.
 - F. Samples for Verification: For the following products, in manufacturer's standard size:
 - 1. Lockers and equipment.
 - 2. Locker benches.

- .3 INFORMATIONAL SUBMITTALS
 - A. Qualification Data: For Installer.
 - B. Sample Warranty: For special warranty.

- .4 CLOSEOUT SUBMITTALS
 - A. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals.

.5 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver metal lockers until spaces to receive them are clean, dry, and ready for their installation.
- B. Deliver combination control charts to Owner by registered mail or overnight package service.

.6 FIELD CONDITIONS

- A. Field Measurements: Verify actual dimensions of recessed openings by field measurements before fabrication.

.7 COORDINATION

- A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of work specified in other Sections to ensure that metal lockers can be supported and installed as indicated.

.8 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of metal lockers that fail in materials or workmanship, excluding finish, within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Structural failures.
 - b. Faulty operation of latches and other door hardware.
 - 2. Damage from deliberate destruction and vandalism is excluded.
 - 3. Warranty Period for Welded Metal Lockers: Lifetime from date of Substantial Completion.

PRODUCTS

.1 SOURCE LIMITATIONS

- A. Obtain metal lockers, and accessories from single source from single locker manufacturer.
 - 1. Obtain locks from single lock manufacturer.

.2 PERFORMANCE REQUIREMENTS

- A. Accessibility Standard: For lockers and locker benches indicated to be accessible, comply with applicable provisions in the ABA standards of the Federal agency having jurisdiction and ICC A117.1.

.3 WELDED CORRIDOR LOCKERS

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Tiffin Metal Products or comparable product as approved by Architect.
1. Metal Sidearm Lockers: Sentinel Law Enforcement Lockers
 - a. Size: 29-1/4w x 8d x 37-1/2h
 - b. Doors: Minimum 7 ga steel, tilt-out style louverless
 - c. Door hinges: Steel, 90 degree type
 - d. Locks: Security type, replaceable cylinder, proprietary keying system, with 12 gauge locking cam
 - e. Each lock keyed differently and master keyed in one set. Provide one key per lock and one master key.
 - f. Provide brackets for wall attachment
 - g. Bottom of lockers lined with felt
 - h. Finish: 3 mil thick factory-finished baked-on textured powder coat finish
 2. Metal Gun Lockers: Sentinel Law Enforcement Lockers
 - a. Size: 34wx12dx74h
 - b. Doors: Louverless, self-closing
 - c. Door hinges: continuous type, 180 degree opening
 - 1) Keyed: High security double bitted lock cylinder with 12 gauge stainless steel cam attached. Each cylinder mater keyed. Provide 1 key per lock and 1 master key.
 - d. Finish: 3 mil thick factory-finished baked-on textured powder coat finish
 3. Recruit Lockers: Republic's Standard Double Tier Lockers
 - a. Color: Selected by Architect from manufacturer's standard line
 - b. Size:
 - 1) EMS: 12"w x 21"d x 36/72"h
 - 2) CPD: 15"w x 21"d x 36/72"h
- B. Personal Storage Lockers with built-in external access drawers.
1. Welded metal lockers with end-user reconfigurable interior, including specialized lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components.
- C. Finishes:
1. Fabricated Metal Components and Assemblies: All components to be painted with an electro-statically applied Powder Coat paint that can meet or exceed test requirements set out by ASTM D3451-06 Standard Guide for Testing Coating Powders and Powder Coatings.
- D. Sizes: As shown on Drawings.
- E. Welded Frame:
1. The welded frame must consist of top, bottom, back, and sides constructed of a minimum of 18-gauge steel. All frame components shall be joined using resistance welding. Riveting of structural members will not be permitted.
 2. Horizontal front flanges will be a minimum of 2 inches. Vertical front flanges will be a minimum of 1 inch. Horizontal and vertical flanges will overlap and be secured with a minimum two (2) resistance welds per corner.
 3. Corner gussets shall be MIG and spot welded in each of the four front corners of the locker for increased stiffness and rigidity.

4. Provide side panel lances evenly spaced on 3 inch centers. Lances to provide the flexibility of on-site, end-user reconfiguration/addition of internal components anytime, anywhere, now or in the future.
 5. Built-in drawer
 - a. Welded frame construction shall consist of top, bottom, and side components joined by using resistance welding.
 - b. Horizontal front flanges will be a minimum of 1 inch.
 - c. Vertical front flanges will be a minimum of 1 inch.
 - d. Horizontal and Vertical front flanges will overlap and shall be secured with minimum of one (1) resistance weld per corner.
 - e. Side panels – Lances symmetric and evenly spaced to provide optimum component locations (standard based on 3 inch on center vertical placement to match mating locker lance design).
 - f. Return flanges on housing to securely fasten housing to welded frame of locker.
 6. Lockers with built-in external access drawer shall have intermediate base shelf with interlocking mechanism for securing drawer when locker door is closed.
 7. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced 0.625 inch diameter holes. Proper ventilation system ensures unpleasant odors are removed from locker system.
 8. Lockers shall be prepared with mounting holes for use with the continuous sloped top system.
 9. Lockers shall be prepared with mounting holes for attaching necessary trim components.
 10. Locker shall be prepared with mounting holes for ganging lockers back-to-back or side-by-side.
 11. Base of lockers shall include four (4) 3/8"-16 UNC threaded weld-nuts and corresponding leveling feet.
 12. Base shelf for lockers with built-in external access drawers shall have holes to accommodate double-door lock rod and door stop bracket.
 13. End Panels: End Panels with no exposed fasteners shall be provided on the end of each locker run; thus providing a clean and aesthetically pleasing appearance.
- F. Ventilation:
1. Provide ventilation holes in top of locker to allow mechanically extracted air to be pulled up through the locker system as required. Ventilation shall be controlled by eight (8) evenly spaced 0.625 inch diameter holes. Proper ventilation system ensures odors are removed from locker system.
 2. Provide an adjustable air baffle for system balancing when mechanical air extraction is used. Upon balancing system, air baffle shall be secured with a fastener to maintain ventilation setting.
 3. Provide louvered air vents in bottom of the main locker door/s to allow mechanically extracted air to be pulled up through the locker system.
 4. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
 5. Minimum 0.500 inch gap between back of shelving components and back of locker to provide uninterrupted air flow up the rear of the locker system.
 6. Minimum 2.00 inches gap between front of shelving and locker door to provide uninterrupted air flow up the front of the locker system.

- G. Drawers:
1. Drawer body wrapper shall be formed from single piece consisting of sides and bottom, with backs secured using structural locking lances.
 2. Drawers for locker with built-in external access drawers shall have box-formed drawer front.
 3. Provide interlock system for securing drawer when main locker doors are closed and provide access only when main locker door/s is opened.
 4. Provide a flush mounted pull handle.
 5. Drawer Slides: Provide 200 lbs maximum load capacity and pass 50,000 cycle performance testing.
 6. Drawer base minimum 21 inches drawer extension
 7. Provide louvered air vents in drawer front when built-in bench drawer or built-in external access drawer models are required.
- H. Single-Piece Welded Doors:
1. Shall be formed from two (2) pieces of minimum 18-gauge cold rolled steel box formed and welded together using modern GMAW techniques. Single-piece door with inner and outer door panels shall have a combined steel thickness of no less than 0.096 inches thick. Welded door design with inner panel optimizes structural integrity of locker door system over and above any single frame door design.
 2. Exterior door panel shall be constructed with formed flanges and return flanges to add stiffness.
 3. Internal door panel shall be constructed with formed flanges for added stiffness.
 4. Single-piece welded door frame shall consist of internal door panel nested inside exterior door panel and welded per the following requirements:
 - a. Top / bottom. Exterior and Interior panels to be welded in a minimum of three (3) places with weld spacing not to exceed 6 inches between adjacent welds and 1 inch from any corner.
 - b. Sides. Exterior and interior panels to be welded with spacing not to exceed 12 inches between adjacent welds and 1 inch from any corner.
 5. Inner door panel to have peg board style hole pattern.
 6. Inner door panel to have 4 inch rectangular slot centered towards the top of the locker.
 7. External door panel shall have louvers to provide adequate air circulation throughout locker system.
 - a. Louvered air vents shall be located at the bottom of the locker door to enhance circulation of mechanically extracted air from the bottom of the locker out of the top.
 - b. Louvered air vents shall be approximately 3 inches in width and 0.75 inches in height and spaced on 1 inch centers.
 8. All doors shall have neoprene silencers on each door for noise reduction.
 9. Diamond Perforated Pattern: Pattern is defined as 0.875 by 0.875 inch diamond perforations on 1.768 inch centers.
 10. Door torsional deflection shall not exceed 0.1875 inch with a 20 lb point load.
 11. Hinge:
 - a. Provide 16-gauge full length hinge for increased strength and security of locker system.
 - b. Hinges to be welded to door frame with spot welds not to exceed 6 inch separation.

12. Door assembly to be riveted to door frame on factory pre-established hole pattern.
13. Locking Mechanism: Combination lock with master and padlock hasp.

I. Accessory components:

1. All interior components must be constructed of minimum 18-gauge steel.
2. For added security, internal component can be secured utilizing blind rivets, threaded fasteners, or bending specially designed tab.
3. Shelf with integral hanger bracket:
 - a. Size specified by locker width.
 - b. Hanger bracket designed with perforations on approximately 3 inch centers to insure clothing separation for optimum ventilation.
 - c. Performance: Uniform load rating 300 lbs.
4. Sloping top.
5. Filler panels.
6. Locker Number plates.

J. Provide locker numbers on each locker per customer requirement.

4 FABRICATION

A. Fabricate metal lockers square, rigid, without warp, and with metal faces flat and free of dents or distortion. Make exposed metal edges safe to touch and free of sharp edges and burrs.

1. Form body panels, doors, shelves, and accessories from one-piece steel sheet unless otherwise indicated.
2. Provide fasteners, filler plates, supports, clips, and closures as required for complete installation.

B. Fabricate each metal locker with an individual door and frame; individual top, bottom, and back; and common intermediate uprights separating compartments.

C. Welded Construction: Factory preassemble metal lockers by welding all joints, seams, and connections; with no bolts, nuts, screws, or rivets used in assembly of main locker groups. Factory weld main locker groups into one-piece structures. Grind exposed welds smooth and flush.

D. Continuous Sloping Tops: Fabricated in lengths as long as practical, without visible fasteners at splice locations; finished to match lockers.

1. Sloping-top corner fillers, mitered.

E. Recess Trim: Fabricated with minimum 2-1/2-inch (64-mm) face width and in lengths as long as practical; finished to match lockers.

F. Filler Panels: Fabricated in an unequal leg angle shape; finished to match lockers. Provide slip-joint filler angle formed to receive filler panel.

.5 ACCESSORIES

- A. Fasteners: Zinc- or nickel-plated steel, slotless-type, exposed bolt heads; with self-locking nuts or lock washers for nuts on moving parts.
- B. Anchors: Material, type, and size required for secure anchorage to each substrate.

EXECUTION**.1 EXAMINATION**

- A. Examine walls and floors or support bases, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

.2 INSTALLATION

- A. Install lockers level, plumb, and true; shim as required, using concealed shims.
 - 1. Anchor locker runs at ends and at intervals recommended by manufacturer, but not more than 36 inches (910 mm) o.c. Using concealed fasteners, install anchors through backup reinforcing plates, channels, or blocking as required to prevent metal distortion.
- B. Welded Lockers: Connect groups together with manufacturer's standard fasteners, with no exposed fasteners on face frames.
- C. Equipment:
 - 1. Attach hooks with at least two fasteners.
 - 2. Attach door locks on doors using security-type fasteners.
 - 3. Identification Plates:
 - a. Attach plates to each locker door, near top, centered, with at least two aluminum rivets.
- D. Trim: Fit exposed connections of trim, fillers, and closures accurately together to form tight, hairline joints, with concealed fasteners and splice plates.
- E. Fixed Benches: Provide no fewer than two pedestals for each bench, uniformly spaced not more than 72 inches (1830 mm) apart. Securely fasten tops of pedestals to undersides of bench tops, and anchor bases to floor.

.3 ADJUSTING

- A. Clean, lubricate, and adjust hardware. Adjust doors and latches to operate easily without binding. Verify that integral locking devices operate properly.

.4 PROTECTION

- A. Protect metal lockers from damage, abuse, dust, dirt, stain, or paint. Do not permit use during construction.
- B. Touch up marred finishes, or replace metal lockers that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by locker manufacturer.

END OF SECTION 105113

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Manually operated roller shades with single rollers.

B. Related Requirements:

1. Section 061053 "Miscellaneous Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

C. Samples: For each exposed product and for each color and texture specified, 10 inches long.

D. Samples for Initial Selection: For each type and color of shadeband material.

1. Include Samples of accessories involving color selection.

E. Samples for Verification: For each type of roller shade.

1. Shadeband Material: Not less than 10 inches square. Mark interior face of material if applicable.
2. Roller Shade: Full-size operating unit, not less than 16 inches wide by 36 inches long for each type of roller shade indicated.
3. Installation Accessories: Full-size unit, not less than 10 inches long.

F. Product Schedule: For roller shades. Use same designations indicated on Drawings.

G. Sustainable Design Submittals:

1. Refer to Section 01 81 13 - Sustainable Design Requirements

1.3 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Product Certificates: For each type of shadeband material.
- C. Product Test Reports: For each type of shadeband material, for tests performed by a qualified testing agency.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Roller Shades: Full-size units equal to 5 percent of quantity installed for each size, color, and shadeband material indicated, but no fewer than two units.

1.6 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.
- B. Mockups: Build mockups to verify selections made under Sample submittals, to demonstrate aesthetic effects, and to set quality standards for fabrication and installation.
 - 1. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
 - 2. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

- B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Source Limitations: Obtain roller shades from single source from single manufacturer.

2.2 MANUALLY OPERATED SHADES WITH SINGLE ROLLERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Basis of Design: Draper Inc.- SunBlock SB9000 (White)
2. Hunter Douglas Contract.
3. MechoShade Systems, Inc.

- B. Chain-and-Clutch Operating Mechanisms: With continuous-loop bead chain and clutch that stops shade movement when bead chain is released; permanently adjusted and lubricated.

1. Bead Chains: Stainless steel.
 - a. Loop Length: Full length of roller shade.
 - b. Limit Stops: Provide upper and lower ball stops.
 - c. Chain-Retainer Type: Chain tensioner, jamb mounted.
2. Spring Lift-Assist Mechanisms: Manufacturer's standard for balancing roller shade weight and for lifting heavy roller shades.
 - a. Provide for shadebands that weigh more than 10 lb or for shades as recommended by manufacturer, whichever criterion is more stringent.

- C. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

- D. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.
- E. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers into a multiband shade that is operated by one roller drive-end assembly.
- F. Shadebands:
 - 1. Shadeband Material: Light-blocking fabric.
 - 2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.
 - a. Type: Exposed with endcaps and integral light seal at bottom where it meets the sill.
 - b. Color and Finish: As selected by Architect from manufacturer's full range.
- G. Installation Accessories:
 - 1. Exposed Headbox: Rectangular, extruded-aluminum enclosure including front fascia, top and back covers, endcaps, and removable bottom closure.
 - a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 3 inches.
 - 2. Endcap Covers: To cover exposed endcaps.

2.3 SHADEBAND MATERIALS

- A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
- B. Light-Blocking Fabric: Opaque fabric, stain and fade resistant.
 - 1. Source: Roller shade manufacturer.
 - 2. Type: Fiberglass textile with PVC film bonded to both sides.
 - 3. Thickness: 0.015 inches
 - 4. Weight: 12 oz./sq. yd..
 - 5. Roll Width: 48 inches.
 - 6. Orientation on Shadeband: Up the bolt.
 - 7. Features: Washable.
 - 8. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

- A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

- B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:
 - 1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
- C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:
 - 1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.
 - 2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
 - 3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

- A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.
 - 1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.
- B. Roller Shade Locations: At exterior windows.

3.3 ADJUSTING

- A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

- A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 24 13

SECTION 12 36 61.16 - SOLID SURFACING COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material apron fronts.
5. Solid phenolic resin composite material countertops.

1.2 REFERENCES

A. Reference Standards:

1. ANSI/NPA A208.2-09 Medium Density Fiberboard (MDF) For Interior Applications
2. ASTM C920-14a Standard Specification for Elastomeric Joint Sealants
3. ASTM D638-10 Standard Test Method for Tensile Properties of Plastics
4. ASTM D785-08 Standard Test Method for Rockwell Hardness of Plastics and Electrical Insulating Materials
5. ASTM D790-10 Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
6. ASTM D5420-10 Standard Test Method for Impact Resistance of Flat, Rigid Plastic Specimen by Means of a Striker Impacted by a Falling Weight (Gardner Impact)
7. ASTM E84-14 Standard Test Method for Surface Burning Characteristics of Building Materials
8. ASTM E228-11 Standard Test Method for Linear Thermal Expansion of Solid Materials with a Push-Rod Dilatometer
9. ASTM G21-13 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
10. ASTM G22-76(96) Standard Practice for Determining Resistance of Plastics to Bacteria
11. ASTM G155-13 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials
12. CSA B45.5-11/
IAPMO Z124-2011 Plastic Plumbing Fixtures
13. NFPA 255-06 Standard Method of Test of Surface Burning Characteristics of Building Materials
14. NSF/ANSI 51-07 Food Equipment Materials
15. SCAQMD Rule 1168 Adhesive and Sealant Applications (amended January 2005)
16. UL 723 Standard for Test for Surface Burning Characteristics of Building Materials

17. UL Environment / Standard for Chemical Emissions for Building Materials, GREENGUARD Finishes and Furnishings, Section 7.1
UL 2818
18. UL Environment / Gold Standard for Chemical Emissions for Building Materials, GREENGUARD Finishes and Furnishings, Section 7.1 and 7.2
UL 2818
19. UL 2824 GREENGUARD Certification Program, Method for Measuring Microbial Resistance from Various Sources Using Static Environmental Chambers

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meetings: Arrange preinstallation meeting 1 week prior to commencing work with all parties associated with trade as designated in Contract Documents or as requested by Architect. Presided over by Contractor, include Architect who may attend, Subcontractor performing work of this trade, Owner's representative, testing company's representative and consultants of applicable discipline. Review Contract Documents for work included under this trade and determine complete understanding of requirements and responsibilities relative to work included, storage and handling of materials, materials to be used, installation of materials, sequence and quality control, Project staffing, restrictions on areas of work and other matters affecting construction, to permit compliance with intent of work of this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For countertop materials at typical space and simulation lab.
- B. Sustainable Design Submittals:
 1. Refer to Section 01 81 13 – SUSTAINABLE DESIGN REQUIREMENTS.
- C. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining, and cutouts for plumbing fixtures.
- D. Samples: For each type of material exposed to view.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 1. Submit manufacturer's care and maintenance data, including repair and cleaning instructions. Include in Project closeout documents.
 2. Provide a commercial care and maintenance kit and video. Review maintenance procedures and warranty details with Owner upon completion.

1.6 QUALITY ASSURANCE:

- A. Qualifications:
 1. Installers: Provide work of this Section executed by competent installers with minimum 5 years' experience in the application of Products, systems and

assemblies specified and with approval and training of the Product manufacturers.

- B. Delivery, storage, and handling
 - 1. Delivery and Acceptance Requirements: Deliver no components to Project site until areas are ready for installation.
 - 2. Storage and Handling Requirements:
 - a. Store components indoors prior to installation.
 - b. Handle materials to prevent damage to finished surfaces.
- C. Warranty
 - 1. Manufacturer Warranty: Provide manufacturer's standard warranty for material only for period of 10 years against defects and/or deficiencies in accordance with General Conditions of the Contract. Promptly correct any defects or deficiencies which become apparent within warranty period, to satisfaction of Architect and at no expense to Owner.

PART 2 - PRODUCTS

2.1 Manufacturers

- A. Manufacturer List: Solid Surface Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 1. Basis of Design: Corian® by DuPont; www.corian.com
 - a. Color: Graphite
 - 2. Samsung Chemical USA; www.staron.com
 - 3. Wilsonart Contract; www.wilsonartcontract.com
- B. Manufacturer List: Solid Phenolic Resin Composite Surface Products of following manufacturers are acceptable subject to conformance to requirements of Drawings, Schedules and Specifications:
 - 1. Basis of Design: Trespa Toplab Base
 - 2. Approved equal.
- C. Substitution Limitations: Refer to specification section 01 25 00 – SUBSTITUTION PROCEDURES

2.2 SOLID SURFACE COUNTERTOP MATERIALS

- A. Description: 3/4" Thick, solid surface countertop in locations as specified in the architectural drawings.
- B. Sustainability Characteristics: Provide Products meeting following LEED® performance criteria:
 - 1. MRc4: Provide Product with maximum pre-consumer and post-consumer recycled content available.

- 2. MRc5: Provide Product with regional content.
- 3. EQc4.1: Provide adhesives and sealants with VOC quantities lower than stated in SCAQMD Rule 1168. Ensure VOC quantities for sealants do not exceed 250 g/l under any circumstances.

C. Performance/Design Criteria:

	Property	Requirement (min or max)	Test Procedure
1.	Solid Surface Based Products:		
a.	Tensile Strength	6000 psi min	ASTM D638
b.	Tensile Modulus	1.5 x 10 ⁶ psi min	ASTM D638
c.	Tensile Elongation	0.4% min.	ASTM D638
d.	Flexural Strength	10000 psi min	ASTM D790
e.	Flexural Modulus	1.2 x 10 ⁶ psi min	ASTM D790
f.	Hardness	85-Rockwell "M" scale min.	ASTM D785
g.	Thermal Expansion	2.2 x 10 ⁻⁵ in./in./°F	ASTM E228
h.	Fungi and Bacteria	Does not support microbial growth	ASTM G21&G22
i.	Microbial Resistance	Highly resistant to mold growth	UL 2824
j.	Ball Impact	No fracture - 1/2 lb. Ball: 6 mm slab - 36" drop 12 mm slab - 144" drop	NEMA LD 3, Method 3.8
k.	Weatherability	ΔE*94<5 in 1,000 hrs	ASTM G155
l.	Flammability		ASTM E84, NFPA 255 & UL 723
m.	Flame Spread	<25	
n.	Smoke Developed	<25	
o.	Class	A	NFPA 101®, Life Safety Code

D. Solid Surface Material:

- 1. Non-porous, homogeneous material maintaining the same composition throughout the part with a composition of acrylic polymer, aluminum trihydrate filler and pigment; not coated, laminated or of composite construction; meeting following criteria:
- 2. Flammability: Class 1 and A when tested to UL 723.
- 3. Adhesive for Bonding to Other Products: One component silicone to ASTM C920.
- 4. Sealant: A standard mildew-resistant, FDA/UL® [and NSF/ANSI 51 compliant in Food Zone area,] recognized silicone color matched sealant or clear silicone sealants.

2.3 SOLID SURFACE COMPONENTS

- A. Counter Perimeter Frame: Ensure 3/4" thick MDF core conforming to ANSI/NPA A208.2 balanced design, manufactured from recycled materials, meeting ANSI Standards for emissions, of minimum density of 48 lb/cu ft and surface character to match sample approved by Architect. Ensure fire retardant Product contains fire-retardant chemicals injected with raw materials during manufacturing and achieves a maximum flame-spread rating of 25 with a maximum smoke development of 200 when tested to ASTM E84.
- B. Color:
 - 1. From manufacturer's standard line per Architect approval
- C. Fabrication:
 - 1. Fabricate components in shop to greatest extent practical to sizes and shapes indicated, in accordance with approved Shop Drawings and solid polymer manufacturer requirements. Form joints between components using manufacturer's standard joint adhesive without conspicuous joints. Provide factory cutouts for plumbing fittings and bath accessories as indicated on Drawings.
 - 2. Where indicated, thermoform corners and edges or other objects to shapes and sizes indicated on Drawings, prior to seaming and joining. Cut components larger than finished dimensions and sand edges to remove nicks and scratches. Heat entire component uniformly prior to forming.
 - 3. Ensure no blistering, whitening and cracking of components during forming.
 - 4. Fabricate backsplashes from solid surfacing material with optional radius cove where counter and backsplashes meet as indicated on Drawings. Backsplashes for most colors may be fabricated by traditional means discussed in K-25294 Backsplashes. Colors with metallic/mica particle or veined colors creating directional aesthetics (K-26833 Directional Aesthetics) may require the techniques in Technical Bulletin K-28235 Thermoformed Backsplash.
 - 5. Fabricate joints between components using manufacturer's standard joint adhesive. Ensure joints are inconspicuous in appearance and without voids. Attach 50 mm (2") wide reinforcing strip of solid polymer material under each joint. Reinforcing strip of solid polymer material is not required when using DuPont™ Joint Adhesive 2.0.
 - 6. Provide holes and cutouts for plumbing and bath accessories as indicated on Drawings.
 - 7. Rout and finish component edges to a smooth, uniform finish. Rout cutouts, then sand edges smooth. Repair or reject defective or inaccurate work.
 - 8. Finish: Ensure surfaces have uniform finish:
 - a. Matte, with a 60° gloss rating of 5 - 20.
 - 9. Fabrication Tolerances:
 - a. Variation in Component Size: +/-1/8".
 - b. Location of Openings: +/-1/8" from indicated location.

2.4 SOLID PHENOLIC RESIN COMPOSITE COMPONENTS

- a. Thickness: 1"
- b. Color: Refer to drawings, finish schedule. As selected by architect from standard range of colors unless noted otherwise.

- c. Edge: Flat with finished exposed edges. 3/16" (4.76 mm) machined radius top edge with blended radius or bevel corners.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verification of Conditions:
 - 1. Examine substrates and conditions, with fabricator present for compliance with requirements for installation tolerances and other conditions affecting performance of work. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 2. Verify actual site dimensions and location of adjacent materials prior to commencing work.
 - 3. Examine cabinets upon which counter tops are to be installed. Verify cabinets are level to within 1/8" in 10' - 0".
 - 4. Notify Architect in writing of any conditions which would be detrimental to installation.
- B. Evaluation and Assessment: Commencement of work implies acceptance of previously completed work.

3.2 INSTALLATION

- A. Install components plumb, level, rigid, scribed to adjacent finishes in accordance with reviewed Shop Drawings and Product installation details.
- B. Fabricate field joints using manufacturer's recommended adhesive, with joints being inconspicuous in finished work. Exposed joints/seams are not permitted. Keep components and hands clean when making joints. Reinforce field joints as specified herein. Cut and finish component edges with clean, sharp returns.
- C. Route radii and contours to template. Anchor securely to base component or other supports. Align adjacent components and form seams to comply with manufacturer's written recommendations using adhesive in color to match work. Carefully dress joints smooth, remove surface scratches and clean entire surface.
- D. Install countertops with no more than 1/8" sag, bow or other variation from a straight line.
- E. Adhere undermount / submount / bevel mount sinks/bowls to countertops using manufacturer's recommended adhesive and mounting hardware.
- F. Adhere topmount sinks/bowls to countertops using manufacturer recommended adhesives and color-coordinated silicone sealant. [Secure seam mount bowls and sinks to counter tops using color matched joint adhesive.]

- G. Seal between wall and components with joint sealant as specified herein and in Section 07 92 00, as applicable.
- H. Provide backsplashes and end splashes as indicated on Drawings. Adhere to countertops using a standard color-coordinated silicone sealant. Adhere applied side splashes to countertops using a standard color-matched silicone sealant. Provide coved backsplashes and side splashes at walls and adjacent millwork. Fabricate radius cove at intersection of counters with backsplashes to dimensions shown on reviewed Shop Drawings. Adhere to countertops using manufacturer's standard color-coordinated joint adhesive.
- I. Keep components and hands clean during installation. Remove adhesives, sealants and other stains. Ensure components are clean on date of Substantial Completion of the Work.
- J. Coordinate connections of plumbing fixtures with Division 22.

3.3 REPAIR

- A. Repair minor imperfections and cracked seams and replace areas of severely damaged surfaces in accordance with manufacturer's "Technical Bulletins".

3.4 SITE QUALITY CONTROL

- A. Non-Conforming Work: Replace damaged work which cannot be satisfactorily repaired, restored or cleaned, to satisfaction of Architect at no cost to Owner.

3.5 CLEANING

- A. Remove excess adhesive and sealant from visible surfaces.
- B. Clean surfaces in accordance with manufacturer's "Care and Maintenance Instructions".

3.6 PROTECTION

- A. Provide protective coverings to prevent physical damage or staining following installation for duration of Project.
- B. Protect surfaces from damage until date of Substantial Completion of the Work.

END OF SECTION 12 36 61.16

SECTION 12 50 00 – FURNITURE PACKAGE**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Furniture and equipment

1.2 PREINSTALLATION MEETINGS**A. Preinstallation Conference: Conduct conference at Project site.**

1. Review methods and procedures related to furniture installation including, but not limited to, the following:
 - a. Review delivery, storage, and handling procedures
 - b. Identify space for furniture installation staging area
 - c. Clarify if manufacturer's delivery/installation staff will be placing furniture in specified rooms
 - d. Review finishes for all furniture items.

1.3 ACTION SUBMITTALS**A. Product Data: For each type of product.**

1. Include manufacturer's written data on physical characteristics and durability.

B. Shop Drawings: Show furniture, finishes, quantities, locations of each furniture item.**C. Samples: For each furniture, provide respective finishes.****D. Product Schedule: Use same designations indicated on Drawings and furniture package.****E. Sustainable Design Submittals:**

1. Refer to Section 01 81 13 - Sustainable Design Requirements

1.4 INFORMATIONAL SUBMITTALS**A. Qualification Data: For Installer.****B. Sample Warranty: Manufacturer's standard warranty**

1.5 CLOSEOUT SUBMITTALS

- A. Maintenance Data: For furniture include maintenance manuals. Include the following:
 - 1. Methods for maintaining furniture, including cleaning and manufacturer's recommended maintenance schedule.

1.6 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match furniture installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Furniture: Provide 5 percent of amount installed for each type indicated.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Fabricator of products.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver furniture in factory packages, marked with manufacturer and product name. Install furniture on project site at designated staging area; coordinate with Client and Contractor for furniture staging area. Deliver furniture to specified locations as indicated on Drawings in furniture package; coordinate final locations with Client. and location of installation using same designations indicated on Drawings.

1.9 FIELD CONDITIONS

- A. Environmental Limitations: Do not install furniture until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1.10 WARRANTY

- A. Special Warranty for Furniture: Manufacturer agrees to repair or replace components or whole furniture that fail in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, the following:
 - a. Dimensional instability
 - b. Cracking
 - c. Delamination
- B. Warranty Period: Manufacturer's standard warranty from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Basis of Design: As indicated in furniture schedule.
- B. Approved Equal by Architect.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Examine areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FURNITURE INSTALLATION

- A. Install furniture level, plumb, and aligned according to manufacturer's written instructions.
- B. Furniture Locations: As designated in Drawings.









3.3 ADJUSTING

- A. Adjust and balance furniture to operate smoothly, easily, safely, and free from binding or malfunction throughout the entire operational range.











3.4 CLEANING AND PROTECTION






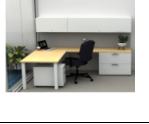



- A. Clean furniture, after installation, according to manufacturer's written instructions.
- B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that the furniture are without damage or deterioration at time of Substantial Completion.
- C. Replace damaged furniture that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

END OF SECTION 12 50 00

EMS Addition Furniture Specification										6/25/2024			
Item Label	Furniture Image	Manufacturer	Model	Model Number	Description	Dimensions	Fabric / Finish	Room	Total Counts	Level 2	Level 3	Level 4	
Accessory													
AC01		Erg International	Drake	DRPD	Mobile Podium with Modesty, Locking Casters, PVC Edgeband	28"W x 18"D x 28"H	Top: Formica Brite White 459-58 Base - Brushed Aluminum Casters - Black Locking	Classrooms	17	5	6	6	
Chair													
CH1.1		VIA	Brisbane HD Mid Back with Large Seat C	1603-67C-SS-FT-39A 6-18BB-165CG-BALL 1-9GA-GR1	With ergonomic enhancement - #67 Quick Adjust Advanced Synchro Control Mech #55-FT - Seat depth adjustment & ergonomic forward tilt #39A - Black roll back arms #18BB - Black Nylon 5-Star Swivel Base #165CG - Two-toned black and grey soft rubber tread all floor casters #BALL1 - Ballistic Brisbane Nylon		9FA - Fabric Textile - Momentum Hue Black (Grade 1) Base- black nylon 5-star swivel base #18BB	Workstations, Offices	146	23	71	52	
CH03		OFS	Harpin Mid Back Chair	85115-M	Molded plastic one-piece shell, Swivel base, black hard casters for use on carpet, armless	18.75"Wx34.75"Hx21.5"D	Seat - Graphite Plastic Shell (GRPH) Base - Polished Aluminum (PAL) Caster - Black Hard casters - std (W48)	EMS Staff	4	4	0	0	
CH04		OFS	Harpin Mid Back Chair	85138-M	Molded plastic one-piece shell, 4 leg with casters for use on carpet, armless	18.75"Wx34.75"Hx21.5"D	Seat - Graphite Plastic Shell (GRPH) Seat Upholstery - Modena Ecosense Graphite Base - Polished Aluminum (PAL) Caster - Black Hard casters - std (W48)	Classroom Seating	742	218	242	282	
CH05		Emeco	Broom Stacking Chair	FBROOMDARKGREY	Polypropylene chair	19" W x 19.5" D x 32.5" H	Propylene shell - Dark Grey	Simulation Apartment	2	2	0	0	
Lounge Seating													
LS03		Keilhauer	Meander	56033+56000+56032	Fully Upholstered Sofa with PC01 Onyx powdercoat base.	131.5" x 33.75" x 27.5"	Upholstery - Maharam, Beck; 466570-002 Molecule Legs - PC01 Onyx	Simulation Apartment	2	2	0	0	
Markerboard													
MB01		Claridge. Alternates will be accepted	MB S-Deluxe	C-LCS2044R	LCS3 Porcelain Dry Erase Whiteboards Aluminum Trim MT/MR	48" x 48"	LCS3-217-M #100 White Chalk Tray - Flat Tray Trim Finish - Clear Anodized	Private Office, Typical	16	4	9	3	
MB02		Claridge. Alternates will be accepted	MB S-Deluxe	C-LCS2048R	LCS3 Porcelain Dry Erase Whiteboards Aluminum Trim MT/MR	48 x 96"	LCS3-217-M #100 White Chalk Tray - Flat Tray Trim Finish - Clear Anodized	Training Room Typical	25	7	7	11	
MB03 (NOT IN SCOPE)						60"x 96"		Large Classrooms	16	5	6	5	

FURNITURE SPECIFICATION EMS ADDITION

Item Label	Furniture Image	Manufacturer	Model	Model Number	Description	Dimensions	Fabric / Finish	Room	Total Counts	Level 2	Level 3	Level 4
Storage												
SG2.1		AIS	L Series Lateral File	S-LATJJ2D30 / W-WSL230JJ	Universal lateral file; (3) 2-drawer 30" wide files w/ (1) common top at 90"w	3H x 30"W	Base - Metal with Satin White Paint; Pulls - rectangular Top - Midwest Maple	Open Offices	3	1	2	0
Stool												
ST01		Emeco	111 Navy Barstool	HCEM-N1S2	111 Navy Barstool	17" x 18.5" x 43" H (SH30")	TBD	Corridor, Simulation	27	21	3	3
Table												
TB02.1		AIS	Day to Day Table	T-RCR488429ATG	AIS Day to Day rectangle table with metal base w/ 2 grommets	84" x 48" x 29"	Top - Midwest Maple Base - white matte Grommet - White	Breakout Rooms	4	0	0	4
TB02.2		AIS	Day to Day Table	T-RCR489629ATG	AIS Day to Day rectangle table with metal base w/ 2 grommets	96" x 48" x 29"	Top - Midwest Maple Base - white matte Grommet - White	Conference Rooms	3	1	1	1
TB4.1		AIS	Day to Day Table	T-RDR3629SXG	AIS Day to Day Round table with metal X base	42" round x 29"H	Top - Midwest Maple Base - white matte	EMS Staff 103	1	1	0	0
TB4.3		AIS	Day to Day Table	T-RDR3629SXG	AIS Day to Day Round table with metal X base	36" round x 29"H	Top - Midwest Maple Base - white matte	Offices	1	1	0	0
TB4.4		AIS	Day to Day Table	T-RDR3624SXG	AIS Day to Day Round table with metal X base	36" round x 42H	Top - Midwest Maple Base - white matte	Corridors, Simulation Bar	6	4	1	1
TB4.5		AIS	Day to Day Table	T-RDR3624SXG	AIS Day to Day Round table with metal X base	24" round x 29"H	Top - Midwest Maple Base - white matte	Simulation Apartment	1	1	0	0
TB6.1		AIS	Day to Day Table	T-RCR246029ATC	AIS Day to Day rectangle table with metal base on casters - 24" deep	60"L x 24"D x 29"H	Top - Midwest Maple Base - Metallic Silver	Classrooms	348	102	112	134
TB6.3		AIS	Day to Day Table	T-RCR306029SCC / T-MOD60 / A-ROK / E-ADTCW	AIS Day to Day Rectangle table, metal base on casters, modesty panel, spin out pencil drawer, clamp mount power 2/Out 2/USB	60"L x 30"D x 29"H	Top - Midwest Maple Base - Metallic Silver	Guardshack	2	2	0	0

Item Label	Furniture Image	Manufacturer	Model	Model Number	Description	Dimensions	Fabric / Finish	Room	Total Counts	Level 2	Level 3	Level 4
TB09		OFS	Kosa	KS-19RD20H	End Table	19"DIA x 20" H	Top - Solid Surface Quartz Modern White Base - Bone White	Simulation Apartment	2	1	1	0
Private Office												
OFA		AIS Magnuson	Calibrate, Univrsal, L Series, Day to Day Tables, DS-Series		U-Shape Desk w/ wire management, (1) Grommet Overhead Storage, Tackboard & Task Light Lateral File & Mobile BF Manuson Group DS Series Wall Racks	Varies	Metal Door Overhead Paint - White Surfaces & Modesty Laminate - Midwest Maple Grommet - White Table Base & Legs - Paint White Tackboard Fabric - Engage Rain Cloud Wall Racks - Lunar White	Private Offices	3	1	2	0
OFC		AIS Magnuson	Calibrate, Univrsal, L Series, Day to Day Tables, DS-Series		L-Shape Desk w/ wire management, (1) Grommet Overhead Storage, Tackboard & Task Light Mobile BF Magnuson Group DS Series Wall Racks	Varies	Metal Door Overhead Paint - White Surfaces & Modesty Laminate - Midwest Maple Grommet - White Table Base & Legs - Paint White Tackboard Fabric - Engage Rain Cloud Wall Racks - Lunar White	Private Offices	3	1	1	1
OFE		AIS Magnuson	Calibrate, Univrsal, L Series, Day to Day Tables, DS-Series		U-Shape Desk w/ wire management, (1) Grommet Overhead Storage, Tackboard & Task Light Lateral File & Mobile BF	Varies	Metal Door Overhead Paint - White Surfaces & Modesty Laminate - Midwest Maple Grommet - White Table Base & Legs - Paint White Tackboard Fabric - Engage Rain Cloud	Private Offices	1	0	1	0
OFF		AIS Magnuson	Calibrate, Univrsal, L Series, Day to Day Tables, DS-Series		L-Shape Desk w/ wire management, (1) Grommet Overhead Storage, Tackboard & Task Light Lateral File & Mobile BF	Varies	Metal Door Overhead Paint - White Surfaces & Modesty Laminate - Midwest Maple Grommet - White Table Base & Legs - Paint White Tackboard Fabric - Engage Rain Cloud	Private Offices	2	0	2	0
OFI		AIS Magnuson	Calibrate, Univrsal, L Series, Day to Day Tables, DS-Series		L-Shape Desk w/ wire management, (1) Grommet Overhead Storage, Tackboard & Task Light Lateral File & Mobile BF	Varies	Metal Door Overhead Paint - White Surfaces & Modesty Laminate - Midwest Maple Grommet - White Table Base & Legs - Paint White Tackboard Fabric - Engage Rain Cloud	Private Offices	5	0	3	2
Workstation												
WSA		AIS	Oxygen Benching		Double Sided 4-Pack Cluster Straight Leg Base (4) Mobile BF24"D Access Boxes for Hardwired Chicago Code Power Center Spline Screen	OA - 60"D x 144"W Each 30"Dx72"W	Laminate: Midwest Maple Paint Metal: White Fabric: Engage Rain Cloud	Open Offices	20	6	11	3
WSC		AIS	Oxygen Benching		Single Sided 2-Pack Cluster Straight Leg Base (2) Mobile BF24"D Access Boxes for Hardwired Chicago Code Power Center Spline Screen	OA - 60"D x 144"W Each 30"Dx72"W	Laminate: Midwest Maple Paint Metal: White Fabric: Engage Rain Cloud	Open Offices	3	3	0	0
WSD		AIS	Oxygen Benching		Double Sided 2-Pack Cluster Straight Leg Base (2) Mobile BF24"D Access Boxes for Hardwired Chicago Code Power Center Spline Screen	OA - 60"D x 72"W Each 30"Dx72"W	Laminate: Midwest Maple Paint Metal: White Fabric: Engage Rain Cloud	Open Offices	11	3	5	3

SECTION 14 21 23.16 - MACHINE ROOM-LESS ELECTRIC TRACTION PASSENGER ELEVATORS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Machine-room-less electric traction passenger elevators.

1.3 DEFINITIONS

- A. Definitions in ASME A17.1/CSA B44 apply to work of this Section.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include capacities, sizes, performances, operations, safety features, finishes, and similar information.
 - 2. Include Product Data for car enclosures, hoistway entrances, and operation, control, and signal systems.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and large-scale details indicating service at each landing, coordination with building structure, relationships with other construction, and locations of equipment.
 - 2. Include large-scale layout of car-control station.
 - 3. Indicate maximum dynamic and static loads imposed on building structure at points of support, and maximum and average power demands.
 - 4. Vibration/noise transmissibility characteristics, including both mechanical and electrical, for all power transmission components and the method of elimination/ attenuation of all potential vibration/noise transmission.
 - 5. Power Data
- C. Sustainable Design Requirements
 - 1. Refer to Section 01 81 13 – Sustainable Design Requirements

- D. Samples for Initial Selection: For each type of exposed finish involving color or finish selection.
- E. Samples for Verification: For exposed car, hoistway door and frame, and signal equipment finishes; 3-inch- (75-mm-) square Samples of sheet materials; and 4-inch (100-mm) lengths of running trim members.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer.
- B. Manufacturer Certificates: Signed by elevator manufacturer certifying that hoistway and pit layout and dimensions, as indicated on Drawings, and electrical service, as shown and specified, are adequate for elevator system being provided.
- C. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For elevators to include in emergency, operation, and maintenance manuals.
 - 1. Submit manufacturer's or Installer's standard operation and maintenance manual, according to ASME A17.1/CSA B44 including diagnostic and repair information available to manufacturer's and Installer's maintenance personnel.
- B. Inspection and Acceptance Certificates and Operating Permits: As required by authorities having jurisdiction for normal, unrestricted elevator use.
- C. Continuing Maintenance Proposal: Submit a continuing maintenance proposal from Installer to Owner, in the form of a standard one-year maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.
- D. Final Shop Drawings: Contractor shall provide complete electronic sets of "AS INSTALLED" drawings. All changes shall be revised on the manufacturer's drawings. No hand written changes will be accepted.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: Elevator manufacturer or an authorized representative who is trained and approved by manufacturer.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials, components, and equipment in manufacturer's protective packaging. Store materials, components, and equipment off of ground, under cover, and in a dry location.

1.9 COORDINATION

- A. Coordinate installation of inserts, sleeves, block outs, elevator equipment with integral anchors, and other items that are embedded in concrete or masonry for elevator equipment. Furnish templates, inserts, sleeves, elevator equipment with integral anchors, and installation instructions and deliver to Project site in time for installation.
- B. Coordinate locations and dimensions of work specified in other Sections that relates to electric traction elevators including pit ladders; entrance subsills; electrical service; and electrical outlets, lights, and switches in hoistways and pits.

1.10 WARRANTY

- A. Manufacturer's Special Warranty: Manufacturer agrees to repair, restore, or replace elevator work that fails in materials or workmanship within specified warranty period.
 - 1. Failures include, but are not limited to, operation or control system failure, including excessive malfunctions; performances below specified ratings; excessive wear; unusual deterioration or aging of materials or finishes; unsafe conditions; need for excessive maintenance; abnormal noise or vibration; and similar unusual, unexpected, and unsatisfactory conditions.
 - 2. Warranty Period: 1 year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Basis of Design:
 - a. Otis Elevator Co., Gen3 Edge
 - 2. KONE Inc.
 - 3. Schindler Elevator Corp.
 - 4. TK Elevator.

2.2 PERFORMANCE REQUIREMENTS

- A. Regulatory Requirements:
 - 1. Comply with ASME A17.1/CSA B44.
 - 2. Chicago Building Code.
 - 3. Chicago Electrical Code.
 - 4. Chicago Fire Department.
 - 5. NFPA 70 - National Electrical Code.
 - 6. NEMA - National Electrical Manufacturers Association.
 - 7. NFPA 101 - Life Safety Code.
- B. Accessibility Requirements:

1. Comply with requirements for accessible elevators in the United States Access Board's ADA-ABA Accessibility Guidelines and with ICC A117.1.
2. Illinois Accessibility Code.
3. Chicago Building Code.

2.3 ELEVATORS

- A. Elevator System, General: Manufacturer's standard elevator systems. Unless otherwise indicated, manufacturer's standard components shall be used, as included in standard elevator systems and as required for complete system.
- B. Elevator Description:
 1. Elevator Number(s): 1.
 2. Rated Load: 3500 lb (1589 kg).
 3. Rated Speed: 150 fpm (0.75 m/s).
 4. Operation System: Selective-collective automatic operation.
 5. Auxiliary Operations:
 - a. Battery-powered automatic evacuation.
 - b. Automatic dispatching of loaded car.
 - c. Nuisance-call cancel.
 - d. Loaded-car bypass.
 6. Dual Car-Control Stations: Provide two car-control stations; equip only one with required keyswitches if any.
 7. Car Enclosures:
 - a. Inside Width: Not less than 6'-6" from side wall to side wall.
 - b. Inside Depth: Not less than 5'-6" from back wall to front wall (return panels).
 - c. Inside Height: Not less than 7'-6" to underside of ceiling.
 - d. Front Walls (Return Panels): Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
 - e. Car Fixtures: Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
 - f. Side and Rear Wall Panels: Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
 - g. Reveals: Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
 - h. Door Faces (Interior): Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
 - i. Door Sills: Aluminum.
 - j. Ceiling: Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 or Gr.220D.
 - k. Handrails: 1-1/4 inches round satin stainless steel, at sides and rear of car.
 - l. Floor prepared to receive resilient flooring (specified in Section 096519 "Resilient Tile Flooring").
 - m. Wall pin studs for removable protection curtain. No grommets.
 8. Hoistway Entrances:

- a. Width: 42 inches (1067 mm).
 - b. Height: 84 inches (2134 mm).
 - c. Type: Single-speed side sliding.
 - d. Frames: Stainless steel, Gr.220D.
 - e. Doors: Satin stainless steel, ASTM A480/480M, No. 4 or 441 Gr.220D.
 - f. Sills: Aluminum.
9. Hall Fixtures: Satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
10. Additional Requirements:
- a. Provide inspection certificate in each car, mounted under acrylic cover with frame made from satin stainless steel, ASTM A480/480M, No. 4 finish or 441 Gr.220D.
 - b. Provide hooks for protective pads in all cars and one complete set(s) of full-height protective pads.

2.4 TRACTION SYSTEMS

- A. Elevator Machines: Permanent magnet, variable-voltage, variable-frequency, ac-type hoisting machines and solid-state power converters.
1. Provide nonregenerative system.
 2. Provide line filters or chokes to prevent electrical peaks or spikes from feeding back into building power system.
- B. Inserts: Furnish required concrete and masonry inserts and similar anchorage devices for installing guide rails, machinery, and other components of elevator work. Device installation is specified in another Section.
- C. Car Frame and Platform: Bolted- or welded-steel units.
- D. Guides: Roller guides or polymer-coated, nonlubricated sliding guides. Provide guides at top and bottom of car and counterweight frames.

2.5 OPERATION SYSTEMS

- A. Provide manufacturer's standard microprocessor operation systems as required to provide type of operation indicated.
- B. Auxiliary Operations:
1. Single-Car Battery-Powered Automatic Evacuation: If power fails and car is at a floor, it remains at that floor, opens its doors, and shuts down. If car is between floors, it moves to the next floor above or below, opens its doors, and shuts down. System includes rechargeable battery and automatic recharging system.
 2. Automatic Dispatching of Loaded Car: When car load exceeds 80 percent of rated capacity, doors begin closing.

3. Nuisance-Call Cancel: When car calls exceed a preset number while car load is less than a predetermined weight, all car calls are canceled. Preset number of calls and predetermined weight can be adjusted.
 4. Automatic Operation of Lights and Fan: When elevator is stopped and unoccupied with doors closed, lighting, ventilation fan, and cab displays are de-energized after five minutes and are re-energized before car doors open.
- C. Security features shall not affect emergency firefighters' service.
1. Keyswitch Operation: Push buttons are activated and deactivated by security keyswitches at car-control stations. Key is removable in either position.
 2. Car-to-Lobby Feature: Feature, activated by keyswitch at main lobby, that causes cart return immediately to lobby and open doors for inspection. On deactivation by keyswitch, calls registered before keyswitch activation are completed and normal operation is resumed.

2.6 DOOR REOPENING DEVICES

- A. Infrared Array: Provide door reopening device with uniform array of 36 or more microprocessor-controlled, infrared light beams projecting across car entrance. Interruption of one or more light beams shall cause doors to stop and reopen.
- B. Nudging Feature: After car doors are prevented from closing for predetermined adjustable time, through activating door reopening device, a loud buzzer shall sound and doors shall begin to close at reduced kinetic energy.

2.7 CAR ENCLOSURES

- A. Provide enameled or powder-coated steel car enclosures to receive nonremovable wall panels, with removable car roof, access doors, power door operators, and ventilation.
 1. Provide standard railings complying with ASME A17.1/CSA B44 on car tops where required by ASME A17.1/CSA B44.
- B. Materials and Finishes: Manufacturer's standards, but not less than the following:
 1. Subfloor:
 - a. Exterior, C-C Plugged grade plywood, not less than 7/8-inch (22.2-mm) nominal thickness.
 2. Floor Finish:
 - a. Specified in Section 096519 "Resilient Tile Flooring".
 3. Stainless Steel Wall Panels: Flush, formed-metal construction; fabricated from stainless steel sheet.
 4. Fabricate car with recesses and cutouts for signal equipment.
 5. Fabricate car door frame integrally with front wall of car.

6. Stainless Steel Doors: Flush, hollow-metal construction; fabricated from stainless steel sheet.
7. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.
8. Luminous Ceiling: Fluorescent light fixtures and ceiling panels of translucent acrylic or other permanent rigid plastic.
9. Metal Ceiling: Flush panels, with LED downlights. Align ceiling panel joints with joints between wall panels.
10. Light Fixture Efficiency: Not less than 35 lumens/W.
11. Ventilation Fan Efficiency: Not less than 3.0 cfm/W (1.4 L/s per W).
12. Pad and Pad Hooks: Provide stainless steel pad hooks on all walls. Pad hooks shall be through bolted to cab walls. Pad hook and mounting stud shall be one piece. Provide four-section fire retardant pad with metal grommet holes for the pad hooks fastening. Mark on backside of pads left, right, front return, and rear return accordingly as fit.

2.8 HOISTWAY ENTRANCES

- A. Hoistway Entrance Assemblies: Manufacturer's standard horizontal-sliding, door-and-frame hoistway entrances complete with track systems, hardware, sills, and accessories. Frame size and profile shall accommodate hoistway wall construction.
 1. Where gypsum board wall construction is indicated, frames shall be self-supporting with reinforced head sections.
- B. Fire-Rated Hoistway Entrance Assemblies: Door and frame assemblies shall comply with NFPA 80 and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction based on testing at as close-to-neutral pressure as possible according to NFPA 252 .
 1. Fire-Protection Rating: 2 hour
- C. Materials and Fabrication: Manufacturer's standards, but not less than the following:
 1. Stainless Steel Frames: Formed from stainless steel sheet.
 2. Stainless Steel Doors and Transoms: Flush, hollow-metal construction; fabricated from stainless steel sheet.
 3. Sight Guards: Provide sight guards on doors matching door edges.
 4. Sills: Extruded or machined metal, with grooved surface, 1/4 inch (6.4 mm) thick.

2.9 SIGNAL EQUIPMENT

- A. Provide hall-call and car-call buttons that light when activated and remain lit until call has been fulfilled. Provide buttons and lighted elements illuminated with LEDs.
- B. Car-Control Stations: Provide manufacturer's standard recessed car-control stations. Mount in return panel adjacent to car door unless otherwise indicated.
 1. Mark buttons and switches for required use or function. Use both tactile symbols and Braille.

2. Provide "No Smoking" sign matching car-control station, either integral with car-control station or mounted adjacent to it, with text and graphics as required by authorities having jurisdiction.
- C. Emergency Communication System: Two-way voice communication system, with visible signal, which dials preprogrammed number of monitoring station and does not require handset use. System is contained in flush-mounted cabinet, with identification, instructions for use, and battery backup power supply.
- D. Firefighters' Two-Way Telephone Communication Service: Provide flush-mounted cabinet in each car and required conductors in traveling cable for firefighters' two-way telephone communication service.
- E. Car Position Indicator: Provide digital-type car position indicator, located above car door or above car-control station. Also, provide audible signal to indicate to passengers that car is either stopping at or passing each of the floors served. Include travel direction arrows if not provided in car-control station.
- F. Hall Push-Button Stations: Provide one hall push-button station at each landing.
 1. Provide manufacturer's standard wall-mounted units.
 2. Equip units with buttons for calling elevator and for indicating desired direction of travel.
- G. Hall Lanterns: Units with illuminated arrows; but provide single arrow at terminal landings. Provide one of the following:
 1. Manufacturer's standard wall-mounted units, for mounting above entrance frames.
- H. Hall Annunciator: With each hall lantern, provide audible signals indicating car arrival and direction of travel. Signals sound once for up and twice for down.
- I. Hall Position Indicators: Provide illuminated, digital-display-type position indicators, located above each hoistway entrance at ground floor. Provide units with flat faceplate and with body of unit recessed in wall.
- J. Standby Power Elevator Selector Switches: Provide switches, as required by ASME A17.1/CSA B44, where indicated. Adjacent to switches, provide illuminated signal that indicates when normal power supply has failed. Emergency Pictorial Signs: Fabricate from materials matching hall push-button stations, with text and graphics as required by authorities having jurisdiction, indicating that in case of fire, elevators are out of service and exits should be used instead. Provide one sign at each hall push-button station unless otherwise indicated.

2.10 FINISH MATERIALS

- A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, commercial steel, Type B, exposed, matte finish.

- B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, commercial steel, Type B, pickled.
- C. Stainless Steel Sheet: ASTM A240/A240M, Type 304 or 441.
- D. Stainless Steel Tubing: ASTM A554, Grade MT 304.
- E. Aluminum Extrusions: ASTM B221 (ASTM B221M), Alloy 6063.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elevator areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work. Examine hoistways, hoistway openings, and pits as constructed; verify critical dimensions; and examine supporting structure and other conditions under which elevator work is to be installed.
- B. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Comply with manufacturer's written instructions.
- B. Welded Construction: Provide welded connections for installing elevator work where bolted connections are not required for subsequent removal or for normal operation, adjustment, inspection, maintenance, and replacement of worn parts. Comply with AWS standards for workmanship and for qualifications of welding operators.
- C. Sound Isolation: Mount rotating and vibrating equipment on vibration-isolating mounts to minimize vibration transmission to structure and structure-borne noise due to elevator system.
- D. Lubricate operating parts of systems, including ropes, as recommended by manufacturers.
- E. Alignment: Coordinate installation of hoistway entrances with installation of elevator guide rails for accurate alignment of entrances with car. Where possible, delay final adjustment of sills and doors until car is operable in shaft. Reduce clearances to minimum, safe, workable dimension at each landing.
- F. Leveling Tolerance: 1/8 inch (3 mm), up or down, regardless of load and travel direction.
- G. Set sills flush with finished floor surface at landing. Fill space under sill solidly with nonshrink, nonmetallic grout.

- H. Locate hall signal equipment for elevators as follows unless otherwise indicated:
 - 1. Place hall lanterns above each hoistway entrance.
 - 2. Mount hall lanterns at a minimum of 72 inches (1829 mm) above finished floor.

3.3 FIELD QUALITY CONTROL

- A. Acceptance Testing: On completion of elevator installation and before permitting elevator use (either temporary or permanent), perform acceptance tests as required and recommended by ASME A17.1/CSA B44 and by governing regulations and agencies.
- B. Advise Owner, Architect, and authorities having jurisdiction in advance of dates and times that tests are to be performed on elevators.

3.4 PROTECTION

3.5 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to operate, adjust, and maintain elevator(s).
- B. Check operation of elevator with Owner's personnel present before date of Substantial Completion and again not more than one month before end of warranty period. Determine that operation systems and devices are functioning properly.

3.6 MAINTENANCE SERVICE

- A. Initial Maintenance Service: Beginning at Substantial Completion, maintenance service shall include 12 months' full maintenance by skilled employees of elevator Installer. Include monthly preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper elevator operation at rated speed and capacity. Parts and supplies shall be manufacturer's authorized replacement parts and supplies.
 - 1. Include 24-hour-per-day, 7-day-per-week emergency callback service with response time of two hours or less.

END OF SECTION 14 21 23.16

SECTION 21 0517 - SLEEVES AND SLEEVE SEALS FOR FIRE-SUPPRESSION PIPING**PART 1 -GENERAL****1.01 SUMMARY**

- A. Section Includes:
1. Sleeves without waterstop.
 2. Sleeves with waterstop.
 3. Stack-sleeve fittings.
 4. Sleeve-seal systems.
 5. Grout.
 6. Silicone sealants.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.03 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 -PRODUCTS**2.01 SLEEVES WITHOUT WATERSTOP**

- A. Cast-Iron Pipe Sleeves: Cast or fabricated of cast or ductile iron and equivalent to ductile-iron pressure pipe, with plain ends.
- B. Steel Pipe Sleeves: ASTM A53/A53M, Type E, Grade B, Schedule 40, hot-dip galvanized, with plain ends.
- C. Steel Sheet Sleeves: ASTM A653/A653M, 0.0239-inch minimum thickness; hot-dip galvanized, round tube closed with welded longitudinal joint.
- D. PVC Pipe Sleeves: ASTM D1785, Schedule 40.
- E. Molded-PVC Sleeves: With nailing flange for attaching to wooden forms.
- F. Molded-PE or -PP Sleeves: Removable, tapered-cup shaped, and smooth outer surface with nailing flange for attaching to wooden forms.

2.02 SLEEVES WITH WATERSTOP

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Advance Products & Systems, LLC.
 2. CALPICO, Inc.
 3. GPT; an EnPro Industries company.
 4. Metraflex Company (The).

- B. Description: Manufactured PVC/HDPE steel stainless steel galvanized steel, sleeve-type, waterstop assembly made for imbedding in concrete slab or wall.

2.03 STACK-SLEEVE FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Jay R. Smith Mfg Co; a division of Morris Group International.
 2. Wade; a subsidiary of McWane Inc.
 3. Zurn Industries, LLC.
- B. Description: Manufactured, Dura-coated or Duco-coated galvanized cast-iron sleeve with integral clamping flange for use in waterproof floors and roofs. Include clamping ring, bolts, and nuts for membrane flashing.
 1. Underdeck Clamp: Clamping ring with setscrews.

2.04 SLEEVE-SEAL SYSTEMS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Advance Products & Systems, LLC.
 2. CALPICO, Inc.
 3. GPT; an EnPro Industries company.
 4. Metraflex Company (The).
 5. Proco Products, Inc.
- B. Description: Modular sealing-element unit, designed for field assembly, for filling annular space between piping and sleeve.
 1. Designed to form a hydrostatic seal of 20 psig minimum.
 2. Sealing Elements: EPDM-rubber High-temperature-silicone Nitrile (Buna N) interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size.
 3. Pressure Plates: Carbon steel Composite plastic Stainless steel Stainless steel, Type 316.
 4. Connecting Bolts and Nuts: Carbon steel, with ASTM B633 coating Stainless steel Stainless steel, Type 316, of length required to secure pressure plates to sealing elements.

2.05 GROUT

- A. Description: Nonshrink, for interior and exterior sealing openings in non-fire-rated walls or floors.
- B. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
- C. Design Mix: 5000 psi, 28-day compressive strength.
- D. Packaging: Premixed and factory packaged.

2.06 SILICONE SEALANTS

- A. Silicone, S, NS, 25, NT: Single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant.

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. GE Construction Sealants; Momentive Performance Materials Inc.
 - b. Permathane®/Acryl-R®; ITW Polymers Sealants North America.
 - c. Polymeric Systems, Inc.
 - d. Sherwin-Williams Company (The).
 - e. Sika Corporation.
 - f. The Dow Chemical Company.
 - g. Tremco Incorporated.
 2. Standard: ASTM C920, Type S, Grade NS, Class 25, Use NT.
- B. Silicone, S, P, T, NT: Single-component, 25 100/50, pourable, plus 25 percent and minus 25 percent plus 100 percent and minus 50 percent movement capability, traffic- and nontraffic-use, neutral-curing silicone joint sealant.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Dow Chemical Company (The).
 - b. Pecora Corporation.
 - c. Sika Corporation.
 - d. Tremco Incorporated.
 2. Standard: ASTM C920, Type S, Grade P, Class 25 Class 100/50, Uses T and NT.
- C. Silicone Foam: Multicomponent, silicone-based liquid elastomers that, when mixed, expand and cure in place to produce a flexible, nonshrinking foam.
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Smooth-On.

PART 3 -EXECUTION

3.01 INSTALLATION OF SLEEVES - GENERAL

- A. Install sleeves for piping passing through penetrations in floors, partitions, roofs, and walls.
- B. For sleeves that will have sleeve-seal system installed, select sleeves of size large enough to provide at least 1-inch annular clear space between piping and concrete slabs and walls.
 1. Sleeves are not required for core-drilled holes.
- C. Install sleeves in concrete floors, concrete roof slabs, and concrete walls as new slabs and walls are constructed.
 1. Permanent sleeves are not required for holes in slabs formed by molded-PE or -PP sleeves.
 2. Cut sleeves to length for mounting flush with both surfaces.
 - a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
 3. Using grout or silicone sealant, seal space outside of sleeves in slabs and walls without sleeve-seal system.
- D. Install sleeves for pipes passing through interior partitions.
 1. Cut sleeves to length for mounting flush with both surfaces.
 2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth, and location of joint.

- E. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with fire- and smoke-stop materials. Comply with requirements for firestopping and fill materials specified in Section 07 8413 "Penetration Firestopping."

3.02 INSTALLATION OF SLEEVES WITH WATERSTOP

- A. Install sleeve with waterstop as new walls and slabs are constructed.
- B. Assemble fitting components of length to be flush with both surfaces of concrete slabs and walls. Position waterstop flange to be centered in concrete slab or wall.
- C. Secure nailing flanges to concrete forms.
- D. Using grout or silicone sealant, seal space around outside of sleeves.

3.03 INSTALLATION OF STACK-SLEEVE FITTINGS

- A. Install stack-sleeve fittings in new slabs as slabs are constructed.
 - 1. Install fittings that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
 - 2. Secure flashing between clamping flanges for pipes penetrating floors with membrane waterproofing. Comply with requirements for flashing specified in Section 07 6200 "Sheet Metal Flashing and Trim."
 - 3. Install section of cast-iron soil pipe to extend sleeve to 3 inches above finished floor level.
 - 4. Extend cast-iron sleeve fittings below floor slab as required to secure clamping ring if ring is specified.
 - 5. Using waterproof silicone sealant, seal space between top hub of stack-sleeve fitting and pipe.
- B. Fire-Resistance-Rated Penetrations, Horizontal Assembly Penetrations, and Smoke Barrier Penetrations: Maintain indicated fire or smoke rating of floors at pipe penetrations. Seal pipe penetrations with fire- or smoke-stop materials. Comply with requirements for firestopping specified in Section 07 8413 "Penetration Firestopping."

3.04 INSTALLATION OF SLEEVE-SEAL SYSTEMS

- A. Install sleeve-seal systems in sleeves in exterior concrete walls and slabs-on-grade at service piping entries into building, and passing through exterior walls.
- B. Select type, size, and number of sealing elements required for piping material and size and for sleeve ID or hole size. Position piping in center of sleeve. Center piping in penetration, assemble sleeve-seal system components, and install in annular space between piping and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make a watertight seal.

3.05 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After allowing for a full cure, test sleeves and sleeve seals for leaks. Repair leaks and retest until no leaks exist.
 - 2. Sleeves and sleeve seals will be considered defective if they do not pass tests and inspections.

- B. Prepare test and inspection reports.

3.06 SLEEVE SCHEDULE

- A. Use sleeves and sleeve seals for the following piping-penetration applications:
 - 1. Exterior Concrete Walls above and below Grade:
 - a. Sleeves with waterstops.
 - 1) Select sleeve size to allow for at least 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 2. Concrete Slabs-on-Grade:
 - a. Sleeves with waterstops.
 - 1) Select sleeve size to allow for at least 1-inch annular clear space between piping and sleeve for installing sleeve-seal system.
 - 3. Concrete Slabs above Grade:
 - a. Sleeves with waterstops or stack-sleeve fittings.
 - 4. Interior Walls and Partitions:
 - a. Sleeves without waterstops.

END OF SECTION 21 05 17

SECTION 21 0523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING**PART 1 -GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Two-piece ball valves with indicators.
 - 2. Iron butterfly valves with indicators.
 - 3. Check valves.
 - 4. Iron OS&Y gate valves.
 - 5. Trim and drain valves.

1.02 DEFINITIONS

- A. NRS: Nonrising stem.
- B. OS&Y: Outside screw and yoke.
- C. SBR: Styrene-butadiene rubber.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of valve.

1.04 DELIVERY, STORAGE, AND HANDLING

- A. Prepare valves for shipping as follows:
 - 1. Protect internal parts against rust and corrosion.
 - 2. Protect threads, flange faces, and weld ends.
 - 3. Set valves open to minimize exposure of functional surfaces.
- B. Use the following precautions during storage:
 - 1. Maintain valve end protection.
 - 2. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.
- C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.
- D. Protect flanges and specialties from moisture and dirt.

PART 2 -PRODUCTS**2.01 SOURCE LIMITATIONS**

- A. Obtain each type of valve from single manufacturer.

2.02 PERFORMANCE REQUIREMENTS

- A. UL Listed: Valves shall be listed in UL's "Online Certifications Directory" under the headings listed below and shall bear UL mark:
1. Fire Main Equipment: HAMV - Main Level.
 - a. Indicator Posts, Gate Valve: HCBZ - Level 1.
 - b. Ball Valves, System Control: HLUG - Level 3.
 - c. Butterfly Valves: HLXS - Level 3.
 - d. Check Valves: HMER - Level 3.
 - e. Gate Valves: HMRZ - Level 3.
 2. Sprinkler System and Water Spray System Devices: VDGT - Main Level.
 - a. Valves, Trim and Drain: VQGU - Level 1.
- B. FM Global Approved: Valves shall be listed in its "Approval Guide," under the headings listed below:
1. Automated Sprinkler Systems:
 - a. Indicator posts.
 - b. Valves.
 - 1) Gate valves.
 - 2) Check valves
 - 3) Miscellaneous valves.
- C. ASME Compliance:
1. ASME B1.20.1 for threads for threaded-end valves.
 2. ASME B16.1 for flanges on iron valves.
 3. ASME B31.9 for building services piping valves.
- D. AWWA Compliance: Comply with AWWA C606 for grooved-end connections.
- E. NFPA Compliance for valves:
1. Comply with NFPA 13, NFPA 14, NFPA 20, and NFPA 24.
- F. Valve Pressure Ratings: Not less than the minimum pressure rating indicated or higher, as required by system pressures.
- G. Valve Sizes: Same as upstream piping unless otherwise indicated.
- H. Valve Actuator Types:
1. Worm-gear actuator with handwheel for quarter-turn valves, except for trim and drain valves.
 2. Handwheel: For other than quarter-turn trim and drain valves.
 3. Handlever: For quarter-turn trim and drain valves NPS 2 and smaller.

2.03 TWO-PIECE BALL VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. Ames Fire & Waterworks; A WATTS Brand.
 2. NIBCO INC.
 3. Victaulic Company.
- B. Description:
1. UL 1091, except with ball instead of disc and FM Global approved for indicating valves (butterfly or ball type), Class Number 1112.
 2. Minimum Pressure Rating: 175 psig.
 3. Body Design: Two piece.

4. Body Material: Forged brass or bronze.
5. Port Size: Full or standard.
6. Seats: PTFE.
7. Stem: Bronze or stainless steel.
8. Ball: Chrome-plated brass.
9. Actuator: Worm gear
10. Supervisory Switch: Internal or external.
11. End Connections for Valves NPS 1 through NPS 2: Threaded ends.
12. End Connections for Valves NPS 2-1/2: Grooved ends.

2.04 IRON BUTTERFLY VALVES WITH INDICATORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ALEUM USA.
 2. Anvil International.
 3. Globe Fire Sprinkler Corporation.
 4. Kennedy Valve Company; a division of McWane, Inc.
 5. NIBCO INC.
 6. Tyco by Johnson Controls Company.
 7. Victaulic Company.
 8. Zurn Industries, LLC.
- B. Description:
1. Standard: UL 1091 and FM Global standard for indicating valves, (butterfly or ball type), Class Number 112.
 2. Minimum Pressure Rating: 175 psig.
 3. Body Material: Cast or ductile iron with nylon, EPDM, epoxy, or polyamide coating.
 4. Seat Material: EPDM.
 5. Stem: Stainless steel.
 6. Disc: Ductile iron, nickel plated and EPDM or SBR coated.
 7. Actuator: Worm gear.
 8. Supervisory Switch: Internal or external.
 9. Body Design: Lug or wafer Grooved-end connections.

2.05 CHECK VALVES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
1. ALEUM USA.
 2. Ames Fire & Waterworks; A WATTS Brand.
 3. Anvil International.
 4. FEBCO; A WATTS Brand.
 5. Fire Protection Products, Inc.
 6. Globe Fire Sprinkler Corporation.
 7. Kennedy Valve Company; a division of McWane, Inc.
 8. Matco-Norca.
 9. Mueller Co.
 10. NIBCO INC.
 11. Reliable Automatic Sprinkler Co., Inc. (The).
 12. Shurjoint; a part of Aalberts Integrated piping Systems.
 13. Tyco by Johnson Controls Company.
 14. United Brass Works, Inc.
 15. Venus Fire Protection Ltd.
 16. Victaulic Company.
 17. Viking Corporation.

18. WATTS.
19. Wilson & Cousins Inc.
20. Zurn Industries, LLC.

B. Description:

1. Standard: UL 312 and FM Global standard for swing check valves, Class Number 1210.
2. Minimum Pressure Rating: 175 psig.
3. Type: Single swing check.
4. Body Material: Cast iron, ductile iron, or bronze.
5. Clapper: Bronze, ductile iron, or stainless steel with elastomeric seal.
6. Clapper Seat: Brass, bronze, or stainless steel.
7. Hinge Shaft: Bronze or stainless steel.
8. Hinge Spring: Stainless steel.
9. End Connections: Flanged, grooved, or threaded.

2.06 IRON OS&Y GATE VALVES

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. American Cast Iron Pipe Company.
2. Clow Valve Company; a subsidiary of McWane, Inc.
3. Hammond Valve.
4. Kennedy Valve Company; a division of McWane, Inc.
5. Mueller Co.
6. NIBCO INC.
7. Victaulic Company.
8. WATTS.
9. Zurn Industries, LLC.

B. Description:

1. Standard: UL 262 and FM Global standard for fire-service water control valves (OS&Y- and NRS-type gate valves).
2. Minimum Pressure Rating: 175 psig.
3. Body and Bonnet Material: Cast or ductile iron.
4. Wedge: Cast or ductile iron, or bronze with elastomeric coating.
5. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.
6. Stem: Brass or bronze.
7. Packing: Non-asbestos PTFE.
8. Supervisory Switch: External.
9. End Connections: Flanged Grooved Threaded.

2.07 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Apollo Valves; a part of Aalberts Integrated Piping Systems.
 - b. Fire Protection Products, Inc.
 - c. Fire-End & Croker Corporation.
 - d. Flowserve Corporation.
 - e. FNW; Ferguson Enterprises, Inc.
 - f. Jomar Valve.
 - g. KITZ Corporation.
 - h. Legend Valve & Fitting, Inc.
 - i. Metso Automation USA Inc.

- j. Milwaukee Valve Company.
 - k. NIBCO INC.
 - l. Potter Roemer LLC; a Division of Morris Group International.
 - m. Red-White Valve Corp.
 - n. Tyco by Johnson Controls Company.
 - o. Victaulic Company.
 - p. WATTS.
 - q. Zurn Industries, LLC.
2. Description:
- a. Pressure Rating: 175 psig 250 psig 300 psig.
 - b. Body Design: Two piece.
 - c. Body Material: Forged brass or bronze.
 - d. Port size: Full or standard.
 - e. Seats: PTFE.
 - f. Stem: Bronze or stainless steel.
 - g. Ball: Chrome-plated brass.
 - h. Actuator: Handlever.
 - i. End Connections for Valves NPS 1 through NPS 2-1/2: Threaded ends.
 - j. End Connections for Valves NPS 1-1/4 and NPS 2-1/2: Grooved ends.
- B. Angle Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- a. Fire Protection Products, Inc.
 - b. NIBCO INC.
 - c. United Brass Works, Inc.
2. Description:
- a. Pressure Rating: 175 psig 250 psig 300 psig.
 - b. Body Material: Brass or bronze.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc: Bronze.
 - f. Packing: Asbestos free.
 - g. Handwheel: Malleable iron, bronze, or aluminum.
- C. Globe Valves:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- a. NIBCO INC.
 - b. United Brass Works, Inc.
2. Description:
- a. Pressure Rating: 175 psig 250 psig 300 psig.
 - b. Body Material: Bronze with integral seat and screw-in bonnet.
 - c. Ends: Threaded.
 - d. Stem: Bronze.
 - e. Disc Holder and Nut: Bronze.
 - f. Disc Seat: Nitrile.
 - g. Packing: Asbestos free.
 - h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 -EXECUTION**3.01 EXAMINATION**

- A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.
- B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
- C. Examine threads on valve and mating pipe for form and cleanliness.
- D. Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.
- E. Do not attempt to repair defective valves; replace with new valves.

3.02 INSTALLATION, GENERAL

- A. Comply with requirements in the following Sections for specific valve-installation requirements and applications:
 - 1. Section 21 1200 "Fire-Suppression Standpipes" for application of valves in fire-suppression standpipes.
 - 2. Section 21 1313 "Wet-Pipe Sprinkler Systems" for application of valves in wet-pipe, fire-suppression sprinkler systems.
- B. Install listed fire-protection shutoff valves supervised-open, located to control sources of water supply, except from fire-department connections. Install permanent identification signs, indicating portion of system controlled by each valve.
- C. Install double-check valve assembly in each fire-protection water-supply connection.
- D. Install valves having threaded connections with unions at each piece of equipment arranged to allow easy access, service, maintenance, and equipment removal without system shutdown. Provide separate support where necessary.
- E. Install valves in horizontal piping with stem at or above the pipe center.
- F. Install valves in position to allow full stem movement.
- G. Install valve tags. Comply with requirements in Section 21 0553 "Identification for Fire-Suppression Piping and Equipment" for valve tags and schedules and signs on surfaces concealing valves; and the NFPA standard applying to the piping system in which valves are installed. Install permanent identification signs indicating the portion of system controlled by each valve.

END OF SECTION 21 05 23

SECTION 21 0553 - IDENTIFICATION FOR FIRE-SUPPRESSION PIPING AND EQUIPMENT**PART 1 -GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Pipe labels.
 - 2. Stencils.
 - 3. Valve tags.

1.02 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Samples: For color, letter style, and graphic representation required for each identification material and device.
- C. Equipment-Label Schedule: Include a listing of all equipment to be labeled and the proposed content for each label.
- D. Valve-numbering scheme.
- E. Valve Schedules: Provide for fire-suppression piping system. Include in operation and maintenance manuals.

PART 2 -PRODUCTS**2.01 PIPE LABELS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Carlton Industries, LP.
 - 5. Champion America.
 - 6. Craftmark Pipe Markers.
 - 7. emedco.
 - 8. Kolbi Pipe Marker Co.
 - 9. LEM Products Inc.
 - 10. Marking Services Inc.
 - 11. Seton Identification Products; a Brady Corporation company.
- B. General Requirements for Manufactured Pipe Labels: Preprinted, color coded, with lettering indicating service and showing flow direction in accordance with ASME A13.1.
- C. Letter and Background Color: As indicated for specific application under Part 3.

- D. Pretensioned Pipe Labels: Precoiled, semirigid plastic formed to partially cover cover full circumference of pipe and to attach to pipe without fasteners or adhesive.
- E. Self-Adhesive Pipe Labels: Printed plastic with contact-type, permanent-adhesive backing.
- F. Pipe-Label Contents: Include identification of piping service using same designations or abbreviations as used on Drawings. Also include the following:
 - 1. Pipe size.
 - 2. Flow-Direction Arrows: Include flow-direction arrows on main distribution piping. Arrows may be either integral with label or applied separately.
 - 3. Lettering Size: At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.

2.02 STENCILS

- A. Stencils for Piping:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Brimar Industries, Inc.
 - b. Craftmark Pipe Markers.
 - c. Kolbi Pipe Marker Co.
 - d. Marking Services Inc.
 - 2. Lettering Size: Size letters in accordance with ASME A13.1 for piping At least 1/2 inch for viewing distances of up to 72 inches and proportionately larger lettering for greater viewing distances.
 - 3. Stencil Material: Aluminum, brass, or fiberboard.
 - 4. Stencil Paint: Exterior, gloss, alkyd enamel acrylic enamel. Paint may be in pressurized spray-can form.
 - 5. Identification Paint: Exterior, alkyd enamel acrylic enamel. Paint may be in pressurized spray-can form.
 - 6. Letter and Background Color: As indicated for specific application under Part 3.

2.03 VALVE TAGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Actioncraft Products, Inc.; a division of Industrial Test Equipment Co., Inc.
 - 2. Brady Corporation.
 - 3. Brimar Industries, Inc.
 - 4. Carlton Industries, LP.
 - 5. Champion America.
 - 6. Craftmark Pipe Markers.
 - 7. emedco.
 - 8. Kolbi Pipe Marker Co.
 - 9. LEM Products Inc.
 - 10. Marking Services Inc.
 - 11. Seton Identification Products; a Brady Corporation company.
- B. Description: Stamped or engraved with 1/4-inch letters for piping-system abbreviation and 1/2-inch numbers.
 - 1. Tag Material: Brass, 0.04 inch stainless steel, 0.024 inch aluminum, 0.031 inch or anodized aluminum, 0.031 inch thick, with predrilled or stamped holes for attachment hardware.
 - 2. Fasteners: Brass wire link chain beaded chain or S-hook.

- C. Letter and Background Color: As indicated for specific application under Part 3.
- D. Valve Schedules: For each piping system, on 8-1/2-by-11-inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal operating position (open, closed, or modulating), and variations for identification. Mark valves for emergency shutoff and similar special uses.
 - 1. Include valve-tag schedule in operation and maintenance data.

PART 3 -EXECUTION

3.01 PREPARATION

- A. Clean piping and equipment surfaces of incompatible primers, paints, and encapsulants, as well as dirt, oil, grease, release agents, and other substances that could impair bond of identification devices.

3.02 INSTALLATION GENERAL REQUIREMENTS

- A. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be installed.
- B. Coordinate installation of identifying devices with locations of access panels and doors.
- C. Install identifying devices before installing acoustical ceilings and similar concealment.
- D. Locate identifying devices so that they are readily visible from the point of normal approach.

3.03 INSTALLATION OF PIPE LABELS

- A. Piping Color Coding: Painting of piping is specified in Section 09 9123 "Interior Painting."
- B. direction with permanent adhesive on pipes.
- C. Stenciled Pipe-Label Option: Stenciled labels showing service and flow direction may be provided instead of manufactured pipe labels, at Installer's option. Install stenciled pipe labels, complying with ASME A13.1, with painted, color-coded bands or rectangles on each piping system.
 - 1. Identification Paint: Use for contrasting background.
 - 2. Stencil Paint: Use for pipe marking.
- D. Pipe-Label Locations: Locate pipe labels where piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:
 - 1. Within 3 ft. of each valve and control device.
 - 2. At access doors, manholes, and similar access points that permit a view of concealed piping.
 - 3. Within 3 ft. of equipment items and other points of origination and termination.
 - 4. Spaced at maximum intervals of 25 ft. along each run. Reduce intervals to 10 ft. in areas of congested piping and equipment.
- E. Flow- Direction Arrows: Provide arrows to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

- F. Fire-Suppression Pipe Label Color Schedule:
 - 1. Fire-Suppression Pipe Labels: White letters on an ANSI Z535.1 safety-red background.

3.04 INSTALLATION OF VALVE TAGS

- A. Install tags on valves and control devices in fire-suppression piping systems. List tagged valves in a valve-tag schedule in the operating and maintenance manual. Include the identification "FSV" on all fire-suppression system valve tags.
- B. Valve-Tag Application Schedule: Tag valves according to size, shape, and with captions similar to those indicated in "Valve-Tag Size and Shape" Subparagraph below.
 - 1. Valve-Tag Size and Shape:
 - a. Fire-Suppression Standpipe: 2 inches, square.
 - b. Wet-Pipe Sprinkler System: 2 inches, square
 - 2. Valve-Tag Color: White letters on an ANSI Z535.1 safety-red background.

END OF SECTION 21 05 53

SECTION 21 11 00 - FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes fire-suppression water-service piping and related components outside the building and service entrance piping through wall into the building and the following:
 - 1. Pipes, fittings, and specialties.
 - 2. Fire-suppression specialty valves.
 - 3. Protective enclosures.
 - 4. Alarm devices.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Shop Drawings

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: For piping and specialties including relation to other services in same area, drawn to scale. Show piping and specialty sizes and valves, meter and specialty locations, and elevations.
- B. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying the water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.

- C. Comply with FM Global's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
- D. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve supervision for fire-suppression water-service piping.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Preparation for Transport: Prepare valves, including fire hydrants, according to the following:
 - 1. Ensure that valves are dry and internally protected against rust and corrosion.
 - 2. Protect valves against damage to threaded ends and flange faces.
 - 3. Set valves in best position for handling. Set valves closed to prevent rattling.
- B. During Storage: Use precautions for valves according to the following:
 - 1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.
 - 2. Protect from weather. Store indoors and maintain temperature higher than ambient dew point temperature. Support off the ground or pavement in watertight enclosures when outdoor storage is necessary.
- C. Handling: Use sling to handle valves if size requires handling by crane or lift. Rig valves to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.
- D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.
- E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.
- F. Protect flanges, fittings, and specialties from moisture and dirt.
- G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.7 PROJECT CONDITIONS

- A. Interruption of Existing Fire-Suppression Water-Service Piping: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary water-distribution service according to requirements indicated:
 - 1. Notify Construction Manager and Owner no fewer than two weeks in advance of proposed interruption of service.
 - 2. Do not proceed with interruption of service without Construction Manager's written permission.

PART 2 - PRODUCTS

2.1 DUCTILE-IRON PIPE AND FITTINGS

- A. Grooved-Joint, Ductile-Iron Pipe: AWWA C151, with cut, rounded-grooved ends.
- B. Mechanical-Joint, Ductile-Iron Pipe: AWWA C151, with mechanical-joint bell and plain spigot end.
- C. Push-on-Joint, Ductile-Iron Pipe: AWWA C151, with push-on-joint bell and plain spigot end.
- D. Grooved-End, Ductile-Iron Pipe Appurtenances:
 - 1. Grooved-End, Ductile-Iron Fittings: ASTM A47/A47M, malleable-iron castings or ASTM A536, ductile-iron castings with dimensions matching pipe.
 - 2. Grooved-End, Ductile-Iron-Piping Couplings: AWWA C606, for ductile-iron-pipe dimensions. Include ferrous housing sections, gasket suitable for water, and bolts and nuts.
- E. Mechanical-Joint, Ductile-Iron Fittings: AWWA C110, ductile- or gray-iron standard pattern or AWWA C153, ductile-iron compact pattern.
 - 1. Glands, Gaskets, and Bolts: AWWA C111, ductile- or gray-iron glands, rubber gaskets, and steel bolts.
- F. Push-on-Joint, Ductile-Iron Fittings: AWWA C153, ductile-iron compact pattern.
 - 1. Gaskets: AWWA C111, rubber.
- G. Flanges: ASME B16.1, Class 125, cast iron.

2.2 PE PIPE AND FITTINGS

- A. PE, Fire-Service Pipe: FM Global approved, with minimum thickness equivalent to Class 200.
- B. Molded PE Fittings: FM Global approved; PE butt-fusion type, made to match PE pipe dimensions and class.

2.3 PVC PIPE AND FITTINGS

- A. PVC Pipe: AWWA C900 or UL 1285, Class 200, with bell end with gasket, and with spigot end.
- B. PVC Fittings: AWWA C900 or UL 1285, Class 150 and Class 200, with bell-and-spigot or double-bell ends. Include elastomeric gasket in each bell.

2.4 JOINING MATERIALS

- A. Gaskets for Ferrous Piping: ASME B16.21, asbestos free.

2.5 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

2.6 CURB VALVES

- A. Curb Valves: Comply with AWWA C800 for high-pressure, service-line valves. Valve has bronze body, ground-key plug or ball, wide tee head, and inlet and outlet matching service piping material.
- B. Service Boxes for Curb Valves: Similar to AWWA M44 requirements for cast-iron valve boxes. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering "WATER," and bottom section with base that fits over curb valve and with a barrel approximately 3 inches in diameter.
 - 1. Shutoff Rods: Steel; with tee-handle with one pointed end, stem of length to operate deepest buried valve, and slotted end matching curb valve.

2.7 BACKFLOW PREVENTERS

- A. Double-Check, Detector-Assembly Backflow Preventers:
 - 1. Standards: ASSE 1048 and UL's "Fire Protection Equipment Directory" listing or FM Global's "Approval Guide."
 - 2. Operation: Continuous-pressure applications.
 - 3. Pressure Loss: 5 psig maximum, through middle one-third of flow range.
 - 4. Body Material: Stainless steel.
 - 5. End Connections: Flanged.
 - 6. Configuration: Designed for horizontal, straight through flow.
 - 7. Accessories:
 - a. Valves: UL 262 and FM Global's "Approval Guide" listing; OS&Y gate type with flanged ends on inlet and outlet.
 - b. Bypass: With displacement-type water meter, shutoff valves, and reduced-pressure backflow preventer.
- B. Backflow Preventer Test Kits:
 - 1. Description: Factory calibrated, with gages, fittings, hoses, and carrying case with test-procedure instructions.

2.8 ALARM DEVICES

- A. General: UL 753 and FM Global's "Approval Guide" listing, of types and sizes to mate and match piping and equipment.
- B. Water-Flow Indicators: Vane-type water-flow detector, rated for 250-psig working pressure; designed for horizontal or vertical installation; with two single-pole, double-throw circuit switches to provide isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal when cover is removed.
- C. Supervisory Switches: Single pole, double throw; designed to signal valve in other than fully open position.
- D. Pressure Switches: Single pole, double throw; designed to signal increase in pressure.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Comply with excavating, trenching, and backfilling requirements in Section 312000 "Earth Moving."

3.2 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with water utility company for tap of size and in location indicated in water main.
- B. Water-Main Connection: Tap water main according to requirements of water utility company and of size and in location indicated.
- C. Make connections larger than NPS 2 with tapping machine according to the following:
 - 1. Install tapping sleeve and tapping valve according to MSS SP-60.
 - 2. Install tapping sleeve on pipe to be tapped. Position flanged outlet for gate valve.
 - 3. Use tapping machine compatible with valve and tapping sleeve; cut hole in main. Remove tapping machine and connect water-service piping.
 - 4. Install gate valve onto tapping sleeve. Comply with MSS SP-60. Install valve with stem pointing up and with valve box.
- D. Comply with NFPA 24 for fire-service-main piping materials and installation.
- E. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
 - 1. Install encasement for piping according to ASTM A674 or AWWA C105.
- F. Install PE pipe according to ASTM D2774 and ASTM F645.
- G. Install PVC, AWWA pipe according to ASTM F645 and AWWA M23.

- H. Bury piping with depth of cover over top at least 30 inches, with top at least 12 inches below level of maximum frost penetration, and according to the following:
 - 1. Under Driveways: With at least 36 inches of cover over top.
 - 2. In Loose Gravelly Soil and Rock: With at least 12 inches of additional cover.
 - I. Install piping by tunneling or jacking, or combination of both, under streets and other obstructions that cannot be disturbed.
 - J. Extend fire-suppression water-service piping and connect to water-supply source and building fire-suppression water-service piping systems at locations and pipe sizes indicated.
 - 1. Terminate fire-suppression water-service piping within the building at the wall until building-water-piping systems are installed. Terminate piping with caps, plugs, or flanges as required for piping material. Make connections to building's fire-suppression water-service piping systems when those systems are installed.
 - K. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
 - L. Comply with requirements for fire-suppression water-service piping inside the building in the following Sections:
 - 1. Section 211200 "Fire-Suppression Standpipes"
 - 2. Section 211313 "Wet-Pipe Sprinkler Systems"
 - M. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
 - N. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 210517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- 3.3 JOINT CONSTRUCTION
- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure rating same as or higher than systems pressure rating for aboveground applications unless otherwise indicated.
 - B. Install flanges, flange adaptors, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
 - C. Ream ends of tubes and remove burrs.
 - D. Remove scale, slag, dirt, and debris from outside and inside of pipes, tubes, and fittings before assembly.
 - E. Ductile-Iron Piping, Gasketed Joints for Fire-Service-Main Piping: UL 194.

- F. Ductile-Iron Piping, Grooved Joints: Cut-groove pipe. Assemble joints with grooved-end, ductile-iron-piping couplings, gaskets, lubricant, and bolts.
- G. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with bolts according to ASME B31.9.
- H. PE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D2657.
- I. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D2774 or ASTM D3139.
- J. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure.
- K. Do not use flanges or unions for underground piping.

3.4 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
 - 1. Concrete thrust blocks.
 - 2. Locking mechanical joints.
 - 3. Set-screw mechanical retainer glands.
 - 4. Bolted flanged joints.
 - 5. Heat-fused joints.
 - 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, and valves in fire-suppression water-service piping according to NFPA 24 and the following:
 - 1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 - 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 - 3. Bonded-Joint Fiberglass, Water-Service Piping: According to AWWA M45.
- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. AWWA Valves Other Than Gate Valves: Comply with AWWA C600 and AWWA M44.
- C. UL-Listed or FM Global-Approved Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.

- D. UL-Listed or FM Global-Approved Valves Other Than Gate Valves: Comply with NFPA 24.
- E. MSS Valves: Install as component of connected piping system.
- F. Curb Valves: Install each underground curb valve with head pointed up and with service box.
- G. Support valves and piping, not direct buried, on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.6 BACKFLOW PREVENTER INSTALLATION

- A. Install backflow preventers of type, size, and capacity indicated. Include valves and test cocks. Install according to requirements of plumbing and health department and authorities having jurisdiction.
- B. Do not install backflow preventers that have relief drain in vault or in other spaces subject to flooding.
- C. Do not install bypass piping around backflow preventers.
- D. Support NPS 2-1/2 and larger backflow preventers and piping on concrete piers. Comply with requirements for concrete piers in Section 033000 "Cast-in-Place Concrete."

3.7 ALARM DEVICE INSTALLATION

- A. General: Comply with NFPA 24 for devices and methods of valve supervision. Underground valves with valve box do not require supervision.
- B. Supervisory Switches: Supervise valves in open position.
 - 1. Valves: Grind away portion of exposed valve stem. Bolt switch, with plunger in stem depression, to OS&Y gate-valve yoke.
 - 2. Indicator Posts: Drill and thread hole in upper-barrel section at target plate. Install switch, with toggle against target plate, on barrel of indicator post.
- C. Locking and Sealing: Secure unsupervised valves as follows:
 - 1. Valves: Install chain and padlock on open OS&Y gate valve.
 - 2. Post Indicators: Install padlock on wrench on indicator post.
- D. Pressure Switches: Drill and thread hole in exposed barrel of fire hydrant. Install switch.
- E. Water-Flow Indicators: Install in water-service piping in vault. Select indicator with saddle and vane matching pipe size. Drill hole in pipe, insert vane, and bolt saddle to pipe.

- F. Connect alarm devices to building's fire-alarm system. Wiring and fire-alarm devices are specified in Section 284621.11 "Addressable Fire-Alarm Systems."

3.8 CONNECTIONS

- A. Connect fire-suppression water-service piping to utility water main. Use tapping sleeve and tapping valve.
- B. Connect fire-suppression water-service piping to interior fire-suppression piping.

3.9 FIELD QUALITY CONTROL

- A. Use test procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described below.
- B. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- C. Hydrostatic Tests: Test at not less than one-and-one-half times the working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for one hour; decrease to zero psig. Slowly increase again to test pressure and hold for one more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- D. Prepare test and inspection reports.

3.10 IDENTIFICATION

- A. Install continuous underground detectable warning tape during backfilling of trench for underground fire-suppression water-service piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Section 312000 "Earth Moving."
- B. Permanently attach equipment nameplate or marker indicating plastic fire-suppression water-service piping or fire-suppression water-service piping with electrically insulated fittings, on main electrical meter panel. Comply with requirements for identifying devices in Section 220553 "Identification for Plumbing Piping and Equipment."

3.11 CLEANING

- A. Clean and disinfect fire-suppression water-service piping as follows:
 - 1. Purge new piping systems and parts of existing systems that have been altered, extended, or repaired before use.

2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow it to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow it to stand for three hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

3.12 PIPING SCHEDULE

- A. Underground fire-suppression water-service piping NPS 6 to NPS 12 Insert pipe size range shall be one of the following:
1. Grooved-end, ductile-iron pipe; grooved-end, ductile-iron pipe appurtenances; and grooved joints.
 2. Mechanical-joint, ductile-iron pipe; mechanical-joint, ductile- or gray-iron, standard-pattern or ductile-iron, compact-pattern fittings; glands, gaskets, and bolts; and gasketed joints.
 3. PE, Class 200, fire-service pipe; molded PE fittings; and heat-fusion joints.
 4. PVC, Class 200 pipe listed for fire-protection service; PVC fittings of same class as pipe; and gasketed joints.

3.13 VALVE SCHEDULE

- A. Underground fire-suppression water-service shutoff valves NPS 3 (DN 80) and larger shall be one of the following:
1. 200-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
 2. 250-psig, AWWA, iron, nonrising-stem, resilient-seated gate valves.
 3. 250-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves.
- B. Indicator-post underground fire-suppression water-service valves NPS 3 and larger shall be 250-psig, UL-listed or FM Global-approved, iron, nonrising-stem gate valves with indicator-post flange.

END OF SECTION 21 11 00

SECTION 21 13 13 - WET-PIPE SPRINKLER SYSTEMS**PART 1 -GENERAL****1.01 SUMMARY**

- A. Section Includes:
 - 1. Steel pipe and fittings.
 - 2. Specialty valves.
 - 3. Air vent.
 - 4. Sprinkler piping specialties.
 - 5. Sprinklers.
 - 6. Alarm devices.
 - 7. Pressure gauges.

- B. Related Requirements:
 - 1. Section 21 0517 "Sleeves and sleeve Seals for Fire-Suppression Piping".
 - 2. Section 21 0523 "General-Duty Valves for Water-Based Fire-Suppression Piping".
 - 3. Section 21 0553 "Identification for Fire-Suppression Piping and Equipment".
 - 4. Section 21 1100 "Facility Fire-Suppression Water-Service Piping".
 - 5. Section 21 1119 "Fire Department Connections".

1.02 DEFINITIONS

- A. Standard-Pressure Sprinkler Piping: Wet-pipe sprinkler system piping designed to operate at working pressure of 175-psig maximum.

1.03 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

- B. Shop Drawings: For wet-pipe sprinkler systems.
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include diagrams for power, signal, and control wiring.

- C. Delegated Design Submittals: For wet-pipe sprinkler systems indicated to comply with performance requirements and design criteria, including analysis data, prepared by NICET Level III-certified technician, "Water-Based Systems Layout." NICET certified-technician submittals are to include the following information on each drawing title block: technician's name, NICET certification number, and NICET certification specialty area and level.

1.04 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Sprinkler system plans and sections, or Building Information Model (BIM), drawn to scale, showing the items described in this Section and coordinated with all building trades.

- B. Design Data: Approved sprinkler piping working plans, prepared according to NFPA 13, including documented approval by authorities having jurisdiction, and including hydraulic calculations if applicable.
 - C. Field Test Reports:
 - 1. Indicate and interpret test results for compliance with performance requirements and as described in NFPA 13. Include "Contractor's Material and Test Certificate for Aboveground Piping."
 - 2. Fire-hydrant flow test report.
 - D. Field quality-control reports.
- 1.05 CLOSEOUT SUBMITTALS
- A. Operation and Maintenance Data: For wet-pipe sprinkler systems and specialties to include in emergency, operation, and maintenance manuals.
- 1.06 MAINTENANCE MATERIAL SUBMITTALS
- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Sprinkler Cabinets: Finished, wall-mounted, steel cabinet with hinged cover, and with space for minimum of six spare sprinklers plus sprinkler wrench. Include number of sprinklers required by NFPA 13 and sprinkler wrench. Include separate cabinet with sprinklers and wrench for each type of sprinkler used on Project.
- 1.07 QUALITY ASSURANCE
- A. Installer Qualifications:
 - 1. Installer's responsibilities include designing, fabricating, and installing sprinkler systems and providing professional engineering services needed to assume engineering responsibility. Base calculations on results of fire-hydrant flow test.
 - a. Engineering Responsibility: Preparation of working plans, calculations, and field test reports by NICET Level III-certified technician, "Water-Based Systems Layout."
 - B. Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

PART 2 -PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Sprinkler system equipment, specialties, accessories, installation, and testing to comply with NFPA 13.
- C. Standard-Pressure Piping System Component: Listed for 175-psig minimum working pressure.
- D. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 "Quality Requirements," to design wet-pipe sprinkler systems.

1. Margin of Safety for Available Water Flow and Pressure: 10 percent, including losses through water-service piping, valves, and backflow preventers.
 2. See AECOM fire suppression drawings for sprinkler occupancy hazard classifications, minimum densities, maximum protection area per sprinkler, and hose allowances.
- E. Obtain documented approval of sprinkler system design from authorities having jurisdiction.

2.02 STEEL PIPE AND FITTINGS

- A. Standard-Weight Steel Pipe: Galvanized- black-steel pipe, ASTM A53/A53M, Type E, Grade B. Pipe ends may be factory or field formed to match joining method.
- B. Schedule 10, Black-Steel Pipe: ASTM A135/A135M or ASTM A795/A795M, Schedule 10 in NPS 5 and smaller; and NFPA 13-specified wall thickness in NPS 6 to NPS 10, plain end.
- C. Steel Pipe Nipples: Galvanized black steel, ASTM A733, made of ASTM A53/A53M, standard-weight, seamless steel pipe with threaded ends.
- D. Steel Couplings: Galvanized uncoated steel, ASTM A865/A865M, threaded.
- E. Gray-Iron Threaded Fittings: Galvanized uncoated gray-iron threaded fittings, ASME B16.4, Class 125, standard pattern.
- F. Malleable- or Ductile-Iron Unions: UL 860.
- G. Cast-Iron Flanges: ASME 16.1, Class 125.
- H. Steel Flanges and Flanged Fittings: ASME B16.5, Class 150.
1. Pipe-Flange Gasket Materials: AWWA C110, rubber, flat face, 1/8 inch thick ASME B16.21, nonmetallic and asbestos free EPDM rubber gasket.
 - a. Class 125 and Class 250, Cast-Iron, Flat-Face Flanges: Full-face gaskets.
 - b. Class 150 and Class 300, Ductile-Iron or -Steel, Raised-Face Flanges: Ring-type gaskets.
 2. Metal, Pipe-Flange Bolts and Nuts: Carbon steel unless otherwise indicated.
- I. Steel Welding Fittings: ASTM A234/A234M and ASME B16.9.
1. Welding Filler Metals: Comply with AWS D10.12M/D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.
- J. Grooved-Joint, Steel-Pipe Appurtenances:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
 - b. National Fittings, Inc.
 - c. Shurjoint; a part of Aalberts Integrated piping Systems.
 - d. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - e. Victaulic Company.
 2. Pressure Rating: 175-psig minimum.
 3. Grooved-End Fittings for Steel Piping: Galvanized Painted Uncoated grooved-end fittings, ASTM A47/A47M, malleable-iron casting or ASTM A536, ductile-iron casting, with dimensions matching steel pipe.

4. Grooved-End-Pipe Couplings for Steel Piping: AWWA C606 and UL 213 rigid pattern, unless otherwise indicated, for steel-pipe dimensions. Include ferrous housing sections, EPDM-rubber gasket, and bolts and nuts.

2.03 SPECIALTY VALVES

- A. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
- B. Pressure Rating:
 1. Standard-Pressure Piping Specialty Valves: 175-psig minimum.
- C. Body Material: Cast or ductile iron.
- D. Size: Same as connected piping.
- E. End Connections: Flanged or grooved.
- F. Alarm Valves:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Globe Fire Sprinkler Corporation.
 - b. Reliable Automatic Sprinkler Co., Inc. (The).
 - c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - d. Victaulic Company.
 - e. Viking Group Inc.
 2. Standard: UL 193.
 3. Design: For horizontal or vertical installation.
 4. Include trim sets for bypass, drain, electrical sprinkler alarm switch, pressure gauges, retarding chamber, and fill-line attachment with strainer.
 5. Drip cup assembly pipe drain without valves and separate from main drain piping with check valve to main drain piping.
 6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- G. Automatic (Ball Drip) Drain Valves:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 2. Standard: UL 1726.
 3. Pressure Rating: 175-psig minimum.
 4. Type: Automatic draining, ball check.
 5. Size: NPS 3/4.
 6. End Connections: Threaded.

2.04 AIR VENT

- A. Manual Air Vent/Valve:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- a. AGF Manufacturing, Inc.
 - b. Shurjoint; a part of Aalberts Integrated piping Systems.
 - c. Victaulic Company.
 2. Description: Ball valve that requires human intervention to vent air.
 3. Body: Forged brass.
 4. Ends: Threaded.
 5. Minimize Size: 1/2 inch.
 6. Minimum Water Working Pressure Rating: 300 psig.
 - B. Automatic Air Vent:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing, Inc.
 - b. CLA-VAL.
 - c. Engineered Corrosion Solutions.
 2. Description: Automatic air vent that automatically vents trapped air without human intervention.
 3. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler systems.
 4. Vents oxygen continuously from system.
 5. Float valve to prevent water discharge.
 6. Minimum Water Working Pressure Rating: 175 psig.
 - C. Automatic Air Vent Assembly:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing, Inc.
 - b. Engineered Corrosion Solutions.
 - c. Potter Electric Signal Company, LLC.
 2. Description: Automatic air vent assembly that automatically vents trapped air without human intervention, including Y-strainer and ball valve in a pre-piped assembly.
 3. Standard: UL listed or FM Global approved for use in wet-pipe fire sprinkler system.
 4. Vents oxygen continuously from system.
 5. Float valve to prevent water discharge.
 6. Minimum Water Working Pressure Rating: 175 psig.
- 2.05 SPRINKLER PIPING SPECIALTIES
- A. Branch Outlet Fittings:
 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing, Inc.
 - b. Anvil International/Smith-Cooper International; Tailwind Capital, LLC.
 - c. National Fittings, Inc.
 - d. Shurjoint; a part of Aalberts Integrated piping Systems.
 - e. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - f. Victaulic Company.
 2. Standard: UL 213.
 3. Pressure Rating: 175-psig minimum 300 psig.
 4. Body Material: Ductile-iron housing with EPDM seals and bolts and nuts.
 5. Type: Mechanical-tee and -cross fittings.
 6. Configurations: Snap-on and strapless, ductile-iron housing with branch outlets.
 7. Size: Of dimension to fit onto sprinkler main and with outlet connections as required to match connected branch piping.

8. Branch Outlets: Grooved, plain-end pipe, or threaded.

B. Flow Detection and Test Assemblies:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing, Inc.
 - b. Reliable Automatic Sprinkler Co., Inc. (The).
 - c. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - d. Victaulic Company.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum 300 psig.
4. Body Material: Cast- or ductile-iron housing with orifice, sight glass, and integral test valve.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded or grooved.

C. Sprinkler Inspector's Test Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. AGF Manufacturing, Inc.
 - b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - c. Victaulic Company.
 - d. Viking Group Inc.
2. Standard: UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."
3. Pressure Rating: 175-psig minimum 300 psig.
4. Body Material: Cast- or ductile-iron housing with sight glass.
5. Size: Same as connected piping.
6. Inlet and Outlet: Threaded.

D. Flexible Sprinkler Hose Fittings:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. FlexHead Industries, Inc.
 - b. Victaulic Company.
2. Standard: UL 1474.
3. Type: Flexible hose for connection to sprinkler, and with bracket for connection to ceiling grid.
4. Pressure Rating: 175-psig minimum 300 psig.
5. Size: Same as connected piping, for sprinkler.

2.06 SPRINKLERS

A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Globe Fire Sprinkler Corporation.
2. Reliable Automatic Sprinkler Co., Inc. (The).
3. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
4. Victaulic Company.
5. Viking Group Inc.

B. Listed in UL's "Fire Protection Equipment Directory" or FM Global's "Approval Guide."

- C. Pressure Rating for Residential Sprinklers: 175-psig maximum.
- D. Pressure Rating for Automatic Sprinklers: 175-psig minimum.
- E. Pressure Rating for High-Pressure Automatic Sprinklers: 250-psig minimum 300 psig.
- F. Automatic Sprinklers with Heat-Responsive Element:
 - 1. Nonresidential Applications: UL 199.
 - 2. Characteristics: Minimum Discharge Coefficient K of 5.6, and for "Ordinary" temperature classification rating unless otherwise indicated or required by application.
- G. Sprinkler Escutcheons: Materials, types, and finishes for the following sprinkler mounting applications. Escutcheons for concealed, flush, and recessed-type sprinklers are specified with sprinklers.
 - 1. Ceiling Mounting: Chrome-plated steel, one piece, flat Chrome-plated steel, two piece, with 1-inch vertical adjustment Plastic, white finish, one piece, flat.
 - 2. Sidewall Mounting: Chrome-plated steel Plastic, white finish, one piece, flat.
- H. Sprinkler Guards:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Reliable Automatic Sprinkler Co., Inc. (The).
 - b. Tyco Fire Products; brand of Johnson Controls International plc, Building Solutions North America.
 - c. Victaulic Company.
 - d. Viking Group Inc.
 - 2. Standard: UL 199.
 - 3. Type: Wire cage with fastening device for attaching to sprinkler.

2.07 ALARM DEVICES

- A. Alarm-device types to match piping and equipment connections.
- B. Water-Flow Indicators:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. ADT Security Services, Inc.
 - b. ITT McDonnell & Miller.
 - c. Potter Electric Signal Company, LLC.
 - d. System Sensor.
 - e. Viking Group Inc.
 - f. Watts Water Technologies; a Watts company.
 - 2. Standard: UL 346.
 - 3. Water-Flow Detector: Electrically supervised.
 - 4. Components: Two single-pole, double-throw circuit switches for isolated alarm and auxiliary contacts, 7 A, 125-V ac and 0.25 A, 24-V dc; complete with factory-set, field-adjustable retard element to prevent false signals and tamperproof cover that sends signal if removed.
 - 5. Type: Paddle operated.
 - 6. Pressure Rating: 250 psig.
 - 7. Design Installation: Horizontal or vertical.
- C. Valve Supervisory Switches:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Fire-Lite Alarms; Honeywell International, Inc.
 - b. Potter Electric Signal Company, LLC.
 - c. System Sensor.
2. Standard: UL 346.
3. Type: Electrically supervised.
4. Components: Single-pole, double-throw switch with normally closed contacts.
5. Design: Signals that controlled valve is in other than fully open position.
6. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.08 PRESSURE GAUGES

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. AGF Manufacturing, Inc.
 2. AMETEK, Inc.
 3. Ashcroft Inc.
 4. Brecco Corporation.
 5. WIKA Instrument Corporation.
- B. Standard: UL 393.
- C. Dial Size: 3-1/2- to 4-1/2-inch diameter.
- D. Pressure Gauge Range: 0- to 250-psig minimum 0 to 300 psig.
- E. Label: Include "WATER" label on dial face.

PART 3 -EXECUTION

3.01 PREPARATION

- A. Perform fire-hydrant flow test according to NFPA 13 and NFPA 291. Use results for system design calculations required in "Quality Assurance" Article.
- B. Report test results promptly and in writing.

3.02 WATER-SUPPLY CONNECTIONS

- A. Install shutoff valve, backflow preventer, pressure gauge, drain, and other accessories indicated at connection to water-distribution piping.

3.03 INSTALLATION OF PIPING

- A. Locations and Arrangements: Drawing plans, schematics, and diagrams indicate general location and arrangement of piping. Install piping as indicated on approved working plans.
 1. Deviations from approved working plans for piping require written approval from authorities having jurisdiction. File written approval with Architect before deviating from approved working plans.

2. Coordinate layout and installation of sprinklers with other construction that penetrates ceilings, including light fixtures, HVAC equipment, and partition assemblies.
- B. Piping Standard: Comply with NFPA 13 requirements for installation of sprinkler piping.
 - C. Use listed fittings to make changes in direction, branch takeoffs from mains, and reductions in pipe sizes.
 - D. Install unions adjacent to each valve in pipes NPS 2 and smaller.
 - E. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
 - F. Install "Inspector's Test Connections" in sprinkler system piping, complete with shutoff valve, and sized and located according to NFPA 13.
 - G. Install sprinkler piping with drains for complete system drainage.
 - H. Install sprinkler control valves, test assemblies, and drain risers adjacent to standpipes when sprinkler piping is connected to standpipes.
 - I. Install automatic (ball drip) drain valve at each check valve for fire-department connection, to drain piping between fire-department connection and check valve. Install drain piping to and spill over floor drain or to outside building.
 - J. Install alarm devices in piping systems.
 - K. Install hangers and supports for sprinkler system piping according to NFPA 13. Comply with requirements for hanger materials in NFPA 13.
 - L. Install pressure gauges on riser or feed main, at each sprinkler test connection, and at top of each standpipe. Include pressure gauges with connection not less than NPS 1/4 and with soft-metal seated globe valve, arranged for draining pipe between gauge and valve. Install gauges to permit removal, and install where they are not subject to freezing.
 - M. Fill sprinkler system piping with water.
 - N. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
 - O. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 21 0517 "Sleeves and Sleeve Seals for Fire-Suppression Piping."
- 3.04 JOINT CONSTRUCTION
- A. Install couplings, flanges, flanged fittings, unions, nipples, and transition and special fittings that have finish and pressure ratings same as or higher than system's pressure rating for aboveground applications unless otherwise indicated.
 - B. Install unions adjacent to each valve in pipes NPS 2 and smaller.

- C. Install flanges, flange adapters, or couplings for grooved-end piping on valves, apparatus, and equipment having NPS 2-1/2 and larger end connections.
- D. Ream ends of pipes and remove burrs. Bevel plain ends of steel pipe.
- E. Remove scale, slag, dirt, and debris from inside and outside of pipes and fittings before assembly.
- F. Flanged Joints: Select appropriate gasket material in size, type, and thickness suitable for water service. Join flanges with gasket and bolts according to ASME B31.9.
- G. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate tape or thread compound to external pipe threads.
 - 2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged.
- H. Welded Joints: Construct joints according to AWS D10.12M/D10.12, using qualified processes and welding operators according to "Quality Assurance" Article.
 - 1. Shop weld pipe joints where welded piping is indicated. Do not use welded joints for galvanized-steel pipe.
- I. Steel-Piping, Roll-Grooved Joints: Roll rounded-edge groove in end of pipe according to AWWA C606. Assemble coupling with housing, gasket, lubricant, and bolts. Join steel pipe and grooved-end fittings according to AWWA C606 for steel-pipe grooved joints.
- J. Dissimilar-Material Piping Joints: Make joints using adapters compatible with materials of both piping systems.

3.05 INSTALLATION OF VALVES AND SPECIALTIES

- A. Install listed fire-protection valves, trim and drain valves, specialty valves and trim, controls, and specialties according to NFPA 13 and authorities having jurisdiction.
- B. Install listed fire-protection shutoff valves supervised open, located to control sources of water supply except from fire-department connections. Install permanent identification signs indicating portion of system controlled by each valve.
- C. Install check valve in each water-supply connection. Install backflow preventers instead of check valves in potable-water-supply sources.
- D. Air Vent:
 - 1. Provide at least one air vent at high point in each wet-pipe sprinkler system in accordance with NFPA 13 requirements. Connect vent into top of fire sprinkler piping.
 - 2. Provide dielectric union for dissimilar metals, ball valve, and strainer upstream of automatic air vent.
 - 3. Pipe from outlet of air vent to drain.

3.06 INSTALLATION OF SPRINKLERS

- A. Install sprinklers in suspended ceilings in center of acoustical ceiling panels.

- B. Install dry-type sprinklers with water supply from heated space. Do not install pendent or sidewall, wet-type sprinklers in areas subject to freezing.
- C. Install sprinklers into flexible, sprinkler hose fittings, and install hose into bracket on ceiling grid.

3.07 IDENTIFICATION

- A. Install labeling and pipe markers on equipment and piping according to requirements in NFPA 13.

3.08 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Leak Test: After installation, charge systems and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 3. Flush, test, and inspect sprinkler systems according to NFPA 13, "Systems Acceptance" Chapter.
 - 4. Verify that equipment hose threads are same as local fire department equipment.
- B. Sprinkler piping system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

3.09 CLEANING

- A. Clean dirt and debris from sprinklers.
- B. Only sprinklers with their original factory finish are acceptable. Remove and replace any sprinklers that are painted or have any other finish than their original factory finish.

3.10 PIPING SCHEDULE

- A. Piping between Fire Department Connections and Check Valves: Galvanized, standard-weight steel pipe with grooved ends, grooved-end fittings, grooved-end-pipe couplings, and grooved joints.
- B. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2 and Smaller, to Be the Following:
 - 1. Standard-weight Schedule 40, black-steel pipe with threaded ends; uncoated, gray-iron threaded fittings; and threaded joints.
- C. Standard-Pressure, Wet-Pipe Sprinkler System, NPS 2-1/2 and Larger, to Be the Following:
 - 1. Schedule 10, black-steel pipe with roll-grooved ends; uncoated, grooved-end fittings for steel piping; grooved-end-pipe couplings for steel piping; and grooved joints.

3.11 SPRINKLER SCHEDULE

- A. Use sprinkler types in subparagraphs below for the following applications:
 - 1. Rooms without Ceilings: Upright sprinklers.
 - 2. Rooms with Suspended Ceilings: Concealed sprinklers.
 - 3. Wall Mounting: Sidewall sprinklers.
 - 4. Special Applications: quick-response sprinklers where indicated.

- B. Provide sprinkler types in subparagraphs below with finishes indicated.
1. Concealed Sprinklers: Rough brass, with factory-painted white cover plate.
 2. Upright, Pendent, and Sidewall Sprinklers: Chrome plated in finished spaces exposed to view; rough bronze in unfinished spaces not exposed to view; wax coated where exposed to acids, chemicals, or other corrosive fumes.

END OF SECTION 21 13 13

SECTION 22 05 01 COMMON WORK RESULTS FOR PLUMBING

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

ALTERNATES

Within the forms of their bid proposals, contractors shall state the total (labor and material) amount, (with markups), to be added to or deducted from the base bid amount for each of the alternates indicated herein or within the Bid Form or Instructions to Bidders, that the Owner may or may not decide to accept.

UNIT PRICES

Within the forms of their bid proposals, contractors shall state the total labor and material unit price (with markups) for each of the unit scope-of-work items that might be added or deducted on a unit-by-unit basis during the construction period of the project, that takes place before final inspection or date of acceptance review. See Bid Form or Instructions to Bidders as relates to these unit cost items.

1. Indicate all unit costs, including controls, wiring and interlocks, as outlined and referenced within the bid form or Instruction to Bidders.

GUARANTEE

In entering into a contract covering this work, the Contractor accepts the Specifications and Drawings and guarantees that the work will be carried out in accordance with the requirements of the Specifications and Drawings, or such authorized modifications as may be made in the Contract Documents. Contractor further guarantees that the workmanship and material will be first class and that only experienced workers, familiar with each particular class of work, will be employed. Contractor further guarantees to replace and make good at his own expense any defects due to faulty workmanship or material which may develop within one (1) year after final payment and acceptance by the Owner, upon receipt of written notification of defect from the Owner.

QUALITY ASSURANCE

Regulations and Standards: All equipment, apparatus, and systems are to be fabricated and installed in complete accordance with fire and insurance rules and regulations, the Life Safety Code, and the latest edition or revision of the following applicable regulations, standards, and codes:

2. AIA American Institute of Architects
3. ASME American Society of Mechanical Engineers
4. ASTM American Society for Testing and Materials
5. NFPA National Fire Protection Association
6. NEC National Electric Code
7. OSHA Occupational Safety and Health Administration

8. UL Underwriter's Laboratories, Inc.
9. MCAA Mechanical Contractors Association of America, Inc.
10. ANSI American National Standard Institute
11. MSSV Manufacturer's Standardization Society of the Valve and Fitting Industry
12. AWWA American Water Works Association
13. AGA American Natural Gas Association
14. PDI Plumbing and Drainage Institute
15. NACE National Association of Corrosion Engineers
16. State and Local Inspection Authorities
17. Division 01 Sections "Regulatory Requirements: and "Reference Standards" of the Project Specifications
18. References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the specific codes applicable to this Project location, together with all additions, amendments, changes, and interpretations adopted by code authorities having jurisdiction over this Project.
19. The applicable edition of all codes shall be that adopted at the time of issuance of permits by the authorities having jurisdiction and shall include all modifications and additions adopted by that jurisdiction.
20. Give all required notices to comply with, and meet, all inspections required by Federal, State, and Local authorities.
21. It is not the intent herewith to modify, reduce, or change any rules, standards, regulations, or requirements that are applicable under local, state and federal codes, ordinances, or regulations of the various authorities having jurisdiction. Where the standards differ among the various authorities, the most restrictive shall apply. Where the requirements shown on the Drawings or called for in the Specifications exceed code requirements, these Drawings and Specifications shall take precedence. Where the requirements within the specifications of this division of work and the Drawings conflict with the referenced Divisions, Sections, and other documents, the documents having the most restrictive and the higher cost requirements shall apply.

JOB CONDITIONS AND COORDINATION

Local Conditions

22. Each Trade Contractor is to inform himself of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work to be done.
23. Contractors shall coordinate and review indicated utility data with the local utility companies.

Present Job Site Inspection

24. Each contractor shall schedule through the Design-Builder a visit to the present site proposed for the work before presenting a Bid and shall make a careful inspection of the existing conditions.
25. During the site visit, each Trade Contractor is to investigate for any existing conditions and responsibilities which are not clearly defined by the Drawings and Specifications. If any such conditions exist, he shall bring them to the attention of the A/E in writing. The A/E will then make the required written clarification. The

absence of questions before the opening of bids shall indicate a clear understanding of the scope of work and the Contractor's responsibility.

Concrete Housekeeping Pads and Supporting Foundations

26. Unless otherwise specified or noted on the Drawings, the Contractor or Subcontractor whose equipment the concrete pad or foundation services is to locate, size, and pay the Concrete Contractor to provide concrete pads and foundations as indicated on the Drawings for all of their equipment.
27. Concrete pads as may be indicated are based upon the design and layout-based manufacturer and model of equipment and devices as specified or as scheduled or noted on the Drawings.
28. The individual Trade Contractor furnishing the equipment or devices is to verify and coordinate all concrete pad sizes so as to have same of proper size to serve the equipment or device supplied and verify the position of all anchor bolts.
29. Any additional cost for larger than indicated pad or foundation sizes to fit the approved manufacturer and model of the equipment or devices is to be borne by the Trade Contractor who supplies such equipment or devices.

Permits and Fees: This Contractor is to obtain all permits and pay all fees required for the work under Division 22 of the Work.

Royalties and Patents

30. The Trade Contractor is to pay all royalties and license fees. He shall defend, indemnify, and hold the Owner and A/E harmless from any and all suits, demands or claims for infringement of any patent rights.
31. The review by A/E or Owner of any method of construction, invention, appliance, process, article, device or material of any kind is to be for adequacy of work and is not to be construed as an approval of the use thereof by the Contractor in violation of any patent or other rights of any third person.

Wiring and Conduit Requirements: In general, most wiring and conduit requirements are addressed, either upon the Drawings as a part of a packaged equipment assembly specifications, or within Divisions 26, 27 and 28 of the Specifications. However, should an equipment component, panel, or system device need additional wiring and conduit so as to be complete, approved and fully operational, the Contractor who supplied the equipment component, panel or system device shall be responsible for the required wiring and conduit as well as circuit disconnect and protection for same when it is not otherwise covered by the Project Drawings and Specifications.

Coordination: Coordinate the exact location of this work with the work of other trades prior to fabrication or installation of same. Verify all dimensions and elevations. Provide additional offsets and sections of material as may be required to meet the applicable job condition requirements. Coordinate with and review all related construction Drawings and Shop Drawings of all equipment suppliers prior to start of work.

SPECIFICATIONS AND DRAWINGS

These specifications and Drawings are intended to describe and provide for a complete and finished project. They are intended to be complementary. All items of work called for by either shall be as binding as if called for by both. The work described shall be

complete in every detail, notwithstanding the fact that every item necessarily involved is not particularly mentioned or shown.

32. If the Bidder, Supplier or Contractor sees anything to question, it must be brought to the attention of the A/E immediately.

Minor Deviations: The Drawings accompanying these Specifications indicate the general design and arrangement of equipment, apparatus, fixtures, accessories and piping necessary to complete the installation of the system. The exact location or arrangement of the apparatus and equipment, unless otherwise dimensioned, is subject to minor changes necessitated by field conditions and shall be required without additional cost to the Owner. Measurements shall be verified through actual observation at the construction site. Each Trade Contractor shall be responsible for fitting all of his work into place in a satisfactory and workmanlike manner, to the approval of the A/E and Owner.

Provide all labor and materials necessary for the completion of the work described. Referenced codes and industry standards and methods shall apply when no other specifics are indicated. Bring questions relating to this paragraph to the attention of the A/E for resolution prior to the receipt of Bids.

All Work indicated on Drawings, diagrams, or details in part only are to continue throughout unless distinctly marked otherwise. The same applies to other parts of the project where merely a typical reference plan, diagram, or section of the drawing is complete. The balance is intended to be the same as the typical plan, section, or diagram as shown and is to be figured accordingly.

The specifications are divided into trades and divisions only for the distinct purpose of facilitating the work. However, the Trade Contractor will become responsible for furnishing all labor and materials necessary to complete the project as contemplated by the Drawings and Specifications. Any item mentioned under any heading of the Specifications must be supplied even though it is not called for again under the heading for the respective work.

Should discrepancies occur within the Contract Documents, the more stringent and more costly approach shall apply for bidding purposes. The Contractor is to notify the A/E of discrepancies for clarification. Clarifications issued after the Contract is awarded shall be incorporated by the Contractor at no additional costs and shall be reviewed by the A/E to determine if a reduction in cost is justified.

TRADE CONTRACTORS, SUBCONTRACTORS AND SUPPLIERS

The Trade Contractor is any person or organization who contracts to perform work for the Project. Wherever the word "Contractor" is used on the Drawings or in the Specifications, it shall be construed to mean the Trade Contractor applicable to the Title Division of these specifications.

A Sub-Contractor is a person or organization who has a direct contract with a Trade Contractor to perform any of the Work at the site and includes all who furnish material worked to a special design in accordance with the Drawings and Specifications but excludes suppliers or persons furnishing material not specially designed. Wherever

the term "Sub-Contractor" is encountered in the Contract Documents, it shall mean the Sub-Contractor and/or his Sub-Sub-Contractors and/or his Material Suppliers.

A Sub-Sub-Contractor is a person or organization who has a direct or indirect contract with a Sub-Contractor to perform any of the Work at the project site or for the subject project.

A Material Supplier is a person or organization who has a direct contract with a Trade Contractor to furnish material not specially designed.

It shall be the responsibility of each Trade Contractor to be fully familiar with various local trade jurisdictional requirements and to engage the services of any other Sub-Contractors as may be required within the various trades to complete all of the work as indicated upon the Drawings and within the Specifications under his respective division or section. Only Trade Sub-Contractors with established knowledge and skills of their specific trade shall be used, so that all work is performed in a complete, finished, and professional manner.

Whenever any provisions of the Specifications conflict with any agreements or regulations in force among members of any Trade Associations, Unions, or Councils which regulate or distinguish what work shall or shall not be included in the work of any particular trade, the Trade Contractor shall make all necessary efforts to reconcile any such conflict without delay, damage or cost to the Owner.

If the progress of the work is affected by any undue delay in furnishing or installing any items of material or equipment required under the contract because of a conflict involving any such agreement or regulation, the A/E may require that other material or equipment of equal kind and quality be provided at no additional cost to the Owner.

Any Trade Contractor, subcontractor, or material supplier not normally employing union labor shall make all provisions necessary to avoid any resulting disputes with labor unions and shall be responsible for any delays, damages or extra cost caused by employment of such non-union labor, except as otherwise governable by state or federal rules and regulations.

Each Trade Contractor shall pay for all applicable Federal, State and local taxes on all materials, labor or services furnished by him, and all taxes arising out of his operations under the Contract Documents which may be imposed upon or collectable from the Owner or become a lien against his property. Such taxes shall include, but not be limited to, Occupational, Sales, Use, Excise, Social Security and Unemployment Taxes, customs duties, and all income taxes and other taxes now in force or enacted prior to final acceptance of the work. The Trade Contractor shall assume all liability for the payment of and shall pay any unemployment benefits payable under any Federal or State law to individuals employed by him during the progress of the work covered by the Contract.

It is the responsibility of each Trade Contractor to coordinate the various related equipment requirements between his subcontractors, suppliers, and other trade contractors, and to also follow the approved manufacturer's installation instructions.

OPERATIONAL AND MAINTENANCE INSTRUCTIONS

All operational and maintenance instructions that are provided to various Owner-selected members of the facility engineering and/or maintenance staff are, at the same time presented, to be fully videotaped by the Contractor so that all such sessions can be later reviewed by the Owner's staff on a retraining basis as needed. All such videotapes are to become the property of the Owner at the end of each applicable training period, with one copy of each also being supplied to the A/E for the A/E project files.

PART 2 - PRODUCTS

MANUFACTURERS/PRODUCTS/SUBMITTALS

Under the Base Bid, no other manufacturers except those indicated on the Drawings or those listed within the Sections of this Division, that are, in turn, able to comply with the contract document requirements and minimum standards of these specifications, will be acceptable. In addition to specific required "Alternates," proposed substitutions that may or may not be acceptable to the Owner may be submitted by the Contractor only at the time of initial base bid submittal.

Although design-based models of various manufacturers may be indicated within the various schedules, it is the responsibility of the various equipment manufacturers to verify the model selections so that all items of equipment comply with the minimum standards of performance that are indicated within the schedules, as well as the requirements within various sections of the specifications under which the equipment is also specified.

All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Division 01 Section "Submittals".

Shop Drawings are to be submitted on each item of specified or scheduled equipment, valves, specialties, insulation, fixtures, drains, controls and related accessories. All control submittals must include a typed sequence of control for each system.

ACCESS DOORS AND PANELS

Unless otherwise indicated, each Trade Contractor is to locate and furnish all access doors required for non-accessible surfaces (such as ceilings, walls, chases, and similar locations), so that all valves and similar items are easily accessible for operation, inspection and maintenance. Access doors for ceiling, walls, chases, etc. are to be installed by the General Contractor. The Trade Contractor is to bear the costs of the installation of the access doors.

See Section 08 3113 for access door types and specifications. Minimum size to be 12 inch x 12 inch, or as indicated or required to allow inspection of items served.

SLEEVES

Each Contractor is to provide properly sized, secured and firestopped sleeves for all of their piping systems at all penetrations of walls, foundations, partitions, floors and roofs throughout the entire facility.

PART 3 - EXECUTION

GENERAL

Provide all materials, labor, equipment, and services necessary for a complete and operable installation as specified and shown on the Drawings. The word "Provide" shall mean "Furnish and install."

Provide new material and equipment in strict accordance with these Specifications and the Project Drawings.

At all times, take such precautions as are necessary to protect materials from damage. Close all pipe openings to prevent obstructions and contamination.

CUTTING AND PATCHING IN BUILDINGS

Each Contractor is responsible for all costs associated with the necessary cutting and patching as required for the installation of his work, unless otherwise indicated.

Patching is to be performed by the trade proper for each material to be patched. Patching shall leave premises and finishes in a complete and neat condition comparable to the original. Painting of patched surfaces to be by the painting sub-contractor of the General Contractor, unless otherwise specifically indicated or the plumbing/fire protection contractor is the prime contractor for the project. Maintain the fire integrity of all walls, floors, ceilings, and partitions.

PROTECTION

Protect equipment and trim against damage and injury due to building materials, acid, tools, equipment and any causes incidental to construction. Cover the finished surface of each piece of equipment with building paper or similar protection. Replace all equipment damaged by any cause and any trim with marred or scratched finish at no cost to the Owner, upon receipt of written notification from the A/E.

Where materials to be installed are being stored at or near the project during construction, arrange such materials so as to minimize the possibility of contamination, corrosion and damage. Keep ends of pipe, equipment, and specialties properly closed during construction and installation to avoid the possibility of miscellaneous materials being placed in the openings.

PAINTING

See Division 09 Section "Interior Painting".

ADJUST AND CLEAN

Inspect all equipment and put in satisfactory working order.

1. Clean all exposed and concealed items.
2. Clean floor drains, cleanouts, and plumbing fixtures.
3. Clean specialties such as traps and strainers and all equipment surface such as pumps, motors, etc.
4. Clean all covers.
5. Clean exposed piping.

6. Adjust pumps, balancing valves, and metering faucets for proper flow rates.
7. Adjust water heaters and thermostatic mixing valves for required temperatures.

END OF SECTION 22 0501

SECTION 22 0507 EXCAVATION AND BACKFILL**PART 1 - GENERAL****1.1 REFERENCE**

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION OF WORK

- A. Each Trade Contractor is to provide all excavating, trenching, sheeting, bracing, pumping, and backfilling as required for the installation of his work.

1.3 QUALITY ASSURANCE

- A. Testing
 - 1. All testing is to be done by an independent testing laboratory employed by this Contractor and approved by the Design-Builder.
 - 2. Conduct up to 10 tests per Trade per 40,000 gross square foot of compacted surface serving each Trade's specific area of work to determine the compaction density of backfill.

PART 2 - PRODUCTS**2.1 SOIL MATERIALS**

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.
- D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.
- F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

- G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- I. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.2 ACCESSORIES

- A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
 - 1. Yellow: Gas, oil, and dangerous materials.
 - 2. Blue: Water systems.
 - 3. Green: Sewer systems.

PART 3 - EXECUTION

3.1 GENERAL PROTECTION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.2 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
 - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 - 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.3 EXPLOSIVES

- A. Explosives: Do not use explosives.

3.4 EXCAVATION, GENERAL

- A. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
 - 1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
 - 2. Remove rock to lines and grades indicated to permit installation of permanent construction.

- B. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross sectioned by A/E. The Contract Sum will be adjusted for rock excavation according to unit prices included in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.
 - 1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling: blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
 - 2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.

3.5 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
 - 1. Beyond building perimeter, excavate trenches to allow installation of top of pipe below frost line.

- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.
 - 1. Clearance: 12 inches each side of pipe or conduit.

- C. Trench Bottoms: Excavate trenches 4 inches deeper than bottom of pipe elevation to allow for bedding course. Hand excavates for bell of pipe.
 - 1. Excavate trenches 6 inches deeper than elevation required in rock or other unyielding bearing material to allow for bedding course.

3.6 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Architect.
 - 1. Fill unauthorized excavations under other construction or utility pipe as directed by Design-Builder.

3.7 STORAGE OF SOIL MATERIALS

- A. Stockpiles borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 - 1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.8 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.9 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.
- D. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.
- E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe.
 - 1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.
- F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- G. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.10 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under steps and ramps, use engineered fill.
 - 2. Under building slabs, use engineered fill.
 - 3. Under footings and foundations, use engineered fill.
- C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.11 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.12 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 8 inches loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.13 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.14 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
 - 1. Scarify or remove and replace soil material to depth as directed by A/E; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
 - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.15 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 22 0507

SECTION 22 0513 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

PART 2 - PRODUCTS

EQUIPMENT MOTORS

Motors shall be of sufficient size for the duty to be performed and shall not exceed the motor's full-rated load when the driven equipment is operating at specified capacity under the most severe conditions likely to be encountered. Motors shall be established, U.S.-manufactured industry standard types for the service intended, having normal starting torque and low starting current characteristics, unless other characteristics are specified. When electrically driven equipment is furnished which materially differs from the contemplated design, the Contractor supplying the driving equipment shall pay for and make necessary the adjustments to the wiring, disconnect devices and branch-circuit protection to accommodate the equipment actually installed. Motors and equipment shall meet NEMA MG1, and State and Local Energy Code minimum COP requirements. Provide suitable overload protection for each motor.

Unless otherwise specified or noted on the Drawings, motors shall be suitable for the service intended, shall be of latest industry standards of design for maximum energy efficiency, and shall be continuous-duty-type, as follows:

1. Motors less than 1/2 HP shall normally be 120-volt, 1-phase, 60-HZ.

Coordinate and verify voltage and phase required with Electrical Drawings, as well as equipment scheduled data.

It shall be the responsibility of this contractor to coordinate and verify the applicable phase and voltage requirements with the electrical contractor before submittal of Shop Drawings.

MOTOR CONTROLLERS AND DISCONNECTS

Except as otherwise specified in each of the various sections of Division 22, motor controllers and disconnects shall be as specified under Divisions 26, 27 and 28.

Verify applicable voltage, phase, and protective device requirements with electrical contractor before manufacture or installation of equipment.

PART 3 - EXECUTION

INSTALLATION

Installation shall comply with manufacturer's latest published instructions and all applicable inspection and code authority requirements.

MOTOR EFFICIENCIES

Drip-Proof Motors

3600 RPM		1800 RPM	
HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT	HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT
1-1/2	81.0	1	84.0
2	84.0	1-1/2	84.0
3	86.0	2	84.0
5	87.0	3	88.0
7-1/2	87.0	5	88.0
10	88.0	7-1/2	90.0
15	90.0	10	90.0
20	90.0	15	91.0
25	91.0	20	91.0
30	91.0	25	93.0
40	91.0	30	93.0
50	91.0	40	93.0
60	92.0	50	94.0
75	93.0	60	94.0
100	93.0	75	94.0
		100	94.0

Totally Enclosed, Fan-Cooled Motors

3600 RPM		1800 RPM	
HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT	HP	NOMINAL FULL-LOAD EFFICIENCY PERCENT
1-1/2	81.0	1	81.0
2	84.0	1-1/2	84.0
3	84.0	2	82.0
5	86.0	3	82.0
7-1/2	88.0	5	85.0
10	90.0	7-1/2	87.0
15	91.0	10	89.0
20	91.0	15	91.0
25	91.0	20	92.0
30	92.0	25	92.0
40	92.0	30	93.0
50	93.0	40	93.0
60	93.0	50	94.0
75	94.0	60	94.0
100	94.0	75	94.0
125	95.0	100	95.0
150	95.0	125	95.0
200	95.0	150	95.0
		200	95.0

END OF SECTION 22 0513

SECTION 22 0519 METERS AND GAUGES FOR PLUMBING PIPING**PART 1 - GENERAL****REFERENCE**

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

SUMMARY

This Section includes the following types of meters and gauges:

1. Temperature gauges and fittings.
2. Pressure gauges and fittings.

Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 specifications.

QUALITY ASSURANCE

UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

SUBMITTALS

Shop Drawings: Each equipment and material item specified.

Product Data: Product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

Samples: Not required for review.

Contract Close-Out Information

3. Maintenance data for each type of meter and gauge in each building for inclusion in Operating and Maintenance Manuals specified in Division 01, and Division 22 Section "Common Work Results for Plumbing".
4. Portable test plug test kit and portable meter receipts as described in this Section.

PART 2 - PRODUCTS**MANUFACTURERS**

Subject to compliance with requirements, provide products by one of the following:

1. Thermometers
 - a. Marshalltown Instruments, Inc.

- b. Terice (H.O.) Co.
 - c. Weiss Instruments, Inc.
2. Thermometer Wells: Same as thermometers.
 - a. Insertion Dial Thermometers.
 - b. Ashcroft Dresser Industries/Instrument Div.
 - c. Terice (H.O.) Co.
 - d. Weiss Instruments, Inc.
3. Pressure Gauges
 - a. Ametek, U.S. Gauge Div.
 - b. Ashcroft Dresser Industries/Instrument Div.
 - c. Marsh Instrument Co., Unit of General Signal.
 - d. Marshalltown Instruments, Inc.
 - e. Terice (H.O.) Co.
 - f. Weiss Instruments, Inc.
4. Pressure Gauge Accessories: Same as for pressure gauges.
 - a. Water Orifice-Type Measurement System.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett, ITT, Fluid Handling Div.
5. Test Plugs
 - a. MG Piping Products Co.
 - b. Peterson Equipment Co., Inc.
 - c. Sisco, A Spedco, Inc. Co.
 - d. Terice (H.O.) Co.
 - e. Watts Regulator Co.
 - f. Flow Design, Inc.

THERMOMETERS, GENERAL

Accuracy: Plus or minus 1% of range span or plus or minus one scale division to maximum of 1.5% of range span.

6. Scale Range: Temperature ranges for services listed as follows:
7. Domestic Hot Water: 30 deg to 240 deg with 2 deg scale divisions (0 deg to 115deg C with 1 deg scale divisions).
8. Domestic Cold Water: 0 deg to 100 deg F with 2 deg scale divisions (minus 18 deg to 38 deg C with 1 deg scale divisions).

THERMOMETERS

Case: Die-cast, aluminum finished in baked epoxy enamel, glass front, spring-secured, 9 inches long.

Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Tube: Red reading, organic liquid-filled magnifying lens.

Scale: Satin-faced, non-reflective aluminum, with permanently etched markings.

Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.

DIAL-TYPE INSERTION THERMOMETERS

Type: Bimetal stainless steel case and stem, 1-inch diameter dial, dust and leakproof, 1/8-inch diameter tapered-end stem with nominal length of 5 inches.

THERMOMETER WELLS

Brass or stainless steel, pressure-rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

PRESSURE GAUGES

Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube-type, bottom connection.

Case: Drawn steel or brass, glass lens, 4-1/2-inch diameter.

Connector: Brass, 1/4-inch NPS.

Scale: White coated aluminum, with permanently etched markings.

Accuracy: Plus or minus 1% of range span.

Range: Conform to the following:

9. Vacuum: 30 inch Hg to 15 psi
10. All fluids: 2 times operating pressure

PRESSURE GAUGE ACCESSORIES

Siphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

TEST PLUGS

Test plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and two self-sealing valve-type core inserts suitable for inserting a 1/8 inch O.D. probe assembly from a dial-type thermometer or pressure gauge. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.

Core Material: Conform to the following for fluid and temperature range:

11. Air, Water, Oil, and Gas, 20 deg to 200 deg F (minus 7 deg to 93 deg C): Neoprene
12. Air and Water, minus 30 deg to 275 deg F (minus 35 deg to 136 deg C): EPDM

Ranges of pressure gauge and thermometers shall be approximately two times systems operating conditions.

PART 3 - EXECUTION

THERMOMETER INSTALLATION

Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

INSTALLATION OF PRESSURE GAUGES

Install pressure gauges in piping tee with pressure gauge valve, located on pipe at most legible position.

Install pressure gauges at top of hot and cold water risers.

Install pressure gauge at incoming water service.

Pressure Gauge Needle Valves: Install in piping tee with snubber.

INSTALLATION OF TEST PLUGS

Test Plugs: Install in piping tee where indicated, located on pipe at most legible position. Secure cap.

1. Install test plugs adjacent to each piping point where a temperature sensing device is required by control specifications.

Test Kit: Provide test kit consisting of one pressure gauge, gauge adapter with probe, two bimetal dial thermometers, and carrying case. Turn over to Owner at completion of job and obtain written receipt. Forward copy of receipt to A/E as part of close-out documents.

ADJUSTING AND CLEANING

Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

CONNECTIONS

Piping installation requirements are specified in other sections of Division 22. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

Install meters and gauges piping adjacent to machine to allow servicing and maintaining of machine.

END OF SECTION 22 0519

SECTION 22 0523 GENERAL-DUTY VALVES FOR PLUMBING PIPING**PART 1 - GENERAL****REFERENCE**

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

QUALITY ASSURANCE

Valve Bodies, Shells and Seats: Factory-tested.

Standard for 125 psi and 150 psi saturated steam rated valve pressure containing parts: ASTM B62.

Standard for 200 psi and 300 psi valves with metallic seats: ASTM B61.

Iron Body Valves

1. Pressure-Containing Parts: ASTM A126, Grade B.
2. Face-to-Face and End-to-End Dimensions: ANSI B16.10.
3. Design, Workmanship, Materials, Testing: MSS-SP-70, 71.
4. Use domestically manufactured valves where required by a Buy American Plan.

Butterfly Valves

5. Face-to-Face and End-to-End Dimensions: MSS-SP-67.

Valve Stems: ASTM B371, Alloy C69400; ASTM B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.

Pressure Castings: Free of impregnating materials.

Manufacturer's name or trademark and working pressure stamped or cast into body.

42 USC 300G: The Reduction of Lead in Drinking Water Act.

SUBMITTALS

Shop Drawings: Schedule indicating proposed valve for each application.

Product Data

6. Manufacturer's cut sheets and/or literature.
7. Performance data.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information

8. Valve chart indicating valve identification number, valve type, service, manufacturer and model number, and location of valve.

9. Operating and maintenance manuals.

JOB CONDITIONS

Coordinate the exact application and location of this work with the work of other trades prior to installation within various piping systems. Verify all positions and elevations. Provide additional offsets and section of piping as required to position valves for equipment clearance and accessibility as well as system and valve operational conditions.

Valve manufacturer to verify indicated figure or model numbers so that selection meets required description and conditions specified. Specified data for valve shall take precedence over indicated figure or model number. Provide proper seat and seal material for applicable temperature, pressure and service indicated for each valve application.

PART 2 - PRODUCTS**ACCEPTABLE MANUFACTURERS**

Gate, Butterfly, Check & Ball Valves: Stockham, Nibco, Hammond, Crane, Jenkins, Powell, Milwaukee, Homestead, Apollo, Mueller, A. Y. McDonald.

DOMESTIC WATER VALVES

For gauge valves within steel or copper lines of 1/8 inch or 1/4 inch size, threaded or solder, 150 psig steam or 300 psig w.o.g., union bonnet, integral seat, renewable seat and disc, bronze globe valve conforming to MSS-SP-80, ASTM B-62.

For service valves within steel piping of 1/4 inch through 2-1/2 inch size; two-piece ball valve with bronze FNPT threaded ends, lever handle, stainless steel ball and stem, Class 150 SWP-600 w.o.g.

For service valves within 1/4 inch through 2 inch size copper piping, similar to above except for solder ends.

For service valves in copper piping 2-1/2 inch through 4 inch size; 200 psi w.o.g. butterfly valve, wafer body, suitable for dead-end and isolation service.

For service valves within steel piping of 3 inch or above; 200 psig w.o.g butterfly valves, installed between standard ANSI Class 125/150 flanges, suitable for dead-end and isolation service without use of downstream flanges. 3 inch through 6 inch size valves to have manual stem position, lock to prevent tampering, notched plate and latching handle while valves of 8 inch size and above shall have manual enclosed weatherproof handwheel actuators with gear box and position indicator window, and all meeting the following criteria.

	<u>Part</u>	<u>Specifications</u>
1.	Stem	Stainless Steel, ASTM A-582 Type 410
2.	Collar Bushing	Brass, ASTM B-124
3.	Stem Seal	EPDM
4.	Body Seal	EPDM

	<u>Part</u>	<u>Specifications</u>
5.	Nameplate	Aluminum
6.	Upper Bushing	Copper CDA 122
7.	Liner	EPDM
8.	Disc	Al. Bronze, ASTM B-148 Alloy 954/955
9.	Lower Bushing	Copper CDA 122
10.	Body (Lug)	Ductile iron, ASTM A-536

For check valves within horizontal steel or copper lines through 2 inch size, bronze check valve with teflon disc, threaded ends, Class 150 swp-300 w.o.g., as follows:

	<u>Part</u>	<u>Material</u>	<u>Specifications</u>
1.	Body	Bronze	ASTM B62
2.	Cap	Bronze	ASTM B62
3.	Lever	Bronze	Commercial
4.	Disc	Teflon	
5.	Disc Holder	Brass	ASTM B16 1/4 inch & 1/2 inch
		Bronze	ASTM B62 3/4 inch to 2 inch incl
6.	Pin	Stainless Steel	Commercial
7.	Plug	Bronze	ASTM B16
8.	Retaining Ring	Stainless Steel	Commercial
9.	Disc Nut	Bronze	Commercial

Optional check valves for vertical type of installation within steel or copper lines, similar to that of above sub-paragraph G, except vertical lift up-flow, bronze with threaded ends.

For check valves within steel piping of 2-1/2 inch size and above, for vertical up-flow applications, Class 250 w.o.g flanged iron body flat style silent check; and for horizontal applications, Class 125 w.o.g flanged iron body horizontal swing check.

For check valves within copper piping of 2-1/2 inch through 4 inch size, Class 300 w.o.g bronze for horizontal or vertical installation with solder ends.

NATURAL GAS SYSTEM

All types of valves used shall be local utility company as well as AGA approved for the service and pressure intended.

Refer to Division 22 Section "Facility Natural Gas System".

OPERATORS

Provide operators for valves 4 inch and larger located in mechanical spaces installed 8 feet or higher above floor.

Provide chain lever or chain sprocket operator with sufficient chain to reach within 5 feet of floor.

Remote operator accessories are to be by same manufacturer as valve.

PART 3 - EXECUTION

INSTALLATION

Installation shall be in accordance with manufacturer's written instructions, and all valves must be suitable for the service intended.

Provide service (isolation) valve at every piece of equipment. Service valves to be positioned in a manner to allow for ease of service and removal of equipment with minimum disruption of the piping system.

All shut-off valves in plumbing water systems 2 inch and smaller shall be ball-type.

END OF SECTION 22 0523

SECTION 22 05 29 - HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

Refer to Division 22 Sections “Vibration Controls for Plumbing Piping and Equipment” for additional requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Pipe hanger and supports.
2. Pipe and equipment anchors.
3. Piping guides/fabricated hard pipe loops/manufactured flexible hose and assemblies.
4. Pipe sleeves.

QUALITY ASSURANCE

Pipe Hanger Standards: Manufacturers Standardization Society (MSS) SP-58, SP-89, and SP-69, as referenced.

SMACNA.

NPFA

SUBMITTALS

Shop Drawings

5. Miscellaneous steel layout. Indicate all point loads where miscellaneous steel is supported by structural members.
6. Brace spacing, guide locations, hard piping loop locations/fabrication and calculations (potable water), manufactured flexible metal hose expansion compensators (non-potable water and gas systems), layout, anchor force calculations, connection method and details.

Product Data: Catalog cuts and performance data.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information

7. Operating and maintenance data.
8. Warranty.

PRODUCTS

ACCEPTABLE MANUFACTURERS

Pipe Hangers (Non-Corrosive Environment): Elcen Metal Products Co., B-Line Systems Inc., Carpenter and Paterson Inc., Anvil.

Stainless Steel Pipe Hangers (Corrosive Environment): American Stainless & Supply, FM Stainless, National Pipe Hanger Corp.

Concrete Anchors: Phillips, Hilti.

Insulated Pipe Supports: Pipe Shields Inc., Anvil, Power Piping.

Pipe and Equipment Anchors

9. Manufactured – Mason Industries or approved equivalent.
10. Shop-fabricated.
11. Field-fabricated.

Piping Guides, Flexible Metal Hose Assemblies and Fabricated Hard Piped Loopd

12. Guides - Mason Industries or approved equivalent.
13. Flexible Metal Hose – Metraflex or approved equivalent. For all non-potable water/sanitary, storm, natural gas systems; **NOT acceptable for potable water.**
14. Fabricated – Hard piped type L copper expansion loops for potable water.

Sleeves

15. Shamrock Industries, "Crete-sleeve" plastic hole forms.
16. Proset Systems Inc., "Proset" fire-safe pipe penetrations.
17. Shop for field fabricated.

Sleeves, Pre-Manufactured Fire and Smoke Wall Barrier: Pipe Shields, Inc., or equal.

PIPE HANGERS

General

18. Materials, Design and Manufacture: MSS SP-58.
19. Fabrication and Installation: MSS SP-89.
20. Selection and Application: MSS SP-69.
21. Hangers Used Directly on Copper Pipe: Copper or cadmium-plated.
22. All Other Hangers and Channels, Angles, and Supporting Steel: Cadmium-plated or galvanized, except in corrosive environment.
23. All Hanger Rods of Continuous Thread Type: Electro-galvanize or cadmium-plate after threads are cut, except in corrosive environment.
24. Galvanize all structural steel, angles, rods, channels, and hardware that are not provided with a rustproof finish, except in corrosive environment.
25. Corrosive Environment: All hangers, threaded rods, nuts, etc. to be 316 stainless steel.
26. Screw Threads on Hangers and Fittings: Conform to Class 2A and 2B of ANSI B1.1.

Pipe Hangers for Insulated and Bare Pipe

27. Insulated Pipe:

MSS	B-Line	ANVIL
1	B3108	260
3	B3144	295

28. Bare Pipe:

MSS	B-Line	ANVIL
1	B3100/02 C	260
3	B3144/46	295
4	B3142	216

29. Hangers for insulated pipe to be oversized to accommodate insulation, protection shields, and/or saddles.

Pipe Hangers in Other Situations: See MSS-SP-69.

Pipe Hangers on Insulated Lines

- 30. Pipe Sizes 2 Inch and Less: Use pipe covering shield to protect insulation.
 - a. Minimum shield length: 12 inch
 - b. Minimum shield thickness: 18 ga.
- 31. Pipe Sizes 2-1/2 Inch and Larger: Use insulated pipe supports.

Hanging Rollers, Cast Iron

- 32. MSS Type 41.
- 33. B-Line B3114.
- 34. Anvil 171.

Supporting Roller, Cast Iron

- 35. MSS Type 44, 45, or 46.
- 36. B-Line B3117SL, B3117, B3118SL or B3119.
- 37. Anvil 271, 277, or 274.

Insulated Pipe Supports

- 38. Protect all insulated pipe at point of support by 360-degree pre-insulated pipe supports.
- 39. Utilize 100 psi, waterproofed calcium silicate fully encased in sheet metal shield for hot pipe applications and cellular glass with ASJ vapor barrier jacket for cold pipe applications.
- 40. Insert same thickness as adjoining pipe insulation.
- 41. Use shield length and minimum sheet metal gages indicated:

Pipe Size	Shield Length	Minimum Gage
2-1/2 - 6 inch	6 inch	20
8 - 10 inch	9 inch	16
12 - 18 inch	12 inch	16
20 inch and up	18 inch	16

42. Pipe Supported on Rod Hangers: Pipe Shields, Inc., Models A1000, A2000, A3000, A4000, and A9000.
43. Pipe Supported on Flat Surfaces: Pipe Shields, Inc., Models A1000, A2000, A5000, A6000, and A7000.
44. Pipe Supported on Pipe Rolls: Pipe Shields, Inc., Models A3000, A4000, A5000, A6000, and A8000.

Concrete Inserts

45. Continuous Slot Inserts
 - a. Anvil Power Struct PS349.
 - b. B-Line Figure B32I.
46. Individual Inserts
 - a. Anvil Figure 282, or 281.
 - b. Do not exceed manufacturer's recommended load on any insert.

Beam Clamps

47. B-Line Figure B3054 or B3055.
48. Anvil Figure 133, 218, 228, 292.

Attachment to "Z" Type Purlin

49. PHD Figure 290.
50. Michigan No. 315.

Attachment to Wood Structure

51. Provide angle clips and lag screws or side beam connectors: PHD figure 920 or 905.
52. Strap-type hangers not acceptable.

Pipe Hangers for Stainless Steel Pipe

53. Split ring type or type as recommended by pipe manufacturer.
54. Hanger shall be stainless steel or have a plastic coating to protect pipe from galvanic corrosion.

PIPE SLEEVES AND SEALANTS

Sleeves - General

55. Sleeve all piping passing through walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping.
56. Box out openings larger than 14 inch diameter.

Sleeves, Steel Pipes: Use in following locations:

57. Fire-rated and smoke-rated construction.
58. Structural steel members (when approved by A/E).
59. Floors: Galvanized.
60. Concrete walls.
61. Mechanical rooms, tunnels, and stairwells.
62. Polyethylene hole forms (Crete-Sleeve): Optional use in poured concrete walls and floors.

Sleeves for Future Work: Same as for this work.

Sleeves in Other Locations: As detailed. If not detailed, use 18 ga galvanized sheet metal or 24 ga spiral duct.

Sleeves for Plastic Piping

- 63. Provide pipe sleeves for all plastic-type piping (PVC, CPVC and polypropylene) at fire-rated assembly and floor slab penetrations.
- 64. Size sleeves per following schedule:

Pipe Size (In.)	Sleeve Size (In.)	Extension Beyond Barrier (Ft.)
1 or less	3	2
1-1/4 to 2	4	2
3	5	3
4	6	4

- 65. Extend sleeve listed distance beyond wall or floor on both sides.
- 66. Insulate plastic pipe with minimum 1 inch thick calcium silicate or 2400 deg F aluminasilica within sleeve length.

Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc.

- 67. Bare Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
- 68. Insulated Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
 - a. Other insulated pipes: Type CS.
- 69. Plastic Pipe through Fire Walls and Floors: Type WFB with 1-inch-thick calcium silicate insulation encased in metal sleeve extension 2 ft. either side of fire-rated walls or floor.

Sleeve Sizes

- 70. Length: Ends flush with finished surfaces.
- 71. Diameter
 - a. Minimum 3 inch.
 - b. Minimum 1 inch larger than pipe and pipe insulation.
 - c. In concrete, 1-1/2 inch larger than pipe.
 - d. Diameter suitable for construction tolerances and to receive sealant, when indicated.

Sealants: Seal annular space around piping.

- 72. For fire- and smoke-rated floors, walls and partitions: Use UL-listed firestopping material that maintains fire-rated wall and floor integrity.
 - a. Provide proper material for each typical application as described by manufacturer.
- 73. Acceptable Manufacturers
 - a. Base
 - 1) Dow Corning "Fire Stop".
 - 2) Nelson "Flameseal".
 - 3) 3M "Fire Barrier".
 - 4) Pipe Shields Inc., Model WFB, DFB, or QDFB Series.
 - 5) Proset Systems.
- 74. For Non-Rated Walls and Partitions: Use mineral or glass fiber insulation.

75. For Exterior and Foundation Walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

ROOF MOUNTED PIPE SUPPORTS

Roof Pipe Rail Base Assembly

76. Pipe support assembly to include galvanized steel counter flashing, treated wood nailer, galvanized steel slide channel, galvanized continuous threaded rods or reinforced strut, cast iron pipe roller, galvanized washers and nuts, removable retainer bracket.
77. Manufactured by Pate, RPS or equal.
78. Closely coordinate locations for pipe support assembly with joist or beam spacing and maximum limits between supports listed in this specification section.
79. Attach piping to roof pipe rail assembly.

Roof Pipe Support Assembly

80. Pipe support assembly to include 10-1/2-inch long galvanized steel Unistrut channel bonded into a block of UV-rated, flexible, closed-cell polyethylene foam; assembly to be ERICO Pipe Pier with Eristrut accessories, Hatch Rail Company, or equal.
81. Closely coordinate locations for pipe support assembly with existing joist spacing and maximum limits between supports listed in this specification section.
82. Attach piping to roof pipe support Unistrut using galvanized clamps and screws.

EXECUTION

GENERAL

Structural Considerations

83. Steel or concrete roof/floor system, including slabs or roof deck shall be in place and complete before installation of any mechanical piping system.
84. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe Hanger Loading."
85. Do not attach hangers to steel roof deck.
86. Do not attach hangers to bottom of concrete filled floor deck, except by permission of A/E.
87. Attach hangers to beams whenever possible.
88. Provide delegated design fabrication drawings and calculations for all piping expansion guides, anchors, and sway control forces of any attachment to building structural for review of each piping system.

Install piping systems with approved hangers and supports to prevent sagging, warping and vibration of piping systems. Install pipe hangers and supports to allow for expansion, contraction, and drainage of piping. Place hangers and supports close to valves, vertical riser drops, heavy equipment, specialties, and each piping change of direction. At first elbow of equipment run out piping risers and horizontal piping within ten (10) feet of all circulating basemounted pumps having four (4) inch or larger piping connections, shall have piping at same supported with flexible spring hangers.

Connect hanger rods to approved "I" beams or channel clamps, concrete inserts or expansion shields. Provide all concrete inserts and structural members required for the proper support of the piping systems with proper approved distribution of weight.

Do not weld to structural steel without special permission of the A/E. Do not use wooden plugs for any form of fastening.

Space pipe hangers for horizontal piping as indicated, unless otherwise directed. Provide pipe hangers with the minimum rod sizes shown, complete with full length machined threads, and adjusting and lock nuts.

Run piping substantially as shown on the Drawings. Run pipe as directly as possible, avoiding unnecessary offsets and interferences, maintaining maximum headroom and concealed in all rooms or areas, except mechanical equipment rooms, unless otherwise noted. Coordinate exact locations of mains, risers and runouts in the field with the various Trade Contractors and the A/E.

Arrange pipe lines to give ample room for pipe insulation. Run piping parallel to or at right angles with the lines of the building.

Assemble and install piping without undue strain and stress and with provision for expansion, contraction and structural settlement. Do not cut or notch structural members unless adequate provision is made with the approval of the A/E. Anchors shall be approved by the A/E before they are used.

PIPE HANGERS AND SUPPORTS

For standard steel and copper piping, locate hangers at each change of direction as well as within remaining lengths spaced at or within following maximum limits:

Pipe Diameter	Standard Steel Liquid	Standard Steel Vapor	Copper Liquid	Copper Vapor
1/2 inch	7 ft.	8 ft.	5 ft.	6 ft.
3/4 inch	7 ft.	9 ft.	5 ft.	7 ft.
1 inch	7 ft.	9 ft.	6 ft.	8 ft.
1-1/4 inch	7 ft.	9 ft.	7 ft.	9 ft.
1-1/2 inch	9 ft.	12 ft.	8 ft.	10 ft.
2 inch	10 ft.	13 ft.	8 ft.	11 ft.
2-1/2 inch	11 ft.	14 ft.	9 ft.	13 ft.
3 inch	12 ft.	15 ft.	10 ft.	14 ft.
4 inch	14 ft.	17 ft.	12 ft.	16 ft.
6 inch	17 ft.	21 ft.	14 ft.	20 ft.
8 inch	19 ft.	24 ft.	16 ft.	23 ft.
10 inch	22 ft.	26 ft.	18 ft.	25 ft.

For Schedule 40 or Schedule 80 PVC or CPVC piping, locate hangers at each change of direction and space at or within the following maximum limits:

PVC or CPVC

Pipe Diameter	Liquid	Vapor
1/2 - 1 inch	3 ft.	3 ft.
1-1/4 - 2 inch	4 ft.	4 ft.
2-1/2 - 3 inch	4 ft.	4 ft.
3-1/2 - 4 inch	4 ft.	4 ft.
5 - 8 inch	4 ft.	4 ft.

Provide a hanger within one (1) foot or less of each horizontal elbow and valves that are above three (3) inches in size. If spacing between horizontal elbows (or plugged tees used as elbows) is less than six (6) feet, provide only one (1) hanger located between the elbows. No hanger size or requirements shall ever be less than the minimum recommended by the Mechanical Contractor's Association of America, Inc.

For cast iron pressure piping, space maximum 12 feet o.c.

89. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.

For cast iron soil piping, space maximum 10 feet o.c.

90. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.

For piping of other materials, space hangers according to manufacturer's recommendations.

Pipe Hanger Loading

91. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 inch	610 lb.
1/2 inch	1,130 lb.
5/8 inch	1,810 lb.
3/4 inch	2,710 lb.

92. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

Trapeze Hangers

93. Suspend trapeze hangers from concrete inserts of approved structural clips.
94. Construct trapeze hangers of galvanized angle iron, channels or other structural shapes with flat surfaces for point of support.

Vertical Pipe Supports

95. Support all vertical pipe runs in pipe chases at base of riser.
96. Support pipes for lateral movement with clamps or brackets.

Concrete Inserts

97. Provide individual or continuous slot concrete inserts for use with hangers for piping and equipment exposed in finished areas, and as required.
98. Provide concrete inserts in time for installation in concrete.

ANCHORS

All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase.

Pipe Anchors

99. Provide as indicated and required to permit complete installation of system.
100. Do not anchor piping to plaster or gypsum wallboard partition walls.
101. Provide anchoring devices at locations indicated.
102. Do not use powder driven fasteners, expansion nails, or friction spring clamps.

SLEEVES

Coordinate location of any opening in structural systems with A/E and other trade contractors.

Maintain rating of fire- and smoke-rated construction.

Set sleeves plumb or level, in proper position, tightly fitted into the work.

Set all sleeves with ends flush with finished wall and ceiling surfaces.

Seal around all pipes and use firestopping for all mechanical penetrations through floor slabs, fire rated walls and partitions, and at each floor level in vertical mechanical service shafts.

103. Install firestopping as described in manufacturer's installation instructions.

Seal around all sleeves.

Fill openings made by others for piping penetrations, with same construction as work opening is in, or construction of equivalent fire or smoke rating.

MISCELLANEOUS STEEL

Piping Contractor (or Plumbing Contractor, as applicable) to provide all miscellaneous steel as required to accommodate pipe supports and hangers.

Provide Shop Drawings detailing miscellaneous steel layout and connection to structural members. Indicate all point loads where miscellaneous steel is supported by structural members.

All miscellaneous steel to be galvanized steel, except in corrosive environments where stainless steel shall be utilized. Repair galvanized steel at field cuts and connections.

END OF SECTION 22 0529

SECTION 22 05 48 - VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.
- B. Refer to Division 22 Sections "Hangers and Supports for Plumbing Piping and Equipment" for additional requirements.

1.2 DESCRIPTION OF WORK

- A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.
- B. Description of Systems
 - 1. Vibration isolators and hangers.
 - 2. Isolation pads.
 - 3. Resilient penetration sleeve/seal and lateral guides.
 - 4. Flexible pipe connectors.

1.3 QUALITY ASSURANCE

- A. Comply with ASHRAE, ASTM, and AASHO standards.
- B. A Practical Guide to Noise and Vibration Control for HVAC Systems, by M.E. Schaffer, and published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., Atlanta, GA 30329.
- C. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate equipment plan dimensions with size of housekeeping pads.
- D. Provide vibration isolators of the appropriate sizes and proper loading to meet the specified deflection requirements.
- E. Supply and install any incidental materials needed to meet the requirements stated herein, even if not expressly specified or shown on the Drawings, without claim for additional payment.
- F. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.
- G. Should any rotating equipment cause excessive noise or vibration, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

1.4 SUBMITTALS

- A. All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Division 01 Section "Submittals".
- B. Shop Drawings
 - 1. All equipment items specified.
 - 2. Spring Isolators
 - a. Spring diameter.
 - b. Deflection.
 - c. Compressed spring height.
 - d. Solid spring height.
 - e. Point location of each isolator.
 - f. Load at each point.
 - g. Field static deflection.
 - h. Horizontal loading and bolt requirements.
 - i. Indicate all bases and rail clearances.
 - 3. Special details necessary to convey complete understanding of the work to be performed.
- C. Product Data
 - 1. A complete description of products to be supplied, including product data, dimension, specifications, and installation instructions.
 - 2. Detailed selection data for each vibration isolator supporting equipment, including:
 - a. The equipment identification mark.
 - b. The isolator type.
 - c. The actual load.
 - d. The static deflection expected under the actual load.
 - e. Specified minimum static deflection.
 - f. The additional deflection to solid under actual load.
 - g. The ratio of spring height under actual load to spring diameter.
- D. Samples: Not required for review.
- E. Reference Submittals: Not required for review.
- F. Contract Closeout Information
 - 1. Operating and maintenance data.
 - 2. Guarantees.

1.5 SPEED AND BALANCE REQUIREMENTS FOR ROTATING EQUIPMENT

- A. Rotating mechanical equipment shall not operate at speeds in excess of 80% of their true critical speed.
- B. Vertical vibration of rotating equipment shall not be greater than the levels indicated. The vibration shall be measured on the equipment or steel frame equipment base when the equipment is mounted on its vibration isolation mounts. If the equipment has an inertia base, the allowable vibration level is reduced by the ratio of the equipment

weight alone to the equipment weight alone to the equipment weight plus the inertia base weight.

Equipment Speed	Vibration Displacement (MILS Peak-to-Peak)
Under 600 rpm	4
600 to 1000 rpm	3
1000 to 2000 rpm	2
Over 2000 rpm	1

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Sound and Vibration Control Devices
 - 1. Amber/Booth Co.
 - 2. Korfund Dynamics Corp.
 - 3. Mason Industries, Inc.
 - 4. Peabody Noise Control Inc.
 - 5. Vibration Mountings & Controls, Inc.

- B. Sealants for acoustical purposes as described in this section are to be one of the non-setting sealants indicated below or an approved equivalent.
 - 1. Acoustical sealant D.A.P.
 - 2. BR-96 Pecora.
 - 3. Acoustical sealant Tremco.
 - 4. Acoustical sealant U.S.G.

2.2 GENERAL

- A. Provide piping and equipment isolation systems as specified and/or as indicated on Drawings.

- B. Select vibration isolators in accordance with weight distribution to produce reasonably uniform deflection.
 - 1. Provide vibration isolation equipment including mountings, hangers, structural steel bases, welded concrete pouring forms and flexible pipe connectors from a single manufacturer or vibration isolation equipment supplier.

- C. Coat all vibration isolation systems exposed to moisture and an outdoor environment as follows:
 - 1. All steel parts to be hot-dip galvanized.
 - 2. All bolts to be cadmium-plated.
 - 3. All springs to be cadmium-plated and neoprene-coated.

2.3 VIBRATION ISOLATORS AND HANGERS

A. Equipment Mounting Isolators

1. Type 1 Isolators: Double-deflection neoprene mountings.
 - a. Minimum static deflection: 0.35 inch.
 - b. Steel top plate and base plate completely embedded in color-coded neoprene stock.
 - c. Friction pads both top and bottom to eliminate the need for bolting.
 - d. Where bolting is required, provide bolt holes in base plate and tapped holes in top plate.
 - e. Mason Industries, Type ND; or Vibration Mountings, Type RD.
2. Type 2 Isolators: Spring-type.
 - a. Free-standing and laterally stable, without any housings, snubbers, or guides.
 - b. Provide 1/4-inch neoprene acoustical friction pads between baseplate and support.
 - c. Provide mounting with leveling bolts that must be rigidly bolted to equipment.
 - d. Spring diameter: Not less than 0.8 of compressed height of spring at rated load.
 - e. Spring to have minimum additional travel to solid equal to 50% of rated deflection.
 - f. Mason Industries, Type SLF; or Vibration Mountings and Controls, Type II, Series A.
3. Type 3 Isolators: Spring-type with vertical limit stop.
 - a. Equal to Type 2 isolator, except that mountings shall incorporate a resilient vertical limit stop to prevent spring extension during weight changes.
 - b. Installed and operating heights to be the same.
 - c. Maintain a minimum clearance of 1/2-inch around restraining bolts and between housing and spring so as not to interfere with spring action.
 - d. Limit stops to be out of contact during normal operations.
 - e. Mason Industries, Type SLR; or Vibration Mountings and Controls, Type AWR.
4. Type 4 Isolators: Neoprene wafer pads.
 - a. Durometer or hardness to suit application.
 - b. Square waffle pattern on 1/2-inch centers.
 - c. Standard pads thickness: 5/16 inch; provide optional pad thickness to suit application.
 - d. Provide natural rubber, hycar, butyl, silicone or other elastomers as prior approved material.
 - e. Provide type "W" adhesive, both sides, for all non-bolted applications.
 - f. Mason Industries, Type "W", "WMW", "WML", or "WM"; or Vibration Mountings, Type VM.

B. Vibration Hangers

1. Type 5 Isolators: Steel spring-type hanger.
 - a. Steel spring and 0.3 inch deflection neoprene element in series.
 - b. Neoprene element to be molded with a rod isolation bushing that passes through the hanger box.
 - c. Springs to have a minimum additional travel to solid equal to 50% of rated deflection.

- d. Spring diameters and hanger box lower hole sizes shall be large enough to permit hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring.
- e. Mason Industries, Type 30N; or Vibration Mountings, Type RSH.
2. Type 6 Isolators: Precompressed steel spring-type hanger.
 - a. Equal to Type 5, except spring is precompressed to rated deflection, so piping or equipment are maintained at a fixed elevation during installation.
 - b. Provide a release mechanism to free spring after installation is complete and hanger is subjected to its full load.
 - c. Mason Industries, Type PC30N; or Vibration Mountings, Type RSHP.
3. Type 7 Isolators: Steel spring in neoprene cup-type hanger.
 - a. Steel spring located in a neoprene cup manufactured with a grommet to prevent short circuiting of hanger rod.
 - b. Provide steel washer in cup to properly distribute load on neoprene and prevent its extrusion.
 - c. Spring diameters and hanger box lower hole sizes shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring.
 - d. Spring to have a minimum additional travel to solid equal to 50% of rated deflections.
 - e. Provide an eye bolt on spring end and provision to attach housing to flat iron duct straps.
 - f. Mason Industries, Type W30; and Vibration Mountings, Type SHP.
4. Type 8 Isolators: Double-deflection neoprene-type hanger.
 - a. Minimum static deflection: 0.40 inch
 - b. Elements to be color-coded neoprene stock for easy identification of rated load capacity.
 - c. Provide hanger for direct attachment to flat iron duct straps.
 - d. Mason Industries, Type WHD; or Vibration Mountings and Controls, Type RHD.

2.4 ISOLATION PADS

- A. Type IP1: Field-assembled for equipment mounting.
 1. Construction: 4-inch-thick, 3,000 psig, concrete pad poured over a 4-inch precompressed glass fiber isolation pad.
 2. Glass Fiber Pads
 - a. Inorganic inert material with loading capacity up to 500 psig.
 - b. Covered with an elastomeric coating to increase vibration dampening and to protect media.
 3. Concrete Caps
 - a. 9 sq. ft. in area or less: Reinforced with 6 x 6 x 6 x 6 mesh.
 - b. Larger than 9 sq. ft. in area: Reinforced with No. 4 rebar 12 inch o.c. each way.
 4. Provide concrete caps with beveled edges.
- B. Type IP2: Field-assembled for equipment isolation bases.
 1. Isolation Bases: Field-assembled concrete pads provided by General Contractor. See Division 03 and structural drawings.
 2. Provide isolation bases with an isolation joint to isolate pad from floor slab. See Division 03.

3. Make isolation bases 1 ft. larger each way than equipment mounting base or skid, and size in accordance with approved equipment shop drawings.
4. Make isolation bases minimum 1 ft.- 2 inch thick with top of pad 4 inches above finished floor slab.
5. Reinforce isolation bases as indicated in specifications and drawings.
6. Type IP2 isolation pads provided by General Contractor and coordinated by mechanical work.

2.5 RESILIENT PENETRATION SLEEVE/SEAL

- A. Resilient penetration sleeve/seals are to be field-fabricated from a pipe or sheet metal section that is 1 inch larger in each dimension than the penetrating element and is used to provide a sleeve through the construction penetrated.
- B. Sleeve to extend 1 inch beyond the penetrated construction on each side. The annular space between the sleeve and the penetrating element to be packed tightly with fire-stop-rated glass fiber or mineral wool to within 1/4 inch of the ends of the sleeve.
- C. The remaining 1/4 inch space on each side is to be filled with acoustical sealant to form an airtight seal. The penetrating element is to be able to pass through the sleeve without contacting the sleeve.
- D. Alternatively, prefabricated fire-rated sleeves accomplishing the same result are acceptable.

2.6 RESILIENT LATERAL GUIDES

- A. These units shall be the standard product of the vibration isolation mounting manufacturer, incorporating neoprene isolation elements which are specifically designed for providing resilient lateral bracing of vertically rising ducts or pipes.
- B. Resilient lateral guides shall be one of the following products:
 1. Mason Industries, Type ADA.
 2. Peabody Noise Control, Type RGN.
 3. Vibration Mounting & Controls, Type MDPA.
 4. Approved equal guides (custom made) by Amber/Booth or Korfund Dynamics.

2.7 FLEXIBLE PIPE CONNECTORS

- A. Spherical Rubber Connector
 1. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners, and Kevlar tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable.
 2. Sizes 2-inches and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16 inches to 24 inches may be single sphere.
 3. Sizes 3/4 inch to 1-1/2 inch may have threaded two-piece bolted flange assemblies, one sphere and cable retention.

4. Connectors shall be rated at 250 psi up to 170 deg F with a uniform drop in allowable pressure to 215 psi at 250 deg F in sizes through 14 inches. 16 inches through 24 inches single sphere minimum ratings are 180 psi at 170 deg F and 150 psi at 250 deg F. Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1.
5. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.
6. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored piping locations where the manufacturer determines the installation exceeds the pressure requirement without control rods.
7. If control rods are used, they must have 1/2-inch thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi maximum on the washer area.
8. Submit two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.
9. All expansion joints shall be installed on the equipment side of the shut-off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR, or SFU and Controls Rods CR as manufactured by Mason Industries, Inc. or approved equal.

B. Flexible Pipe Hoses: Type FPH, stainless-steel-type.

1. Stainless steel braid and carbon steel fittings.
2. Sizes 3-inch and larger: Flanged.
3. Sizes 2-1/2-inch and less: Male nipples.
4. Mason Industries, Type BSS; or Vibration Mountings, Type MFP.

PART 3 - EXECUTION

3.1 APPLICATION

A. General

1. Install all vibration control equipment in accordance with manufacturer's installation instructions and as specified.
2. All vibration control equipment shall be selected as specified and sized in accordance with weight distribution, pull or torque imposed by shop-drawing-approved equipment being isolated.
 - a. Minimum static deflections may be revised subject to prior approval.
 - b. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected on the basis of rated deflection are not acceptable and will be disapproved.
 - 1) Provide revised vibration control equipment to match revised or substituted equipment.
3. Locations of all vibration isolation equipment shall be selected for ease of inspection and adjustment as well as for proper operation.
 - a. All vibration isolators to be aligned squarely above or below mounting points of the supported equipment.

- b. Isolators for equipment with bases to be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
- c. Locate isolators to provide stable support for equipment, without excess rocking. Consideration to be given to the location of the center of gravity of the system and the location and spacing of the isolators.
- d. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plate shall rest entirely on the pad.
- e. Hanger rods for vibration isolated support to be connected to structural beams or joists, not from the floor slab between beams and joists. Provide intermediate support members as necessary.
- f. Vibration isolation hanger elements to be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360 degrees about the rod axis without contacting any object.
- g. Parallel running pipes may be hung together on a trapeze which is isolated from the building. Isolator deflections must be the largest determined by the provisions for pipe isolation. Do not mix isolated and non-isolated pipes on the same trapeze.
- h. No pipes or equipment are to be supported from other pipes or equipment.
- i. Resiliently isolated pipes are not to contact the building construction or other equipment.
- j. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting pipes.

B. Major Equipment

- 1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on 4-inch-high concrete housekeeping pads. See architectural or structural Drawings for details.
- 2. Flexible pipe connections, are to be installed at all pipe connections to vibration isolated equipment in the positions shown on the Drawings.

C. Pipes

- 1. All piping within three support positions of a connection to a pump, compressor engine, or other rotating type equipment piping is to be supported by means of vibration isolation mounts, resilient pipe guides, and resilient penetration sleeve/seals.
- 2. Where lateral support of pipe risers is required within the specified limits, this is to be accomplished by use of resilient lateral supports.
- 3. Pipes within the specified limits (three support positions) that penetrate the building construction are to be isolated from the building structure by use of resilient penetrating sleeve/seals.
- 4. Drain piping connected to vibration isolated equipment shall not contact the building structure or other non-isolated system unless it is resiliently mounted.

3.2 VIBRATION ISOLATORS

- A. Use Type 1 isolators for equipment mounted on floors other than grade-supported floor slabs.**
- 1. Air compressors, 3 hp or less.
 - 2. Minimum static deflections, 0.35 inch.

- B. Use Type 2 isolators for equipment mounted on floors other than grade-supported floor slabs.
 - 1. Air compressors, 15 hp and larger.
 - 2. All pumps, 30 hp and larger.
 - 3. Minimum static deflections, 1.5 inch.

- C. Use Type 3 isolators for equipment mounted on floors other than grade-supported floor slabs.
 - 1. All boilers.
 - 2. Minimum static deflections, 1.5 inch.

- D. Use Type 4 isolation pads for equipment mounted on grade supported floor slabs.
 - 1. Air compressors.
 - 2. Boilers.
 - 3. Minimum static deflections, 0.3 inch.

- E. Use Type 5 vibration hangers for suspended equipment.
 - 1. Individual runs of piping, 3-inch and smaller.
 - 2. In-line pumps, 2 hp and smaller.
 - 3. Minimum static deflections, 0.3 inch.

- F. Use Type 6 vibration hangers for suspended equipment.
 - 1. Trapeze-type pipe hangers.
 - 2. Individual runs of piping, 4 inch through 6 inch.
 - 3. Inline pumps, 3 hp through 5 hp.
 - 4. Minimum static deflection, 1.5 inch.

- G. Use Type 6 or Type 7 vibration hangers for suspended equipment.
 - 1. Trapeze-type pipe hangers.
 - 2. Individual runs or piping, 8 inch and larger.
 - 3. Minimum static deflection, 2.5 inch.

3.3 ISOLATION PADS

- A. Use Type IP1 isolation pads for equipment mounted on floors other than grade-supported floor slabs.
 - 1. Air compressors, 5 hp through 10 hp.
 - 2. Vacuum pumps, 5 hp through 10 hp.
 - 3. All base-mounted pumps, 25 hp and less.

- B. Use Type IP2 isolation pads for equipment mounted on grade.
 - 1. Boilers.
 - 2. Pump groups where one pad serves two or more pumps.

3.4 FLEXIBLE PIPE CONNECTIONS

- A. Use Type FPC flexible connectors in piping systems.
 - 1. Pump Suction and Discharge
 - a. Exception: When two or more mechanical grooved pipe (Victaulic type) couplings are used at each pump suction or discharge side.
 - 2. Building expansion joints.

- B. Use Type FPH flexible hose in piping systems.
 - 1. Air compressor discharge piping.
- C. Install flexible pipe connections and flexible hoses on equipment side of equipment isolation valves.
- D. Provide flexible connectors and flexible hose to suit the application.
 - 1. Indicate specific applications on shop drawings.

3.5 HORIZONTAL PIPE ISOLATION

- A. First three pipe hangers in the main lines near mechanical equipment shall be Type 8 isolators.
- B. Horizontal runs in all other locations throughout the building shall be isolated by Type 7 isolators.
- C. Floor supported piping shall rest on Type 3 isolators.
- D. All Type 7 isolators, or the first three Type 8 mounts, as noted above, will have same static deflection as specified for the mountings under the connected equipment.
- E. If piping is connected to equipment located in basements and hangs from ceiling under occupied spaces, the first three hangers shall have 0.75 inch deflection for pipe sizes up to and including 3 inch; 1.5 inch deflection for pipe sizes up to and including 6 inch; and 2.5 inch deflection thereafter.
- F. All other hangers and mounts will have a minimum steel spring deflection of 0.75 inch.
- G. Locate hanger as close to overhead supports as is practical.

END OF SECTION 22 05 48

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Piping identification.
2. Valve identification.
3. Equipment identification.

QUALITY ASSURANCE

Piping System Identification: ANSI A13.1-2015, "Scheme for the Identification of Piping Systems."

SUBMITTALS

Shop Drawings: Not required for review.

Product Data: Manufacturer's cut sheets and/or literature.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information: Valve chart showing valve numbers, type, and location.

PART 2 - PRODUCTS

PIPE MARKERS

Conform to ANSI A13.1-2015.

1. Pressure-sensitive vinyl (self-sticking) material.
2. Mechanically Fastened Type: Snap-on or strap-on.
 - a. For dirty greasy, oily pipe where pressure-sensitive markers may not perform satisfactorily.
3. Provide with direction of flow arrows.

4. Size of Letters Legend

<u>Outside Diameter of Pipe or Pipe Covering</u>	<u>Length of Color Field</u>	<u>Size of Letters and Arrows</u>
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inch	24 inch	2-1/2 inch
Over 10 inch	32 inch	3-1/2 inch

VALVE TAGS

Brass or Anodized Aluminum Type

5. Brass: Minimum 19 ga, polished, 1-1/2-inch diameter with following lettering:
 - a. Service: 1/4 inch stamped black filled letters.
 - b. Valve numbers: 1/2 inch stamped black filled letters.
6. Aluminum: 2-inch diameter, 0.032 inch thick, with following lettering:
 - a. Service: 1/4 inch engraved letters.
 - b. Valve numbers: 1/2 inch engraved letters.

Valve Tag Fasteners: 4-ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

EQUIPMENT NAME PLATES

1/16-inch rigid plastic "Setonply," "Emedolite," or bakelite with 4 edges beveled, or engraved aluminum with black enamel background and natural aluminum border and letters.

7. Two 3/8-inch mounting holes.
8. Lettering size: Minimum 1/2-inch high.
9. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

CHART AND DIAGRAM FRAMES

Extruded aluminum with plexiglass or glass windows.

ACCEPTABLE MANUFACTURERS

Pipe, Valve, and Equipment Markers

10. Craftmark Identification Systems.
11. W. H. Brady Co.
12. EMED Company, Inc.
13. Kolbi Industries, Inc.
14. 3M Co.
15. Seton Name Plate Corp.

PART 3 - EXECUTION

VALVE AND EQUIPMENT IDENTIFICATION

Designate all equipment and valves by distinguishing numbers and letters on charts and/or diagrams.

1. Tag and locate following equipment items:
 - a. Valves.
 - b. All items indicated on drawing equipment schedules.

Install tags on all devices with numbers and letters corresponding to charts.

Fasten tags securely to devices with tag fasteners in manner for easy reading.

Attach equipment nameplates in conspicuous location on item of equipment or apparatus such as starters, pumps, and control panels.

2. Secure nameplates with self-tapping screws, or nuts and bolts.

For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

Furnish 4 charts including device number, location (room number, department) and purpose.

3. Mount 1 chart in frame and secure on wall in location directed by Owner.
4. Include remaining 3 sets in "Operation and Maintenance Manuals."

Provide all devices located above ceilings with additional identification.

5. Use access panel markers (metal-tack-style) for acoustical tile ceilings, or engraved plastic style, 3/4 inch square, for mounting on panel door.
6. Coordinate with Owner on identification method and color codes.

PIPE IDENTIFICATION

Soil, waste, and vent piping do not require color coded paint or bands.

Locate pipe markers as follows:

7. Next to each valve and fitting, except on plumbing fixtures and equipment.
8. At each branch or riser take-off.
9. At each passage through walls, floors, and ceilings.
10. At each pipe passage to underground.
11. On all horizontal pipe runs every 20 ft., at least once in each room and each story traversed by piping system.
12. Identify piping contents, flow direction, supply and return.

Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

Where supplementary color identification of medical gas piping is used, paint in accordance with gases and colors indicated in CGA Pamphlet C-9.

All domestic hot water piping using hot water maintenance cable (heat tracing) shall have an identification label of "ELECTRIC HEAT TRACE" on piping insulation.

SERVICE ABBREVIATIONS

General

- 13. DCW Domestic Cold Water
- 14. DHW (___) Domestic Hot Water Supply (indicate temperature)
- 15. DHWR Domestic Hot Water Recirculating
- 16. SCW Soft Cold Water
- 17. PD Pump Discharge -Sump Pump/Sewage Ejector
- 18. G Natural Gas
- 19. A Compressed Air

END OF SECTION 22 05 53

SECTION 22 05 61 - PREPARATION OF PLUMBING SYSTEMS

PART 1 - GENERAL

1.1 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 CLEANING AND PREPARATION FOR SERVICE

- A. Flushing Mains. Immediately upon completion of the water distribution system, test valves to ensure their full opening. Flush the system as follows: Open valve and permit the flow to continue until the water runs clear. Repeat the operation at the next valve and proceed in order to the valve farthest from the source of supply. Use outlets in building to flush the upper ends of mains and service lines. During such flushing operation, the Design-Builder may test the flows from valves and, before final acceptance of the work, make further tests of flows to ascertain that lines are clear.
- B. Interior and Exterior Sterilization of Water Distribution System. After the water distribution system has been flushed, sterilize the system by the following or other, more rigid methods satisfactory to the A/E and the State and Local Plumbing Authorities.
 - 1. Introduce chlorine or a solution of calcium or sodium hypochlorite, filling the lines slowly and applying the sterilizing agent at a rate of 50 parts per million of chlorine, as determined by residual chlorine tests at the ends of the lines. Open and close all valves and hydrants while chlorinating the system.
 - 2. After sterilization agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 25 ppm is indicated, repeat the sterilization process.
 - 3. When tests show at least 25 ppm of residual chlorine, flush the system until all traces of the chemical are removed.
- C. The Owner reserves the right to require testing of the water again at any time prior to final acceptance of the work and, if found bacteriologically unsafe, to require the Contractor to rechlorinate the system until the water is proven equal to that supplied by the public system.

3.2 SANITARY WASTE/VENT AND STORM DRAINAGE SYSTEMS

- A. Test systems as recommended by Local and State Plumbing Inspection Authorities.

3.3 OPERATIONAL TEST

- A. Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:
1. Time, date, and duration of test.
 2. Water pressure at the most remote and the highest fixtures.
 3. Operation of each fixture and fixture trim.
 4. Operation of each valve, hydrant, and faucet.
 5. Pump suction and discharge pressures.
 6. Temperature of each domestic hot water supply.
 7. Operation of each floor and roof drain by flooding with water.
 8. Operation of each vacuum breaker and backflow preventer.
 9. Complete operation of each water pressure booster system (when applicable), including pump start pressure and stop pressure.

END OF SECTION 22 0561

SECTION 22 05 93 - PLUMBING SYSTEMS TESTING, ADJUSTING, AND BALANCING**PART 1 - GENERAL**

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work Includes

1. Furnishing all labor, materials, tools, equipment, and services to test, balance and adjust all mechanical systems as indicated, in accord with provisions of Contract Documents.
2. Complete coordination with work of all other trades.

Test, balance, and adjust following mechanical systems:

3. Domestic Circulating water systems, Hot Water.

QUALITY ASSURANCE

Agency Qualifications: Independent balance and testing agency, member of the Associated Air Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).

Balancing Standards: AABC requirements and recommendations.

RESPONSIBILITIES OF TESTING AND BALANCING AGENCY WORK

Schedule work with trades involved.

Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.

Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.

Balance to within plus or minus 10% of set point of balancing valves or pumps.

Prepare and submit test reports.

RESPONSIBILITIES OF PLUMBING CONTRACTOR'S WORK

Startup systems and keep in correct operation during balancing operations.

Clean strainers prior to balancing system.

Make personnel accessible to provide necessary adjustments and corrections to systems as directed by balancing agency.

Maintain accessibility to test locations and devices requiring adjustment.

Provide to the Test and Balance Agency a complete set of approved Shop Drawings and submittals and a posted set of Plumbing Drawings, indicating any and all changes to the Contract Documents.

JOB CONDITIONS

Balance at time directed by Design-Builder.

GUARANTEE

Provide extended warranty of 90 days, after completion of test and balance work, during which time the Design-Builder may, at their discretion, request recheck or resetting of any equipment or system which is not performing satisfactorily. Provide technicians to assist as required in making such tests.

SUBMITTALS

Shop Drawings: Not required for review.

Product Data: Not required for review.

Samples: Not required for review.

Reference Submittals: Qualifications of balancing agency and sample report forms.

Contract Closeout Information

4. Balancing Reports
 - a. Use forms similar to AABC latest edition.
 - b. Report to include the following:
 - 1) All specified data including balancing valve location and gpm.
 - 2) All equipment nameplate information.
 - 3) AABC equipment data sheets.
 - 4) Pump curves.
 - 5) Temperature readings leaving water heater or thermostatic mixing valve and at recirculation pump.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

GENERAL

Accurately calibrate and maintain all test instruments in good working order.

1. If requested, conduct tests of instruments in presence of Design-Builder.

If requested, conduct balancing tests in presence of Design-Builder.

Do not begin balancing until system(s) have been completed and are in good working order.

Record all inspections, tests, and adjustments.

WATER BALANCE PROCEDURE

Open all valves to full open position.

Checks pump rotation.

Check expansion tanks to determine they are not air-bound.

Check for installation and proper operation of manual air vents.

Check hot water supply temperatures and return water temperatures at mains. Reset to correct design temperatures.

After completing balancing valve to set points noted on drawings, test hot water pressures and flows at the pumps and re-adjust if required.

Check the following in domestic hot and cold water systems.

2. Leaving water temperature at water heater.
3. Leaving water temperature at thermostatic mixing valve.
4. Pressure of domestic cold water at water service entrance.
5. Pump operating suction and discharge pressures and final total dynamic head.
6. Water metering device readings.

List all mechanical specifications of pumps.

Record nameplate and actual operating amperages of pump motor.

3.3 SPARE PARTS

- A. Provide portable readout kit and specific manufacturer's balancing wheel (charts) for Owner's use.

3.4 OPERATING TEST

- A. After systems are balanced, conduct operating test of not less than 8 hours' duration for domestic hot water system to demonstrate to satisfaction of the Design-Builder that systems comply with requirements of plans and specifications, and that all equipment and controls are functioning properly.

END OF SECTION 22 05 93

SECTION 22 0700 PLUMBING INSULATION**PART 1 - GENERAL**

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to;

1. Pipe insulation.
2. Equipment insulation.
3. Insulation adhesives, mastics and caulking.

Definitions

4. Concealed Insulated Surfaces: Piping and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed alleyways, and above suspended ceilings.
5. Exposed Insulated Surfaces: Piping and equipment located in mechanical rooms, tunnels, and rooms without suspended ceilings.

QUALITY ASSURANCE

Comply with fire and smoke hazard ratings indicated.

6. Test by procedure ASTM E84, NFPA 255, and UL 723.
7. Accessories such as adhesives, mastics, cements, tapes, and glass fabric, same or better component ratings.
8. Following are rating requirements:
 - a. Flame spread (maximum): 25
 - b. Smoke developed (maximum): 50
9. Properly identify products and/or their shipping cartons for flame and smoke ratings.
10. Where prohibited by code or local ordinances, do not use elastomeric-type insulation anywhere within ceiling plenum return air systems.

SUBMITTALS

Shop Drawings: Submit schedule indicating service, application, thickness and finishes.

Product Data

11. Manufacturer's cut sheets and literature.
12. Performance data.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Close-Out Information

13. Manufacturer's installation, maintenance, and painting data.
14. Guarantees.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Glass Fiber Pipe Covering, Calcium Silicate, and Thermal Insulating Wool: Manville, Owens-Corning, Manson, Knauf.

Fire-Retardant Adhesive: Manville, Benjamin Foster, 3M, Insul-Coustic, Childers.

Lagging Adhesive: Manville, Benjamin Foster, Borden, Insul-Coustic.

Elastomeric Pipe Insulation and Equipment Covering: Armstrong Armaflex, IMCOA, Imcolock, Ultrafoam.

Insulated Fitting Covers: Manville, Certain-Teed, Knauf.

Insulation Caulking: Dow No. 11.

GENERAL

Provide fire and smoke hazard ratings as indicated for entire composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation).

Do not use material that exceeds specified flame and smoke ratings.

Use permanent treatments to jackets or facings to impart specified fire ratings.

Use of water soluble treatments is prohibited.

At Hangers and Bracing: See Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".

PIPE INSULATION, NON-FLEXIBLE

Pipe Insulation, Non-flexible

1. O-C fiberglass ASJ/SSL-II pipe insulation with all service jacket (ASJ).
2. Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75 deg F.
3. Apply to the following piping in thickness indicated:
 - a. (Domestic) potable & non-potable cold water:
 - 1) Runouts to fixture (<12 feet).....1/2 inch
 - 2) 1-1/4 inch and smaller.....1/2 inch
 - 3) 1-1/2 and larger.....1 inch

- b. Domestic hot/recirculating water (thru 140 deg F):
 - 1) 1-1/4 inch and smaller..... 1 inch
 - 2) 1-1/2 inch and larger.....1-1/2 inch
- c. Domestic hot/recirculating water (141 deg F thru 160 deg F):
 - 1) 1-1/4 inch and smaller.....1-1/2 inch
 - 2) 1-1/2 inch and larger.....2 inch
- d. Domestic hot water with temperature maintenance cable (thru 140 deg F):
 - 1) 1 inch and smaller.....1 inch
 - 2) 1-1/4 inch thru 1-1/2 inch.....1-1/2 inch
 - 3) 2 inch and larger.....2 inch
 - 4) 2-1/2 inch.....2-1/2 inch
 - 5) 3 inch..... 3 inch
- e. Horizontal rain leaders (including 24 inch up and down from horizontal and up to underside of roof deck):
 - 1) All sizes.....1 inch

PIPE INSULATION, FLEXIBLE

Pipe Insulation, Flexible

- 4. Armstrong self-seal AP Armaflex flexible elastomeric pipe insulation.
- 5. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
- 6. Apply to following piping in thickness indicated:
 - a. Domestic (potable) cold water:
 - 1) 2 inch and smaller.....1/2 inch
 - b. Waste piping from water coolers and drinking fountains:
 - 1) All sizes.....1/2 inch

INSULATION FOR HOT EQUIPMENT

Insulation For Hot Equipment (Domestic Water Systems)

- 7. O-C Type 703 fiberglass board, 3.0 pcf, FRK facing.
- 8. Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75 deg F.
- 9. Apply to following equipment in 2 inch thickness:
 - a. Domestic hot water instantaneous heaters

INSULATION FOR DOMESTIC WATER HEATER STORAGE TANKS

Insulation for Domestic Water Heater Storage Tanks

- 10. O-C Type 703 fiberglass board, 2 inch thickness, 3.0 pcf density, unfaced.
- 11. Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75deg F.
- 12. Apply to all domestic water heater storage tanks, except when specified as factory-insulated.

INSULATION FOR COLD EQUIPMENT

Insulation for Cold Equipment

13. Armstrong Armaflex II sheet insulation; 1-1/2 inch material installed in 2 layers with joints staggered.
14. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
15. Apply to following equipment in thickness indicated:
 - a. Domestic water meter.....3/4 inch
 - b. Roof drain bodies.....3/4 inch
 - c. Water softeners.....3/4 inch

INSULATION FASTENERS

Insulation Adhesive: Childers CP-82.

Insulation Mastic: Childers CP-30.

Insulation Caulking: Dow No. 11.

PART 3 - EXECUTION**APPLICATION - GENERAL**

Do not insulate piping until satisfactory completion of required pressure tests.

Do not insulate heat-traced piping until cable installation is complete and a megohmmeter test has been passed.

Apply insulation to clean, dry surfaces with pipe surfaces at room temperature.

Butt insulation firmly together with longitudinal and end joints sealed with compatible jackets, facings and adhesives as specified.

Apply adhesives, mastics and coatings per manufacturer's recommendations and as specified.

On cold surfaces where vapor barrier jackets are used, apply insulation with a continuous, unbroken vapor seal.

1. Adequately insulate and vapor seal hangers, supports, and anchors that are secured directly to cold surfaces to prevent condensation.

Continue insulation through sleeves and wall and ceiling openings except insulation shall not continue through fire-rated (2-hour or greater) partitions, walls, floor-ceiling systems.

Insulate all fittings, valve bodies, flanges and other pipeline accessories.

At hangers and bracing, install in accord with Division 22 Section "Hangers and Supports for Plumbing Piping and Equipment".

Contractors shall consult manufacturer's Technical Bulletins for detailed information on safety precautions in using all insulation products, polyurethanes, polyisocyanurates, and

related materials. The data shall describe fire and other risks, safety in handling, toxicity, threshold limit values, physiological effects of inhalation and eye and skin contact, incompatibilities and other essential information regarding use. Obtain six (6) copies for distribution and use at jobsite and for submittal with shop drawing submittals.

APPLICATION OF NON-FLEXIBLE PIPE INSULATION

On piping, install with lap joint attached using outward clinching staples, 3-inch centers, 1/4 inch from edge on hot piping.

2. On cold piping, use self-sealing lap system or adhesive applied to both surfaces per manufacturer's recommendation.
3. Do not staple cold piping.
4. Butt adjoining sections of insulation tightly together and continue jacket by installing self-adhering butt strips over entire circumferential joint.

Installation of Insulation of Fittings

5. For pipe sizes 2 inches and smaller, finish with mineral fiber cement to thickness of adjoining pipe insulation.
6. Over 2 inches, insulate with mitered pipe insulation segments or preformed fiberglass fittings secured with vinyl faced insulation strapping tape or 20 ga galvanized annealed wire and finished with one coat of mineral fiber cement.
7. After cement is dry, finish with Glass Fab and seal with Foster 30-36 adhesive.
8. Prefabricated fitting covers approved for use at pipe fittings may be used instead of finishing method outlined above.
9. Install in accordance with manufacturer's recommendations.

Cover all insulated piping exposed to weather with additional jacket of 0.016-inch smooth aluminum with moisture barrier.

10. Apply aluminum jacket with 0.020-inch x 3/8-inch aluminum bands on 9-inch centers, minimum 2-inch lap joint.
11. Protect fittings, valves, and specialties exposed to weather in like manner.
12. Contractor option: Use Ceel-Co 300 Series plastic jacketing applied per manufacturer's recommendations.

Reinforce jackets on insulated piping in mechanical rooms and central plant less than 8 ft. above floor.

13. Cover with 0.030 inch PVC jacket conforming to 25-50 fire requirements.

APPLICATION OF FLEXIBLE PIPE INSULATION

Install tubing wherever possible by slipping material over piping. Otherwise, slit pipe insulation, tightly butt ends and seal butt joints and slit seams with suitable adhesive.

Insulate fittings and valve bodies with segments cut from pipe insulation. Apply with adhesive.

Insulate piping at hanger points with fiberglass material protected with metal saddles.

APPLICATION OF INSULATION ON HOT EQUIPMENT

Install insulation with lap joint attached using outward clinching staples, 3-inch centers, 1/4 inch from edge.

Butt adjoining sections of insulating tightly together and continue jacket by installing self-adhering butt strips over entire joint.

Insulate flanges and fittings with mineral fiber cement.

Finish body with 0.016-inch aluminum jacket. Reinforce end and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

APPLICATION OF INSULATION ON DOMESTIC WATER HEATER STORAGE TANKS WHEN TANKS NOT FACTORY-INSULATED

Install insulation with lap joint attached using outward clinching staples, 3-inch centers, 1/4 inch from edge.

Butt adjoining sections of insulating tightly together and continue jacket by installing self-adhering butt strips over entire joint.

Insulate flanges and fittings with mineral fiber cement.

Finish body with 0.016-inch aluminum jacket. Reinforce end and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

APPLICATION OF INSULATION ON COLD EQUIPMENT

Apply with Armstrong 520 adhesive covering entire surface as well as back of insulation.

Coat all butt edges and press firmly together with 1/8-inch overlay pressure.

Apply two (2) coats of Armstrong Armaflex finish over sheet surfaces.

END OF SECTION 22 07 00

SECTION 22 0800 - COMMISSIONING OF PLUMBING**PART 1 - GENERAL**

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes commissioning process requirements for PLUMBING systems, assemblies, and equipment.
- B. Provide documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel. Work with the Commissioning Authority and in cooperation with other members of the commissioning team to ensure compliance.
- C. Refer to Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS for commissioning requirements.
- D. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for commissioning process requirements.
 - 2. Division 23 Sections related to Testing, Adjusting and Balancing (TAB).
 - 3. Division 23 Sections related to Building Direct Digital Control (DDC) System.

1.3 COMMISSIONING

- A. This section governs the commissioning of Plumbing systems.
- B. The following systems and equipment shall be commissioned, where applicable.
 - 1. Domestic Gas Fired Water Heaters
 - 2. Hot Water Circulation Pumps
 - 3. Elevator Pit Pumps
 - 4. Domestic Water Distribution
- C. Refer to Division 01. Section 01 91 13, "General Commissioning Requirements" for the Work related to commissioning of these systems.



22 08 00 - COMMISSIONING FOR PLUMBING - REFERENCED TO DIV - 2

PART 2 - PRODUCTS: NOT USED

PART 3 - EXECUTION: NOT USED

END OF SECTION 22 08 00

SECTION 22 11 16 - DOMESTIC WATER PIPING

GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

This Section applies to potable cold water, hot water, hot water recirculation and soft water piping.

EQUIPMENT BY OTHERS

Include all necessary roughing-in and final equipment connections by plumbing trade as required.

Wherever equipment is furnished and set in place under Work of another Section or by Owner, they shall furnish detailed Drawings and exact rough-in dimensions and locations at the Site.

1. Information shall be furnished sufficiently in advance to allow proper installation of all required services.
2. If the Owner does not provide information sufficiently in advance, the Owner shall provide compensation for additional costs incurred due to changes in location of required services.
3. This Division shall include all required service rough-ins and final connections to the equipment.

QUALITY ASSURANCE

General

4. Provide all supervision, labor, tools, materials, equipment, accessories and specialties necessary to completely install, clean and test the plumbing systems.
5. All materials shall be free from defects impairing strength and durability and shall be of the best quality for the indicated purposes. All Work shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected; all Work shall be true to detail.

Codes and Standards (Division 22 Section "Common Work Results for Plumbing" Listings and the following).

6. Plumbing installation shall be in accordance with the state and local plumbing code, and all other codes having jurisdiction.
7. American Standard Code for Pressure Piping ANSI B31.1
8. National Association of Corrosion Engineers
9. American National Standards Institute (ANSI)
10. American Society of Mechanical Engineers (ASME)
11. American Society for Testing and Materials (ASTM)

12. American Water Works Association
13. Manufacturer's Standardization Society of the Valve and Fitting Industry
14. Plumbing and Drainage Institute
15. State or local Plumbing Code, as applicable.
16. State or local Building Code, as applicable.
17. 42 USC 300G: The Reduction of Lead In Drinking Water Act.

Material Standards

18. ASTM B32: Specification for Solder, Metal Sizes.
19. ASTM B42: Specification for Seamless Copper Pipe, Standard Size.
20. ASTM B75: Specification for Seamless Copper Tube.
21. ASTM B88: Specification for Seamless Copper Water Tube.
22. ASTM B251: Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
23. ASTM B302: Specification for Threadless Copper Pipe.
24. ASTM A53: Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
25. AWWA C651: Standard for Disinfecting Water Mains.

SUBMITTALS

Shop Drawings

26. Piping Systems: Submit piping layout drawings for domestic cold water, hot water, hot water recirculation and soft water piping systems prior to installation.

Product Data: Catalog cuts.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information

27. Valve Chart (See Division 22 Section "General Duty Valves for Plumbing Piping")
 - a. Prepare valve chart for review prior to installation.
28. Test reports.
29. Final approvals by authorities having jurisdiction.

HANDLING, DELIVERY, AND STORAGE

General

30. Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations.
31. No extra cost shall be charged the Owner for handling, delivery, or storage.
32. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.

JOB CONDITIONS

Coordinate the exact location of this work with the work of other trades prior to fabrication and installation. Verify all dimensions and elevations. Provide additional offsets and section of piping as required to meet job conditions. Coordinate with and review all related Drawings of all trades prior to start of work.

All piping and fittings in kitchen shall be chrome-plated or painted with a high-temperature aluminum paint.

PRODUCTS

PIPING

General

33. The outside of all piping and fittings shall bear the Manufacturer's standard marking for type, pressure, etc.
34. The A/E does not guarantee the accuracy of the figure numbers as listed.

Pipe - General

35. All pipe and fittings shall be equal to or better than the grade specified.
36. All piping material shall be new and free from defects and shall be subject to standard mill test before being shipped.
37. Pipe shall be labeled.
38. Fittings and valves shall have the Manufacturer's name or trademark legibly raised or cut into each piece.
39. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
40. No salvaged or used pipe shall be used without the written approval of the Design-Builder. Wherever such approval is given, recut the ends of the pipe, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.

Pipe 6-inch Size and Smaller

41. Pipe: Copper tube, seamless, type L hard temper, ASTM B-88, above ground, and type K soft temper, 2-inch and smaller, below ground.
 - a. Fittings: Cast brass or wrought copper, solder type, ASTM 75, ANSI B16.22, or B16.18.
 - b. Joints: Soldered, 95-5 tin-antimony solder above ground, and silver solder below ground.
 - c. Unions: Sweat-end, 150 lb. cast brass, ground joint.
 - d. Mechanically formed tee connections and couplings, such as T-drill, are acceptable. All joints shall be brazed with brazing material conforming to AWS A5.8 Classification BCUP-3 or BCUP-4.
 - e. Also acceptable for 2-1/2-inch through 4-inch Type L copper piping above ground, is the use of a grooved piping system including couplings, reducers, elbows, tees, and flange adaptors that are certified and approved by BOCA, IAPMO, SBCCI, and UL for up to 300 psig working pressure and up to 230 deg F operating temperature. All copper piping to be roll grooved.
42. Pipe: Stainless steel, Type 316, ASTM A312, aboveground, cold water only.
 - a. Fittings: Stainless steel, Type 316.
 - b. Joints: Welded autogenously or with approved filler material listed in ASTM A312 or mechanical joints in accordance with manufacturer's instructions.
 - c. Unions: Mechanical joint of the compression or mechanical sealing type, or dielectric fitting.

Pipe and Fittings 3-inch and Larger (Underground)

43. Ductile Iron Pipe
 - a. Pipe: Conform to AWWA C151.
 - b. Cement-mortar lining: Conform to AWWA C104.
 - c. Protective coating outside: Bitumastic or coal tar enamel.
 - d. Thickness class: 53.
 - e. Pressure class: 350 psi
 - f. Joints: Mechanical or push-on, conform to AWWA C111.
 - g. Fittings
 - 1) Gray iron or ductile iron
 - a) Full-body: Conform to AWWA C110, or
 - b) Compact: Conform to AWWA C153.
 - 2) Class
 - a) 250 or 350 up to 24-inch diameter.
 - 3) Bituminous coating: Inside and outside.
 - 4) Cement lining: Conform to AWWA C104.
 - a) Polyethylene encasement.
 - 5) Conform to AWWA C105.
 - 6) Thickness: 8 mil.

PIPING AUXILIARIES/SPECIALTIES

General: All auxiliaries and specialties shall be guaranteed by the manufacturer for the pressure, temperature and materials being handled. All auxiliaries and specialties shall be suitable for the piping to which they are attached.

Interior Hose Bibbs

44. Manufacturers: Woodford, Prier, Crane, Nibco, or Red-White.
45. 3/4-inch brass construction, wheel handle, teflon impregnated packing, soldered or threaded inlet (concealed or exposed supply as indicated on drawings).

Wall Hydrants

46. Manufacturers: Josam, J.R. Smith, Mifab, Wade, Woodford, or Zurn.
47. Freezeproof faucet, bronze casing, hinged, locking polished bronze (nickel) box and cover, self-draining vacuum breaker, integral backflow preventer, 3/4-inch size. Length as required.
48. Freezeproof faucet, bronze casing, (polished brass), nickel head with polished face, self-draining vacuum breaker, integral backflow preventer, 3/4-inch size. Length as required.

Water Meter

49. Meter is purchased from the utility company and installed by the Plumbing Contractor.
50. Provide meter installation meeting utility company requirements.
51. Sub-meters may be required to also be purchased from the water utility, especially if billing deduct is anticipated for water requirements such as irrigation.
 - a. Otherwise, provide Onicon or approved equivalent direct insertion type mass flow meters with BacNet interface capabilities to supervise and trend all incidental sub-meters for all fluids and gases. Installation per approved manufacturer's instructions.

Strainers

52. Manufacturers: Sarco, Anderson, Armstrong, Crane, or Watts.
53. Sarco type BT or BF-150, bronze body with stainless steel screen. Provide drain valve on strainer.

Washer Connection Boxes

54. Manufacturers: Guy Gray, Oatey, Water-Tite, or Acorn.
55. Bottom or top supply with 1/2-inch combination MPT brass sweat connection, 1/2-inch hose end valves with vacuum breakers, 2-inch drain pipe and overflow guard.
56. Where boxes are installed in concrete block walls, Contractor shall provide a stainless steel or chrome-plated trim on box so that it is flush with wall. No concrete block shall be exposed within enclosure. All exposed screws to be vandalproof.

Water Hammer Arresters

57. Manufacturers: Josam, Mifab, Wade, J.R. Smith, Watts, or Zurn.
58. Josam type "Absorbatron".
59. Meet the requirements of PDI Standard WH-201 for size and location.
60. Size of unit shall be clearly indicated on unit.

Vacuum Breakers and Dual Checks

61. Manufacturers: Watts, Chicago Faucet, Febco, Wilkins, Conbraco, or Woodford.
62. Hose Connections: ASSE 1011, Watts #8A, 3/4-inch hose thread. (#8AC in finished areas).
63. Ice Machines: ASSE 1024, Watts Series 7 with two chrome nickel plated brass replaceable dual checks for 3/8 inch thru 1 inch size.
64. Coffee Maker: ASSE 1022, Watts SD-3 with stainless steel body, dual checks, wye strainer and drain port for 1/4 inch through 3/8 inch size. Pipe drain port to drain and terminate with air gap.

Reduced Pressure Backflow Preventers

65. Manufacturers: Watts, Conbraco, Febco, Wilkins, Ames, or Mifab, Beeco.
66. Pipes 1-1/2 inch and Smaller: ASSE 1013, Watts LF009 Series, all bronze, lead free, reduced-pressure-type with two ball valves. Provide strainer upstream.
67. Pipes 2 inch and Larger: ASSE 1013, Watts 957 Series, lead free, reduced-pressure-type with two check valves, pressure relief valve, and two ball (2 inch size) or gate valves. Provide strainer upstream.
68. Backflow preventers shall be serviceable without removal from pipe line.
69. Provide indirect drain with air gap fitting.

Mechanical Trap Primer

70. Manufacturers: Josam, J.R. Smith, Precision Plumbing Products, Wade, Zurn, Watts, Mifab, E&S or approved equivalent.
71. Basis of Design: Mifab M-500 trap primer with M1-DU distribution unit as required.
72. Provide 1/2 inch soft type K copper pipe from the trap primer distribution devices to the trap primer inlet of the floor drains.
73. Trap primer shall require no greater than 3 psi to activate.

Electronic Trap Primer Manifold System

74. Precision Plumbing Products "Prime-Time" electronic trap priming manifold with atmospheric vacuum breaker, solenoid valve, water hammer arrestor, 3/4 inch copier manifold with 1/2 inch compression fitting taps, and 24-hour timer all installed in a 16 ga. steel enclosure with prime-coated access door and screwdriver door latch.
75. Provide 1/2 inch soft type "K" copper pipe from the trap primer distribution system to the trap primer inlet of the floor drains.
76. Electrical Contractor to provide 120 volt, one-phase, power to unit.
77. See noted data on Plans relating to locations of distribution systems and number of outlets required at each system.
78. Manufacturer: Precision Plumbing Products, Mifab, Zurn or approved equivalent.

Trap Seal Protection Devices

79. Subject to compliance with requirements, provide SureSeal by Rectorseal Manufacturing; Inline Floor Drain Trap Sealer or approved equivalent.
80. Standard: ASSE 1072-2007
81. Body: ASB Plastic
82. Diaphragm & Sealing Gasket: Neoprene Rubber
83. Size: 2 inch (50 mm), 3 inch (75 mm), 4 inch (100 mm).
84. Gravity Drain Outlet Connection: Compression fit sealing gasket 80 durometer.

Domestic Water Valve Cabinet

85. 16 inch x 16 inch x 4 inch deep recessed cabinet with 1 inch flange all around flush with wall.
86. Cabinet shall be constructed of 18-gauge, 304 stainless steel with #3 polished finish.
87. Cabinet shall have continuously hinged door (gasketed) with keyed cam lock. Door shall be same construction as cabinet.
88. Cabinet to be as manufactured by Karp Associates, Inc., Milcor, Mifab, Wilconsin Co., or equal.

Drain Valves: Powell 502-HS with cap and chain, or equal by Hammond, Keystone, or Watts.

Water Pressure Regulator at Equipment: Cash Acme type E-55, or equal by Cla-Val, Conbraco, Mifab, Watts.

Gauge Cocks: Powell Fig. 757, or equal by Anvil, Waltec, Victaulic, White Rogers.

Thermostatic Hot Water Balancing Valves.

89. Manufacturers: Bell & Gossett, or approved equivalent.
90. Automatic Thermostatic throttling actuator, stainless steel body, adjustable or fixed temperature return settings (98-150 degrees F or higher), actuated bypass minimum GPM flow port, maximum working pressure 145 PSIG, accuracy plus or minus 3.6 degrees, supplied with standard insulation block.
91. Building Management System (BMS) data output for trending log by addressable valve(s) location(s).

Relief Valves

92. ASME tested and certified.
93. Shall have capacity to handle 100% of service.

94. Shall be set at 10% above the working pressure of equipment or service to which it is connected, or as noted.
95. Shall be iron body with stainless steel trim, renewable discs and seat rings, slow-opening-type.
96. Discharge shall be piped to nearest floor drain and arranged for safe discharge.
97. Manufacturers: Consolidated, Farris, Leslie, Lonergan, Manning-Maxwell-Moore.

Temperature and Pressure Relief Valves

98. ASME-coded
99. All-bronze construction with seat-to-disc alignment that will not stick or freeze.
100. Shall start to open at 230 deg F and shall be fully open at 240 deg F.
101. Shall have snap action thermostat and sensing bulb sized to water heater Manufacturer's recommendations
102. Manufacturers: Watts, McDonnell, Wilkins, Conbraco.

EXECUTION

INSTALLATION, GENERAL

General

103. Comply with Division 22 Section "Common Work Results for Plumbing", as well as the requirements of Division 22 Sections "Hangers and Supports for Plumbing Piping, and "Plumbing Insulation".
104. Piping shall be installed in a manner which permits easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.
105. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
106. Piping shall not be supported from other pipes, conduits, ducts or similar installations.
107. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
108. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the run-outs of main piping and shall be installed by using multiple elbows or other similar methods to minimize strain on the equipment connections.
109. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
110. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping.
111. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
112. Pipe size reductions shall be made with factory-fabricated eccentric reducers or reducing fittings and shall be installed in a manner which does not cause pocketing or inhibit the flow of the material.
113. Install shut-off service valves with unions on all connections to equipment and on each side of control valves as required for ease of proper servicing and

- maintenance; see Division 22 Section "General Duty Valves for Plumbing Piping".
114. Unless otherwise indicated, the discharge from pressure-and temperature-relief valves and equipment drains shall be piped to the nearest floor drain, hub drain, or mop sink, installed with an approved air gap as required, and arranged for safe discharge.
 115. No pipe shall penetrate any structural member without the written approval of the A/E. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the A/E.
 116. Flanges and Gaskets
 - a. Where forged steel flanges are to be bolted to cast iron flanges, a smooth or flat-face forged steel flange with a full-face gasket shall be used.
 - b. All gaskets, other than teflon envelope or full-face, shall be of the flat ring type, with the outside diameter of the gasket extending to the edge of the bolts.
 - c. Gaskets for all joints shall have an inside diameter equal to the outside diameter of the pipes on which they are to be used, to ensure that no portion of the gasket will project into the ports of valves, pipe, or fittings.
 - d. The dimensions of all gaskets shall conform to ANSI Standard B-16.21 for non-metallic gaskets.
 117. Dielectric Separation
 - a. Provide dielectric separation at all copper piping and valves connected to ferrous piping.
 - b. Brass or bronze valves installed in ferrous piping shall not require dielectric separation.
 - c. Connections between copper piping and ferrous flanged piping and equipment connections shall be with a bronze companion flange with dielectric separation for flanges and bolts.
 - d. Connections between copper piping and screwed ferrous piping shall be Clearflow Dielectric Waterway fittings.
 118. Movement
 - a. Mains: Provide adequate offsets, bends, loops, flexible joints and guides as required to prevent over-stressing of piping and/or the structure.
 - b. Branches: Provide for expansion and contraction by means of offsets, swings, joints or loops to eliminate stress on connected piping, valves or equipment. Provide for proper drainage as required.
 - c. Maintain a free floating, properly braced and supported piping system.
 119. Provide all rough-in and final connections to equipment and services indicated in the Contract Documents for equipment and services to be functional.

Cross Connections and Interconnections: No plumbing fixtures, devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

Painting of Piping: Refer to Division 09 Section "Interior Painting".

SLEEVES

General

120. All sleeves shall be accurately located as required under this Division, and shall be properly sealed. Sleeves shall be set true to line, grade and position, shall be plumb or level, and shall be maintained during the work under other Divisions.
121. Sufficient advance notice shall be supplied to the proper trade to enable the installation to progress.
122. Whenever improper location or insufficient notice is provided for the installation of the sleeves, such work shall be done by the proper trade at the cost of this Division, with no change in the Contract Sum or the Date of Substantial Completion.
123. Sleeves shall not penetrate any structural member, except as shown on Drawings, without written approval from the A/E. Wherever any additional reinforcing of members is required, the cost shall be under this Division.
124. Provide sleeves when underground piping passes under or through footings/grade beams. Sleeves under footings/grade beams shall have lean concrete from sleeve to underside of footing/grade beam.

BUILDING PIPING SYSTEM: INSTALLATION

Domestic Water: Cold, Hot, Tempered, Recirculating

125. General
 - a. All piping shall be installed and pitched to provide proper drainage.
 - b. Install drain valves at all low points and as required to provide drainage facilities for the piping. Wherever system is sectionalized, install drain valves between each sectional shut-off valve.
 - c. All hot water piping shall be pitched to provide natural gravity recirculation regardless of a recirculation pump.
 - d. Install pressure gauge in domestic cold water main at water entrances to building.
126. Shock Elimination
 - a. All piping shall be protected against water shock.
 - b. Install a water hammer arrestor of the proper size at the end of the main, at the end of all branch lines, and at the end of lines serving groups of fixtures.
 - c. Water hammer arrestors shall be sized and installed as recommended by the Plumbing and Drainage Institute and shall eliminate water hammer.
 - d. All water hammer arrestors shall be installed in locations where they are readily accessible for service. Where required, provide suitable access doors.
127. Contamination Protection
 - a. All new distribution systems shall be protected against contamination due to backflow from non-potable sources.
 - b. Provide an approved backflow preventer of the reduced pressure zone type at each connection to a fixture where indicated or required by code.
 - c. Pipe to nearest floor drain.
128. Backflow Prevention
 - a. Install a code approved backflow preventer unit in the service main, where indicated on the Drawings, or as required by code.
 - b. Include strainer, dual-service shut-off valves, double-check valves, and check cocks.
 - c. Properly support, independent of the piping, with union connections.
129. Trap Primer

- a. All trap primers are to be located in an accessible area, preferably in mechanical rooms, janitor's closets, or accessible chases.
 - b. Install trap primer so that, for every 20 feet of piping to floor drain inlet, the device is mounted one foot above the finished floor.
130. Water Meter
- a. Arrange for and pay all costs involved in the installation of a water meter in the building service line, where indicated.
 - b. Support independent of the piping with union connections.
 - c. Installation and meter shall be in accord with and approved by the water utility company.

END OF SECTION 22 11 16

SECTION 22 13 16 - BUILDING SANITARY AND STORM DRAINAGE

GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Provide a complete building storm water drainage system to 5 feet outside building exterior wall. Work includes, but is not limited to, the following:
 - a. Roof drains.
 - b. Pipe materials.
 - c. Expansion joints.
 - d. Clean-outs.
2. Provide a complete soil, waste and vent piping system to 5 feet outside building exterior wall. Work includes, but is not limited to the following:
 - a. Equipment coordination when equipment or fixtures are supplied by others.
 - b. Pipe materials.
 - c. Piping auxiliaries/specialties.
 - d. Drains.
 - e. Clean-outs.
3. Grease interceptor.

EQUIPMENT BY OTHERS

Include all necessary roughing-in and final equipment connections by the plumbing trade as specified.

Wherever equipment is furnished and set in place under Work of another Section or by Owner, they shall furnish detailed Drawings and exact rough-in dimensions and locations at the Site.

4. Information shall be furnished sufficiently in advance to allow proper installation of all required services.
5. This Division shall include all required service rough-ins and final connections to the equipment.

QUALITY ASSURANCE

General

6. Provide all supervision, labor, tools, materials, equipment, accessories and specialties necessary to completely install, clean and test the building sanitary and storm plumbing systems.
7. All materials shall be free from defects impairing strength and durability and shall be of the best quality for the purposes indicated. All Work shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected and shall be true to detail.

Codes and Standards (Division 22 Section "Common Work Results for Plumbing" Listings and the following.)

8. Plumbing installation shall be in accordance with the state and local plumbing code and all other codes having jurisdiction.
9. American Standard Code for Pressure Piping ANSI B31.1.
10. National Association of Corrosion Engineers.
11. American National Standards Institute (ANSI).
12. American Society of Mechanical Engineers (ASME).
13. American Society for Testing and Materials (ASTM).
14. American Water Works Association.
15. Manufacturer's Standardization Society of the Valve and Fitting Industry.
16. Plumbing and Drainage Institute.
17. State or local Plumbing Code, as applicable.
18. State or local Building Code, as applicable.

Material Standards

19. ASTM A74: Specifications for Cast Iron Soil Pipe and Fittings.
20. ASTM A53: Specifications for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated (Galvanized) Welded and Seamless, for Ordinary Uses.
21. ASTM B306: Specifications for DWV Copper Pipe.
22. ASTM C564: Specifications for Rubber Gaskets for Cast Iron Soil Pipe and Fittings.
23. Cast Iron Soil Pipe Institute CISPI No. 301-90 and ASTM A888: Specification Data for Hubless Cast Iron Pipe Systems with No-Hub Pipe and Fittings.
24. Cast Iron Soil Pipe Institute CISPI No. 310-90: Specification for coupling for use in connection with no-hub cast iron soil pipe and fittings for sanitary and storm drain, waste, and vent piping applications.
25. ANSI A112.21.1: Floor Drains.
26. ANSI A112.36.2M: Metallic Clean-Outs.
27. ANSI A112.1.2: Air Gaps in Plumbing Systems.
28. ANSI A112.21.2M: Roof Drains.

SUBMITTALS

Shop Drawings

29. Piping Systems: Submit piping layout drawings for sanitary waste and vent, and storm piping systems prior to installation.

Product Data: Catalog cuts.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information

30. Test reports.
31. Final approvals by authorities having jurisdiction.

HANDLING, DELIVERY, AND STORAGE

General

32. Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations.
33. No extra cost shall be charged the Owner for handling, delivery, or storage.
34. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.

PRODUCTS

PIPE MATERIALS

General

35. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
36. No salvaged or used pipe shall be used without the written approval of the Design-Builder. Wherever such approval is given, recut the ends of the pipe, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.
37. All cast iron pipe and fittings shall be marked with the trademark of the Cast Iron Soil Pipe Institute and listed by NSF International.

Buried Soil, Waste, and Vent Piping

38. ASTM A74 service weight cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasketed joints.
39. Options
 - a. ASTM A888 and CISPI 301 hubless cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with 304 corrugated stainless steel couplings.

Above-Ground Soil, Waste and Vent

40. ASTM A888 and CISPI 301 hubless cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with 304 corrugated stainless steel couplings.
41. Options
 - a. ASTM A74 service weight cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasketed joints.
 - b. ASTM A53 Schedule 40 galvanized steel pipe with cast iron screwed drainage fittings.
 - c. ASME A112.3.1 type 316L stainless steel drainage pipe and fittings, spigot, and socket joints with EDPM gaskets.
 - d. Vent piping only: ASTM D2665 solid schedule 40 plastic pipe with drainage fittings and solvent welded joints

Indirect Waste and Drains Above Ground

42. ASTM B306 DWV copper tubing with DWV copper fittings.
43. Options
 - a. ASTM D2665 PVC-DWV plastic pipe, drainage fittings with solvent weld joints.
 - b. Same materials as soil, waste, and vent.

Sump Pump Discharges

44. ASTM B306 DWV copper tubing with DWV copper fittings. shall be used to point of connection to a gravity storm line or terminating with air gap at plumbing fixture/equipment as required by local AHJ.
45. Options: ASTM A53 Schedule 40 galvanized steel with cast iron screwed drainage fittings.

Interior Buried Storm Piping

46. ASTM A74 cast iron service weight soil pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasketed.
47. Options
 - a. CISPI 301 hubless cast iron pipe as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with 304 corrugated stainless-steel couplings.
 - b. ASTM D1785 solid schedule 40 plastic pipe with ASTM D2665 drainage fittings and solvent welded joints.

Exterior Buried Storm Piping

48. ASTM A74 cast iron service weight soil pipe as manufactured by AB&I, Tyler, or Charlotte with bell and spigot joints, drainage fittings with ASTM C564 gasket or oakum-lead joints.
49. Options: ASTM D3034, Type PSM, polyvinyl chloride (PVC), SDR 35 for solvent cement or elastomeric joints. Fittings to conform to ASTM D2556.
 - a. Joints with elastomeric seals (integral bell) shall conform to ASTM D3212. Gaskets shall conform to ASTM F477.
 - b. Joints with solvent cement shall conform to requirements of ASTM D2885 and ASTM D2564.

Above Ground Storm Piping

50. CISPI 301 hubless cast iron pipe, as manufactured by AB&I, Tyler, or Charlotte with mechanical joints, drainage fittings with heavy duty 304 corrugated stainless-steel couplings.
51. Options
 - a. ASTM A74 service weight cast iron pipe, bitumastic-coated, bell and spigot joints, drainage fittings with ASTM C564 gasketed.
 - b. ASTM A53 Schedule 40 galvanized steel pipe with cast iron screwed drainage fittings.
 - c. ASTM A112.3.1 type 316L stainless steel drainage pipe and fittings, spigot and socket joints with EDPM gaskets.

PIPING AUXILIARIES/SPECIALTIES

General: All auxiliaries and specialties shall be guaranteed by the manufacturer for the pressure, temperature and materials being handled, and shall be suitable for the piping to which they are attached.

Air Gap Fitting

52. J.R. Smith Fig 3951, rough bronze or plain end with set screw, threaded inlet and threaded outlet, sizes as indicated.
53. Manufacturers: Mifab, Watts, Wade, or Zurn.

Vent Flashings

54. Furnish 6 lb. lead flashing for General Contractor installation.
55. Flashing shall extend 12 inches in all directions, sealed between roofing plies, extended up to end of vent and clamped with vandalproof vent cap.
56. Vents Thru Roof (VTR): Refer to Architectural Drawings for vent thru roof detail in EPDM roof.

Vandalproof Vent Cap

57. J.R. Smith Fig. 1748 cast iron with set screws.
58. Manufacturers: Josam, Mifab, Stoneman, Wade, or Zurn.

Storm and Sanitary Piping Hubless Cast Iron Couplings

59. Shield constructed of type 304 stainless steel meeting ASTM 240. Neoprene gaskets shall conform to ASTM C564.
60. Couplings shall have a minimum of 4 bands and be capable of tightening to 80 lbs. torque.
61. The use of sealant or adhesives on couplings is not permitted unless approved by the manufacturer.
62. Couplings shall be heavy duty in accordance with ASTM C1540.

F. Cast Iron No-hub Restraints

1. Cast iron no-hub horizontal pipe and fittings, larger than 4", shall be suitably braced to prevent horizontal movement. Install at every branch opening or change in direction by the use of braces, blocks and rods to prevent movement or joint separation. This bracing may be field fabricated or a manufactured system.
2. Holdrite 117 series or equal.

DRAINS**General**

63. All drains installed in waterproofed slabs shall be provided with a flashing ring.
64. Install a 30-inch x 30-inch x 6 lb. lead flashing properly fastened to the flashing ring.
65. Cast Iron roof, area, and floor drain manufacturers: J.R. Smith, Josam, Kusel, Mifab, Wade, Watts and Zurn.
66. Precast trench drains manufacturers: Zurn, ABT, ACO, Polycast.
67. Stainless steel trench drain manufacturers: Advance Tabco, ACO, Blucher, Kusel, Stainless Drains.

Roof Drains

68. Primary Roof Drain: Large, general purpose roof drain with cast iron body, cast iron dome, bottom outlet, adjustable extension sleeve, reversed collar, flashing clamp with gravel stop, sump receiver, and underdeck clamp. Vandal-resistant top. Provide expansion joint on all bottom outlet roof drains. Size of piping on plan indicates outlet size of roof drains.
69. Overflow Roof Drain: Flooding dam-type with 2-inch cast iron water collar, cast iron body, cast iron dome, bottom outlet, extension, flashing clamp with gravel stop, sump receiver, underdeck clamp. Vandal resistant top. Provide expansion joint on all bottom outlet roof drains. Size of piping on plan indicates outlet size of roof drain.

70. Downspout Nozzle: Stainless steel body, NPT threads, perforated stainless steel hinged cover with wall flange with mounting holes. Size of piping on Plans indicates outlet size.

Floor Drains

71. Floor Drain (general finished floor areas and for small HVAC unit condensate drains): Adjustable cast iron body, round nickel bronze strainer. Vandalproof screws. Caulk outlet. 1/2-inch trap primer inlet. Contractor shall buff strainer to be suitable for barefoot traffic in shower areas.
72. Floor Drain (mechanical rooms and equipment areas): Cast iron body, 12-inch-diameter cast iron tractor grate, solid free-standing sediment bucket, 1/2-inch trap primer inlet. Size as indicated on Drawings.
 - a. Floor drains located in mechanical rooms at air handling units to have cast iron funnels.
73. Floor Drain (general clean-up areas in kitchen): Type 304 stainless steel body and adjustable strainer, round top. Provide with 4-inch funnel at locations noted in Kitchen such as a freezers and coolers; stainless steel screws. Provide trap primer connection unless noted otherwise on Drawings.
74. Floor Sink (water treatment equipment, large backflow preventers and kitchen areas): Stainless steel Type 304, 14 gauge flanged receptor body with seepage control holes, ribbed non-tilt loose set grate with 1/2-inch square holes. Perforated S.S. dome bottom strainer. Provide S.S. half grate. Provide trap primer connection unless noted otherwise on Drawings.

Trench Drains: 6-inch or 12-inch, as noted on drawing schedules, wide modular sections interlocking channel system with 0.75% built-in sloped channels as manufactured by Zurn Industries, LLC, Z886-HD or Z882, or equal. First sloped channel shall be minimum of 5-inch deep. Channels shall all be the same width and length and be constructed of high density polyethylene (HDPE) with a 0% water absorption rate and heavy-duty frame with anchor studs. Provide a slotted ductile iron grating over the entire length of drain, with a Class E load rating. Grating shall be secured with a locking device including all nuts and bolts. Provide trench drain complete with all channel end caps, so that total length is as noted on Drawings.

CLEANOUTS

General

75. Capable of adjustment to match finish surface.
 - a. Be round.
76. All cover plates/plugs shall be permanently labeled to match the drain service.
77. For cast iron fittings
78. Cast Iron clean-out manufacturers: Josam, J.R. Smith, Mifab, Wade, Zurn, Watts
79. Corrosion-Resistant Clean-Out Manufacturer: Duriron.

Clean-Out Types

80. Floor Clean-Outs
 - a. Finished Floor and Tile Floor: J. R. Smith Fig. 4020, Duco cast iron body and frame with round adjustable scoriated nickel bronze top. Vandalproof

- top. Top Labeled Co. Provide nickel bronze carpet clamping frame with vandalproof screw in carpeted areas.
 - b. Unfinished Floor and Equipment Area Floor: J. R. Smith Fig. 4240, Duco cast iron body and frame with round adjustable scoriated cast iron top. Vandalproof top. Top Labeled Co.
81. Wall Cleanouts
- a. J. R. Smith Fig. 4422, Duco cast iron caulk ferrule with vast bronze taper thread plug and prime-coated steel shallow cover. Vandalproof screws.
82. Grade Cleanouts

PLASTIC UNDERGROUND GREASE INTERCEPTOR

Elliptical fiberglass (FRP) tank system designed with built-in inlet piping and baffle penetration that introduces wastewater in a tangential laminar flow to reduce disruption of collected grease and solids. Tank system is designed to capture and hold grease and solids to maximize waste retention and optimize Stokes Law separation. System backed by 30 year manufacturer warranty.

- 83. Include accessways, tanks, and piping and baffle openings to retain grease and solids and to permit tangential laminar wastewater flow.
- 84. Factory installed Schedule 40 PVC cement welded type socket ports, or straight pipe, fitted into interceptor walls for each pipe connection.
- 85. Accessway Extension Collar: Fiberglass risers, 24-inch.
- 86. Accessway Frames and Covers: Round cover with non-slip cover finish, gasketed and non-vented top design.
 - a. Cast Iron: AASHTO M306 Traffic load rated. 24-inch- diameter cover with 0.25-inch gasket. Two closed pickholes. Non-bolted or bolted option. Weight 249 lbs. ASTM A48 CL35B.
- 87. Watertight Flexible Caulking: Sikaflex 255 or Sikaflex 221 or approved alternate to provide watertight seal at extension collar joints.
- 88. Interceptor is to be factory-assembled complete with inlet and outlet pipe openings, top access openings, riser rings, manhole covers, and baffles. Provide manholes to finished grade.
- 89. OPTIONS as required:
 - a. 4-inch side or top suction port for remote pump-out.
 - b. Alarm for high oil accumulation. Includes alarm probe to be installed in top of tank accessway and alarm panel for indoor wall mount
- 90. Fiberglass accessway extensions: Fiberglass wound pipe.
 - a. Length: From top of underground tank to underside of access frame at grade.
 - b. Extension Sections: 0.25-inch minimum thickness and 24-inch as a single continuous piece, without joints unless approved by the manufacturer.
 - c. Sealant: Watertight Flexible Caulking, Sikaflex 255 or Sikaflex 221 or approved alternate to provide watertight seal at extension collar joining to tank on bottom and access frame at top.
- 91. When the grease interceptor is located in a parking area, the assembly, including concrete and manhole cover, shall be capable of withstanding a live load H-20 axle load (32,000 lbs/axle) under design conditions.
- 92. Capacity and size shall be as noted on the Drawings.
- 93. Basis of design is Green Turtle Americas Ltd. or Green Turtle Technologies Ltd.

EXECUTION

INSTALLATION, GENERAL

General

94. Comply with Division 22 Section "Common Work Results for Plumbing".
95. Piping shall be installed in a manner to permit easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.
96. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
97. Piping shall not be supported from other pipes, conduits, ducts or similar installations.
98. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
99. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the run-outs of main piping, and shall be installed by the use of multiple elbows or other similar methods to minimize strain on the equipment connections.
100. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
101. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping.
102. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
103. Pipe size reductions shall be made with factory-fabricated eccentric reducers or reducing fittings and shall be installed not to cause pocketing or inhibit the flow of the material.
104. No pipe shall penetrate any structural member without the written approval of the A/E. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the A/E.
105. Provide all rough-in and final connections to equipment and services indicated in the Contract Documents for equipment and services to be functional.

Cross Connections and Interconnections: No plumbing fixtures, devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

JOINT CONSTRUCTION

Hub-and-Spigot, Cast-Iron Soil Piping Gasketed Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

Hub-and-Spigot, Cast-Iron Soil Piping Calked Joints: Join according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

Hubless, Cast-Iron Soil Piping Coupled Joints: Join according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

106. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
107. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

Join copper tube and fittings with soldered joints according to ASTM B 828 procedure. Use ASTM B 813, water-flushable, lead-free flux and ASTM B 32, lead-free-alloy solder.

Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fittings. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

Plastic, Nonpressure-Piping, Solvent-Cemented Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:

108. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
109. ABS Piping: Join according to ASTM D 2235 and ASTM D 2661 Appendices.
110. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendices.

SLEEVES: INSTALLATION

General

111. All sleeves shall be accurately located as required under this Division. Sleeves shall be set true to line, grade and position, shall be plumb or level, and shall be maintained during the work under other Divisions.
112. Sufficient advance notice shall be supplied to the proper trade to enable the installation to progress.
113. Whenever improper location or insufficient notice is provided for the installation of the sleeves, such work shall be done by the proper trade at the cost of this Division, with no change in the Contract Sum or the Date of Substantial Completion.
114. Sleeves shall not penetrate any structural member, except as shown on Drawings, without written approval of the A/E. Wherever any additional reinforcing of members is required, the cost shall be under this Division.
115. Provide sleeves when underground piping passes under or through footings/grade beams. Sleeves under footings/grade beams shall have lean concrete from sleeve to underside of footing/grade beams.

FLASHINGS: INSTALLATION

General

116. All penetrations of roofs and similar areas required for installation of vents, roof drains, and piping under this Division shall be properly flashed and made watertight.
117. Coordinate with all necessary General Trades Work sufficiently in advance and install in conjunction with roofing installation.

Flashing of Vent and Soil Pipe Extensions: All vent and soil pipe extensions through roof shall be minimum 3-inch size and flashed with 6 lb. sheet lead or 16 oz copper, 24-inch square, with sleeve soldered on, extending to top of pipe and turned down 2-inch inside.

Flashing of Roof Drains: All roof drains shall be flashed with 6 lb. sheet lead extending 12 inches from outer edge of drain opening.

Flashing of Curbs

118. Curbs shall be flashed under the General Trades Divisions of this Specification.
119. Provide counterflashing as required for weathertight construction.

BUILDING DRAINAGE SYSTEM: INSTALLATION**General**

120. All storm and sanitary lines shall be of the sizes noted and routed as indicated.
121. Unless otherwise indicated or required by codes, all building drains shall be installed with a minimum uniform grade of one percent (1%).
122. No underground drains shall be installed in water. Trenches shall be dry and acceptable before laying of pipe.
123. All overhead lines shall be installed as close to the building structure as possible.
124. All overhead cast iron drains shall be supported at each joint, each change of directions, each cast iron trap, and all necessary intermediate points to maintain a uniform pitch without sagging or pocketing of the line.

Floor Drains

125. Install floor drains with lead flashing in waterproof floors per manufacturer's recommendations.
126. Install floor drains 1/2-inch lower than finished floor elevations to ensure positive drainage. Coordinate installation closely with General Contractor.

Cleanouts

127. Install at each of the following points, but not limited to:
 - a. Base of each soil and waste stack
 - b. Base of interior storm downspouts
 - c. Change of direction of 45 deg or greater in the building drains
 - d. Inside where the drains leave the building
 - e. Where a battery of wall hung water closets are installed, provide wall cleanout at end of sanitary line in wall.
 - f. Where indicated
 - g. Install on continuous runs of the drains at 100' intervals on the storm and sanitary.
 - h. As directed by local code

128. Shall be connected to the main with long sweep or sanitary wye fittings, unless otherwise noted.
129. Shall be installed to match the finished surface line.
130. Removable plugs shall be lubricated with a mixture of grease and graphite.

Traps

131. Install on all floor drains, all waste and soil discharge connections, and where indicated. Locate for ease of service. Any other traps required by official bodies having jurisdiction shall be installed at no additional cost to the Owner.
132. Where traps on plumbing fixtures are installed below grade or otherwise concealed, a clean-out shall be installed in the adjacent finished surface as indicated.

FIELD QUALITY CONTROL

During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.

133. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in.
134. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

Test storm drainage piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

135. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
136. Leave uncovered and unconcealed new, altered, extended, or replaced storm drainage piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
137. Test Procedure: Test storm drainage piping on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts until completion of inspection, water level must not drop. Inspect joints for leaks.
138. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
139. Prepare reports for tests and required corrective action.

Test force-main piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:

140. Leave uncovered and unconcealed new, altered, extended, or replaced force-main piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
 141. Cap and subject piping to static-water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow to stand for four hours. Leaks and loss in test pressure constitute defects that must be repaired.
 142. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
- Prepare reports for tests and required corrective action.

END OF SECTION 22 13 13

SECTION 22 13 31 - ELEVATOR SUMP PUMP**PART 1 - GENERAL****REFERENCE**

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Elevator sump pump.

QUALITY ASSURANCE**General**

2. Provide all equipment as necessary for a complete installation of the Plumbing Systems.
3. Receptacle and associated wiring shall be provided by the Electrical Contractor.
4. The complete installation shall be in accordance with all applicable state and local codes.

SUBMITTALS

Shop Drawings: Submit shop drawings of all products in this section.

Product Data

5. Manufacturer's cut sheets and literature.
6. Performance data.
7. Pump curves.
8. Wiring diagrams for control panels.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Close-Out

9. Operating and maintenance information.
10. Owner instruction report.
11. Guarantees and warranties.

PART 2 - PRODUCTS

One simplex Submersible Pump shall be furnished. Pump shall be capable of pumping storm water. Pump shall be equipped with hermetically sealed, Class F insulated motor, installed in a heavy ribbed cast iron shell.

Pump construction to include single mechanical seal. The motor shell and pump volute shall be made of close grained cast iron. Pump shaft shall be stainless steel and all fastening hardware shall be stainless steel. The pump impeller shall be bronze closed type, accurately machined to the proper diameter, and dynamically balanced prior to installation in the pump. The impeller shall be non-overloading throughout the entire range of the pump curve. Pump and motor unit to receive a coat of red chromate primer and finish coat of water resistant metallic blue enamel.

Integral mechanical float type liquid level control shall be furnished for proper pump operation.

Manufacturers: Zoeller, Weil, Liberty, or equivalent.

FIBERGLASS BASIN

Supply a fiberglass basin 24 inch ID x 3-foot depth, constructed of resin reinforced with not less than 20 percent glass strands.

Cover plate shall be minimum 1/4-inch-thick perforated and painted steel with necessary openings for pump discharge, power and control cables.

Manufacturers: Jackel, Topp Industries, Weil.

VALVES

Bronze check valve shall be installed on the pump discharge.

A Bronze shutoff valve shall be installed on the pump discharge.

WARRANTY

Warranty time shall be one-year from start up. Warranty shall extend to material and workmanship of the complete system.

PART 3 - EXECUTION

EXECUTION

See additional details and diagrams on the project drawing documents.

The complete installation of all items of equipment shall be in accordance with the Manufacturer's instructions. The entire system shall be tested and adjusted under actual operating conditions.

These pumps are not to be used during construction.

Flush all incoming lines to the pump basin and thoroughly clean the basin prior to placing pumps into operation.

A representative of the manufacturer shall be present during the pump start-up and shall completely check the pump system prior to the placing of pumps into operation.

START-UP

The pump manufacturer shall provide a technician for one (1) day start-up of the complete system, to insure ample time to make corrections and/or repairs. Start-up will consist of but not limited to the following:

1. Start-up and run of pump
2. Check all electrical devices
3. Provide a start-up report to the contractor, within 48 hours from start-up date for review and corrections if needed.

END OF SECTION 22 13 31

SECTION 22 20 00 - FACILITY NATURAL GAS SYSTEM**PART 1 - GENERAL****1.1 REFERENCE**

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 JOB CONDITIONS

- A. Coordinate the exact location of this work with the work of other trades before fabrication and installation. Verify all dimensions and elevations. Provide additional offsets and section of piping as may be required to meet the applicable job conditions. Coordinate with and review all related drawings of all trades before starting work.

1.3 SUBMITTALS

- A. Shop Drawings: Not required for review.
- B. Product Data: Manufacturer's cut sheets and/or literature.
- C. Samples: Not required for review.
- D. Reference Submittals: Not required for review.

PART 2 - PRODUCTS**2.1 PIPING**

- A. Below-ground pipe 5 feet from the building to above-ground at the building shall be Schedule 40 welded-joint steel pipe with factory-applied protective coating, such as X-Trucote. Joints shall be field-coated with the same material applied as recommended by the manufacturer. If under ground gas distribution pipe is steel, provide a dielectric union at point of connection. Install a 17-pound anode pack between the building and 5 feet outside the building next to the connection to the main service pipe. Attach the anode lead wire to the piping by means of an exothermic weld, following the instructions of the manufacturer.
- B. Above-Ground Pipe, Fittings and Joints (Under 1 psig)
 - 1. 2 Inches and Smaller
 - a. Pipe: ASTM A53, Type F, Schedule 40, carbon steel.
 - b. Fittings: ASTM A197/ANSI B16.3 Class 150, black malleable iron, threaded.
 - c. Joints: Threaded.
 - 2. 2-1/2 Inches and Larger
 - a. Pipe: ASTM A53, Grade B, Type E or S, Schedule 40, carbon steel.
 - b. Fittings: ASTM A234 Grade WPB/ANSI B16.9, Schedule 40, seamless, carbon steel, welded.
 - c. Joints: Welded.

- C. Above Ground Pipe, Fittings and Joints (Over 1 psig)
 - 1. 2 Inches and Smaller
 - a. Pipe: ASTM A106, Type B, Schedule 40, carbon steel.
 - b. Fittings: ASTM A105/ANSI B16.11, 3000 pound forged steel, socket weld.
 - c. Joints: Welded.
 - 2. 2-1/2 Inches and Larger
 - a. Pipe: ASTM A53, Grade B, Type E or S, Schedule 40, carbon steel.
 - b. Fittings: ASTM A234 Grade WPB/ANSI B16.9, Schedule 40, seamless, carbon steel, welded.
 - c. Joints: Welded.
- D. Unions
 - 1. 2 Inches and Smaller
 - a. Malleable iron, ground brass seat, 150 psi steam working pressure; Stockham Figure 604 or equivalent.
 - b. Forged steel, spiral wound gasket seats, ASTM A105, ANSI B16.5.
 - 2. 2-1/2 Inches and Larger
 - a. ANSI 150 pound class forged steel flanges, ASTM A105/ANSI B16.5. Standard bolt pattern, ANSI 150 pound class 1/8-inch thick gasket, Type 304 stainless steel, spiral wound metal with graphite filler.
 - 3. The union of the underground coating and above-ground paint shall be at least 2 inches above finished grade and shall be well-bonded by application of the coating materials.
- E. Corrugated, Stainless-Steel Tubing (CSST): Comply with ANSI/IAS LC 1. (To be used only in corrosive environments)
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. OmegaFlex, Inc.
 - b. Parker Hannifin Corporation; Parflex Division.
 - c. Titeflex.
 - d. Tru-Flex Metal Hose Corp.
 - e. Gastite.
 - 2. Tubing: ASTM A 240/A 240M, corrugated, Series 300 stainless steel.
 - 3. Coating: PE with flame retardant.
 - a. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
 - 1) Flame-Spread Index: 25 or less.
 - 2) Smoke-Developed Index: 50 or less.
 - 4. Fittings: Copper-alloy mechanical fittings with ends made to fit and listed for use with corrugated stainless-steel tubing and capable of metal-to-metal seal without gaskets. Include brazing socket or threaded ends complying with ASME B1.20.1.
 - 5. Striker Plates: Steel, designed to protect tubing from penetrations.
 - 6. Operating-Pressure Rating: 5 psig
- F. Gas piping within the building shall be electrically continuous and bonded to a grounding electrode.

2.2 ACCESSORIES

A. Shut-Off Valves

1. Plug Valves: Rockwell Nordstrom lubricated plug, Fig. 114 or 115 (regular pattern), or Fig. 142 or 143 (short pattern), or equal by A.Y. McDonald, Mueller Co., or Homestead Valve. Cast iron body, bronze plug, 125 psig rated, MSS SP-78, square or lug type operator, and suitable for natural gas service.
2. Ball Valves: Valves to be as manufactured by Conbraco Industries, A.Y. McDonald, or Perfection Corp. Bronze body, chrome-plated bronze ball, 2-piece, full port, 600 psi, CWP rating, MSS SP-110, and Suitable for natural gas service.

B. Gas pressure regulators shall be as manufactured by Equimeter, Spence or Fisher. Regulator shall have cast iron body, die-cast aluminum alloy diaphragm case and aluminum or brass orifices. Spring shall be adjustable and selected for an outlet pressure as indicated on Drawings, or 7-inch to 14-inch W.C. at equipment when pressures are not indicated on Drawings.

1. Properly vent gas pressure regulators to the outdoor atmosphere with screened vent caps.

C. Provide Grinnell Figure 13 or Figure 2, Fee and Mason or Crane nickel-plated steel plates on exposed pipes passing through walls, ceilings, floors, and partitions.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Gas piping system installation shall conform to the Standard for the Installation of Gas Appliances and Gas Piping USA Z21.30, ANSI Z106.1, NFPA No. 54 and No. 58, the rules of local and state regulatory agencies governing the installation of gas piping, the Gas Utility Energy Code for indirect gas service, and local gas utility company.

B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Design locations and arrangements of piping take into consideration pipe sizing, flow direction, slope of pipe, expansion, and other design considerations. So far as practical, install piping as indicated.

C. Concealed Locations: Except as specified below, install gas piping (in masonry walls) in an airtight conduit constructed of Schedule 40 seamless black steel with welded joints. Vent conduit to the outside and terminate with a screened vent cap.

1. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to the approval of the authority having jurisdiction), whether or not such spaces are used as a plenum. Valves shall not be located in such spaces. Piping in plenums shall be welded.
2. In Floors: Piping installed in floors shall have protective wrapping specified in PART 2 above. Piping cast in concrete slabs shall be surrounded with a minimum of 1-1/2 inches of concrete and shall not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Piping shall not be embedded in concrete slabs containing quick-set additives or cinder aggregate. Piping shall be welded.
3. Piping in Partitions: Concealed piping shall not be located in solid partitions.

4. Prohibited Locations: Do not install gas piping in or through a circulating air duct, clothes chute, chimney or gas vent, ventilating duct, dumbwaiter or elevator shaft. This does not apply to accessible above-ceiling space specified above.
- D. Sleeves
1. Set sleeves during construction of walls, floors and foundations.
 2. If a hole is required after the structure is cast, its location and size shall be approved by the A/E. Core-drill the hole. Maintain the fire integrity of the structure.
 3. Where pipes pass through building construction, use proper length and gauge pipe sleeves of galvanized steel. Anchor sleeves to building construction. Size anchors to permit passage of insulation where insulation is required. Maintain the fire integrity of walls, floors, ceilings, and partitions.
 4. Where pipes pass through foundation walls and footings, provide cast iron sleeve and caulk the space between sleeve and pipe with lead wool, watertight.
 5. Install sleeves in floors perfectly plumb and in walls level. Center the pipe in the sleeve. Pack sleeves with fire-rated materials, per shop-drawing-approved submittals, and caulk in tight.
 6. Extend floor sleeves only 3/8 inch to 1/2 inch above finished floors. Neatly level tops of sleeves.
 7. Finish wall and partition sleeves flush with wall lines.
- E. Seal pipe penetrations of fire barriers using fire barrier penetration sealers specified in Division 07 Section "Joint Sealants".
- F. Drips and Sediment Traps
1. Install a drip leg at points where condensate may collect, at the outlet of the gas meter, and in a location readily accessible to permit cleaning and emptying. Do not install drips where condensate is likely to freeze.
 2. Construct drips and sediment traps using a tee fitting with the bottom outlet plugged or capped. Use a minimum of 3 pipe diameters in length for the drip leg. Use same size pipe for drip leg as the connected pipe.
 3. Drip legs at equipment connections shall be down stream of valve.
- G. Use fittings for all changes in direction and all branch connections.
- H. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.
- I. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.
- J. Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.
- K. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

- L. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.
- M. Install gas piping at a uniform grade of 1/4 inch in 15 feet, upward to risers, and from the risers to the meter, or service regulator when meter is not provided, or the equipment.
- N. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.
- O. Connect branch outlet pipes from the top or sides of horizontal lines, not from the bottom.
- P. Conform to the table below for maximum spacing of supports:

Steel Pipe Size (NPS)	Spacing in Feet	Min Rod Size Inches
1/2	6	3/8
3/4 to 1-1/4	6	3/8
1-1/2 to 3 (horizontal)	12	1/2
3-1/2 to 5 all sizes (vertical)	Every floor level	

- Q. Install unions in threaded pipes, adjacent to each valve, at final connections to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.
- R. Install dielectric unions where piping of dissimilar metals are joined.
- S. Install flanges in welded piping, on valves, apparatus, and final connections to each piece of equipment.
- T. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, and elsewhere as indicated.
- U. All gas piping exposed to outside weather environment to be protected from corrosion by application of a non-metallic based painting system specifically designed and manufactured for protection of steel structures. Color as selected by Owner.

3.2 PIPE JOINT CONSTRUCTION

- A. Welded Joints: Comply with the requirements in ASME Boiler and Pressure Vessel Code, Section IX.
- B. Threaded Joints
 - 1. Conform to ANSI B1.20.1, tapered pipe threads for field-cut threads. Join pipe, fittings, and valves as follows:
 - a. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.
 - b. Align threads at point of assembly.
 - c. Apply appropriate tape to thread compound to the external pipe threads.

- d. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
 - e. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.
- C. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

3.3 VALVE APPLICATIONS

- A. General: The drawings indicate valve types, locations, and arrangements.
- B. Shut-off Duty: Use gas cocks specified in PART 2 above.

3.4 VALVE INSTALLATIONS

- A. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.
- B. Install a gas cock upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.
- C. Install pressure relief or pressure limiting devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position.

3.5 TERMINAL EQUIPMENT CONNECTIONS

- A. Install gas cock upstream and within 6 feet of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of controls or equipment.
- B. Sediment Traps: Install a tee fitting with the bottom outlet plugged or capped as close to the inlet of the gas appliance as practical. Drip leg shall be a minimum of 3 pipe diameters in length. Sediment shall be downstream of shut-off valve.

3.6 ELECTRICAL BONDING AND GROUNDING

- A. Install above-ground portions of gas piping systems, upstream from equipment shut-off valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code."
- B. Do not use gas piping as a grounding electrode.
- C. Conform to NFPA 70, National Electrical Code, for electrical connections between wiring and electrically-operated control devices.

3.7 FIELD QUALITY CONTROL

- A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54 and local utility requirements.

END OF SECTION 22 20 00

SECTION 22 33 00 - DOMESTIC WATER HEATERS

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Gas-Fired water heater.
2. Recirculation pumps.
3. Thermostatic mixing valves.
4. Expansion tanks.
5. Scale Elimination System.
6. Accessories.

SUBMITTALS

General: Submit the following in accordance with Conditions of Contract and Division 01 Specification Sections.

7. Product data, including rated capacities of selected models, weights (shipping, installed and operating), furnished specialties, accessories, dimensions, required clearances, methods of assembly of components, piping and wiring connections.
8. Wiring diagrams from manufacturers, detailing electrical requirements for electric power supply wiring to water heaters. Include ladder-type diagrams for interlock and control wiring required for final installations of water heaters and controls. Differentiate between portions of wiring that are factory-installed and portions that are to be field-installed.

QUALITY ASSURANCE

ASME Boiler and Pressure vessel code, section IV, Part HLW.

ANSI Z21.10.3 /CSA 4.3 "Gas Water Heaters"

ISO 9001 Quality Management System

CSD-1 "Controls and Safety Devices for Automatically Fired Boilers"

NFPA 54- National Fuel Gas Code

NSF/ANSI Standard 61- Drinking Water System Components

NSF/ANSI Standard 372 – Drinking Water System Components – Lead Content

ASTM G123 - 00(2005) "Standard Test Method for Evaluating Stress-Corrosion Cracking of Stainless Alloys with Different Nickel Content in Boiling Acidified Sodium Chloride Solution."

Electrical Component Standard: Provide components complying with NFPA 70, National Electric Code.

Listing and Labeling: Provide water heaters that are listed and labeled.

9. The terms "listed" and "labeled" shall be as defined in the National Electric Code, Article 100.
10. Listing and Labeling Agency Qualifications: A Nationally Recognized Testing Laboratory (NRTL) as defined in OSHA Regulation 1910.7.

ASHRAE Standards: Provide water heaters with performance efficiencies not less than prescribed in ASHRAE 90A, Energy Conservation in New Building Design.

WARRANTY

Special Project Warranty

11. Submit a written warranty, executed by manufacturer, agreeing to repair or replace water heater units that fail in materials or workmanship within the specified warranty period. Failures include, but shall not be limited to, tanks. This warranty shall be in addition to, and a limitation of, rights the Owner may have against the Contractor under the Contract Documents.
12. Warranty period is 3 years after date of Substantial Completion.

PART 2 - PRODUCTS

2.1 HIGH EFFICIENCY, CONDENSING NATURAL GAS FIRED WATER HEATER

- A. Provide natural gas fired storage type water heaters to serve the domestic hot water system. Water Heater shall be sized at a minimum of 100% of total calculated peak demand at 100% recovery as required by code.
- B. Provide make and model as scheduled, or approved equivalent.
- C. Standard: ANSI Z21.10.3/CSA 4.3.and ASHRAE/IESNA 90.1
- D. Certified by SCAQMD for Oxides of Nitrogen (NOx) of 20 ppm or less at 3% O₂
- E. Comply with National Sanitation Foundation (NSF)/ANSI Standard Number 5
- F. Storage-Tank Construction: Glass-lined steel with 150-psig minimum working-pressure rating.
 1. Tappings: Factory fabricated of materials compatible with tank. Attach tappings to tank before testing.
 - a. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.

2. Interior Finish: Comply with NSF 61 Annex G barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
3. Factory-Installed Storage-Tank Appurtenances:
 - a. Anode Rod: Replaceable magnesium.
 - b. Dip Tube: Required unless cold-water inlet is near bottom of tank.
 - c. Drain Valve: Corrosion-resistant metal complying with ASSE 1005.
 - d. Insulation: Comply with ASHRAE/IESNA 90.1. Surround entire storage tank except connections and controls.
 - e. Jacket: Steel with enameled finish.
 - f. Burner or Heat Exchanger: Comply with UL 795 or approved testing agency requirements for gas-fired, high-efficiency, domestic-water heaters and natural-gas fuel.
 - g. Temperature Control: Adjustable thermostat.
 - h. Safety Controls: Automatic, high-temperature-limit and low-water cutoff devices or systems.
 - i. Combination Temperature-and-Pressure Relief Valves: ANSI Z21.22/CSA 4.4-M. Include one or more relief valves with total relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select one relief valve with sensing element that extends into storage tank.
4. Refer to Plans, Diagrams and Schedules for additional capacities and characteristics.
5. Insulation of tank and piping shall be per Division 22 Specification "Plumbing Insulation".
6. Refer to Mechanical Plan for Air Intake and Vent.
7. Provide condensate neutralizer kit at minimum 60,000 BTU/Hour minimum input plumbed to nearest floor drain with NPT size connection and code approved air gap of two (2) times the pipe diameter. Install per manufacturer instructions.
8. Water heater shall have an interface for operating status and output temperature. Interface shall connect to Building Management System (BacNET).
9. Provide line size isolation valve on incoming cold water and outgoing hot water piping.
10. Refer to details for additional information on hot water system.

2.2 RECIRCULATING PUMPS

Pump is close coupled centrifugal type and integral variable speed/pressure integral ECM motor with 420 stainless steel shaft with seals. Bearings lubricated by pumped liquid. Maximum operating pressure of 175 psi.

Constant speed, constant pressure or proportional pressure mode ECM motor, carbon sleeve bearings, stainless steel impeller and permanent magnet rotor, 304 stainless

steel pump housing, stator with built in thermal switch, flanged connections. Pump suitable for continuous operation at 230 deg F. Built-in overload protection. Motor shall be non-overloading at any point on the pump curve.

Capacity and electrical characteristics as noted on the Drawings.

Manufacturers: Bell & Gossett, Grundfos, TACO, Armstrong.

2.2 THERMOSTATIC MIXING VALVES

A. Primary, Thermostatic, Digital Water Mixing Valves

1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated on Drawings or comparable product by one of the following:
 - a. Armstrong International, Inc. (Brain).
2. Standard: ASSE 1017.
3. Pressure Rating: 125 psig minimum unless otherwise indicated.
4. Type: Exposed-mounted, thermostatically controlled, digital water mixing valve, +/- 2 deg. adjustable temperature control, automatic hot water shut-off in the event of cold water failure, programmable.
5. Material: Bronze body with corrosion-resistant interior components or stainless steel. Lead-free design.
6. Connections: Threaded union or flanged inlets and outlet.
7. Accessories: Adjustable temperature control, check stops on hot- and cold-water supplies, wall mounting bracket, and adjustable temperature-control, 120-240 volt. Thermometer and pressure gauge on hot water outlet and hot water return inlet. Ability to communicate with BAS (BacNet) system.
8. Tempered-Water Setting: As noted on Drawings.
9. Refer to Drawings for design characteristics such as flow rate and pressure drop.

EXPANSION TANKS

Description: Steel, pressure-rated tank constructed with welded joints and factory-installed, butyl-rubber diaphragm. Include air precharge to minimum system-operating pressure at tank.

2. Available Manufacturers
 - a. AMTROL Inc.
 - b. Armstrong Pumps, Inc.
 - c. Elbi of America, Inc.
 - d. Taco, Inc.
 - e. Watts Regulator Co.
 - f. Wessels Co.
3. Construction
 - a. Tappings: Factory-fabricated steel, welded to tank before testing and labeling. Include ASME B1.20.1 pipe thread. Include tap for pressure gauge.
 - b. Interior Finish: Comply with NSF 61 barrier materials for potable-water tank linings, including extending finish into and through tank fittings and outlets.
 - c. Air-Charging Valve: Factory installed.
 - d. ASME rated.

4. Capacity and Characteristics
 - a. Working-Pressure Rating: 150 psig.
 - b. Capacity Acceptable: Refer to Schedule on Drawings.
 - c. Air Precharge Pressure: Set air pressure equal to incoming water pressure downstream of water service backflow preventer.

SCALE ELIMINATION SYSTEM

Aquasolve (or Engineer approved equivalent) scale prevention system shall be installed on the branch water service pipe just after it enters the boiler room, but after other water safety devices (backflow preventers or pressure reducing valves), to effectively address water hardness concerns. The system shall be plumbed with a bypass valve to allow isolation of the tank(s) and to allow the bypass of untreated water if service or media replacement be necessary. The installation area should be suitable in size for the tank(s) to be serviced without encumbrance and sit upright on a flat level surface.

The system must operate in an up-flow manner and does not require additional water to backwash, flush or regenerate once put into service. The system shall not require any chemical additives and does not require electricity for operation.

Replace resin media on a maximum three-year cycle. PVI automatically extends its water heater warranty with installation of this product.

WATER HEATER ACCESSORIES

Drain Pans: Corrosion-resistant metal with raised edge. Comply with ANSI/CSA LC3. Include dimensions not less than base of domestic-water heater and include drain outlet not less than NPS 3/4 (DN 20) WITH ASME B1.20.1 pipe threads or with ASME B1.20.7 garden-hose threads.

Piping-Type Heat Traps: Field-fabricated piping arrangement according to ASHRAE/IESNA 90.1.

Manifold Kits: Domestic-water heater manufacturer's factory-fabricated inlet and outlet piping for field installation, for multiple domestic-water heater installation. Include ball-, butterfly-, or gate-type shutoff valves to isolate each domestic-water heater and calibrated balancing valves to provide balanced flow through each domestic-water heater.

Gas Shutoff Valves: ANSI Z21.15/CSA 9.1-M, manually operated. Furnish for installation in piping.

Gas Pressure Regulators: ANSI Z21.18/CSA 6.3, appliance type. Include regulator with pressure rating as required to match gas supply. Pipe all interior regulator vents to outdoors with insect screen termination fittings per NFPA 54 requirements.

Automatic Gas Valves: ANSI Z21.21/CSA 6.5, appliance, electrically operated, on-off automatic valve.

Combination Temperature-and-Pressure Relief Valves: Include relieving capacity at least as great as heat input and include pressure setting less than domestic-water heater working-pressure rating. Select relief valves with sensing element that extends into storage tank.

5. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
6. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

Pressure Relief Valves: Include pressure setting less than domestic-water heater working-pressure rating.

7. Gas-Fired, Domestic-Water Heaters: ANSI Z21.22/CSA 4.4-M.
8. Oil-Fired, Domestic-Water Heaters: ASME rated and stamped.

Vacuum Relief Valves: ANSI Z21.22/CSA 4.4-M.

Domestic-Water Heater Concentric Vent Kit : Manufacturer's factory-fabricated Polypropylene Concentric Vent kit with combustion air piped through outer annular space and exhaust air piped through interior annular space. Suitable for horizontal/vertical installation (wall or roof)

Provide Condensate Neutralization tank and/or kit

9. Provide NEUTRA-SAFE or equivalent tube style condensate neutralizer with minimum guideline capacity of 60,000 BTU/hour.
10. Provide outlet trap at condensate collection sump and install neutralizer per manufacturer's instructions and local AHJ requirements.

2.3 SOURCE QUALITY CONTROL

- A. Factory Tests: Test and inspect assembled domestic-water heaters specified to be ASME-code construction, according to ASME Boiler and Pressure Vessel Code.
- B. Hydrostatically test commercial domestic-water heaters to minimum of one and one-half times pressure rating before shipment.
- C. Domestic-water heaters will be considered defective if they do not pass tests and inspections. Comply with requirements in Section 014000 "Quality Requirements" for re-testing and re-inspecting requirements and Section 017300 "Execution" for requirements for correcting the Work.
- D. Prepare test and inspection reports.

PART 3 - EXECUTION

CONCRETE BASES

Construct concrete equipment base.

Install reinforcing bars, tied to frame and place anchor bolts and sleeves using manufacturer's installation template.

Place concrete and allow to cure before installation of equipment.

WATER HEATER INSTALLATION

- A. Install domestic-water heaters level and plumb, according to layout drawings, original design, and referenced standards. Maintain manufacturer's recommended clearances. Arrange units so controls and devices needing service are accessible.
- B. General: Install water heaters on 4-inch concrete bases with drip drain pans. Set and connect units in accordance with manufacturer's written installations instructions. Install units plumb and level, firmly anchored in locations indicated and maintain manufacturer's recommended clearances. Orient so controls and devices needing servicing are accessible.
- C. Install shutoff valves on domestic-water-supply piping to domestic-water heaters and on domestic-hot-water outlet piping. Comply with requirements for shutoff valves specified in Section 220523 "General Duty Valves for Plumbing Piping."
- D. Install gas-fired, domestic-water heaters according to NFPA 54.
 - a. Install gas shutoff valves on gas supply piping to gas-fired, domestic-water heaters without shutoff valves.
 - b. Install gas pressure regulators on gas supplies to gas-fired, domestic-water heaters without gas pressure regulators if gas pressure regulators are required to reduce gas pressure at burner.
 - c. Install automatic gas valves on gas supplies to gas-fired, domestic-water heaters if required for operation of safety control.
 - d. Comply with requirements for gas shutoff valves, gas pressure regulators, and automatic gas valves specified in Section 231123 "Facility Natural-Gas Piping."
- E. Install combination temperature-and-pressure relief valves in top portion of storage tanks. Use relief valves with sensing elements that extend into tanks. Extend commercial-water-heater relief-valve outlet, with drain piping same as domestic-water piping in continuous downward pitch, and discharge by positive air gap onto closest floor drain.
- E. Install water-heater drain piping as indirect waste to spill by positive air gap into open drains or over floor drains. Install hose-end drain valves at low points in water piping for domestic-water heaters that do not have tank drains. Comply with requirements for hose-end drain valves specified in Section 221116 "Domestic Water Piping."
- F. Install thermometer on outlet piping of domestic-water heaters. Comply with requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."
- G. Assemble and install inlet and outlet piping manifold kits for multiple domestic-water heaters. Fabricate, modify, or arrange manifolds for balanced water flow through each domestic-water heater. Include shutoff valve and thermometer in each domestic-water heater inlet and outlet, and throttling valve in each domestic-water heater outlet. Comply with requirements for valves specified in Section 220523 "General Duty Valves for Plumbing Piping," and comply with

requirements for thermometers specified in Section 220519 "Meters and Gages for Plumbing Piping."

- H. Install piping-type heat traps on inlet and outlet piping of domestic-water heater storage tanks without integral or fitting-type heat traps.
- I. Fill domestic-water heaters with water.
- J. Charge domestic-water expansion tanks with air. Provide one tank downstream of check valve at each water heater.

CONNECTIONS

Piping installation requirements are specified in other Sections of Division 22. The drawings indicate general arrangement of piping, fittings and specialties. The following are specific connection requirements:

- 1. Install piping adjacent to equipment arranged to allow servicing and maintenance.
- 2. Connect hot and cold water piping to units with shut-off valves and unions. Extend relief valve discharge full-size to closest floor drain.
 - a. Where water heater piping connections are dissimilar metals, make connections with dielectric fittings or dielectric unions specified in Division 22 Section "Common Work Results for Plumbing".
 - b. Install expansion tanks at cold water inlet piping as shown on drawings.
- 3. Install drain as indirect waste spill into open drain or over floor drain.
 - a. Install drain valves at low point in water piping, for water heaters not having tank drain.

Electric Connections

- 4. Power wiring and disconnect switches area specified in Division 26.
- 5. Grounding: Connect unit components to ground in accordance with the National Electric Code.

FIELD QUALITY CONTROL

General

- 6. Provide the services of a factory-authorized service representative to test and inspect unit installation, provide start-up service, and demonstrate and train Owner's maintenance personnel as specified below.
- 7. Test and adjust operating and safety controls. Replace damaged and malfunctioning controls and equipment.

Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing and preventative maintenance.

- 8. Review data in Operating and Maintenance Manuals. Refer to Division 01 Section "Contract Close-Out".
- 9. Schedule training with at least 7 days' advance notice.

COMMISSIONING

Perform the following before start-up final checks:

10. Fill water heater with water.
11. Piping system test complete.
12. Check for pipe connection leaks.
13. Test operation of safety controls and devices.

Perform the following start-up procedures:

14. Energize circuits.
15. Adjust operating controls.
16. Adjust hot water outlet temperature setting.

END OF SECTION 22 33 00

SECTION 22 40 00 - PLUMBING FIXTURES**PART 1 - GENERAL**

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Inclusion of all plumbing fixtures, complete and ready for use.
 - a. All fixtures, except as otherwise specified, shall be constructed of vitreous china with all visible exposed surfaces glazed.
2. Providing all stops, traps, escutcheons, connections, etc., as are necessary to complete the installation of each fixture, whether such items are listed or not.
3. Plumbing Trim
 - a. All finished exposed faucets, traps, connecting piping, stops, flush valves and other fixture trim shall be chromium-plated brass unless otherwise specified and shall be supported rigidly to fixtures and to walls with matching brackets at not more than 2'-0" center. All fastenings shall be chromium-plated brass or may be 302 stainless steel if of matching color and finish.
 - b. Faucets shall be furnished as required. All faucets shall be lead-free.
 - c. Vacuum breakers shall be provided as a part of the fixture trim wherever there is a possibility of back-siphoning.
4. Fixture Stops
 - a. Shut-offs for urinal and water closet flush valves shall be an integral part of the fixture or fitting; shut-offs for all other fixtures shall be loose-key, lock-shield-type.
 - b. All fixture stops shall be angle- or straight-type adapted for each particular location and shall be located immediately adjacent to the fixture. Use threaded adaptors when used in conjunction with copper tube work. All stop valves shall be lead-free
5. All exposed screws or fasteners for plumbing fixtures and faucets shall be vandalproof. Contractor shall take care to coordinate this item with his suppliers prior to Shop Drawings submittal.
6. Aerators, where required for sinks and lavatories shall be vandalproof.

QUALITY ASSURANCE

Meet the requirements of the following:

7. State Plumbing Code.
8. State Department of Housing, Buildings and Construction.
9. 42 USC 300G: The Reduction of Lead In Drinking Water Act.

Material Standards

10. ANSI/ASME A112.19.2: Vitreous China Plumbing Fixtures.

11. ANSI/ASME A112.19.3: Stainless Steel Plumbing Fixtures (Designed for Residential Use).
12. ANSI/ASME A112.19.4M: Porcelain Enameled Formed Steel Plumbing Fixtures.
13. ANSI/ASME A112.19.5: Trim for Water Closet Bowls, Tanks, and Urinals.
14. ANSI/ASSE 1016: Performance Requirements for Thermostatic, Pressure Balancing and Combination Control Valves for Bathing Facilities.
15. ANSI/ASSE 1025: Performance Requirements for Diverters for Plumbing Faucets with Hose Spray, Anti-Siphon-Type, Residential Applications.

SUBMITTALS

Shop Drawings: Not required for review.

Product Data: Catalog cuts, including all fixture trim.

Samples: Not required for review.

Project Information: Not required for review.

Contract Close-Out Information

16. Operating and maintenance data.
17. Guarantees.

PART 2 - PRODUCTS

MATERIALS - GENERAL

Acceptable Manufacturers

1. Plumbing Faucets (Commercial Grade): Chicago Faucet, Delta, Moen, Powers, Symmons, Speakman, T&S Brass Co., Hydrotek
2. Flush Valves: Sloan, Delany, Zurn, and Hydrotek
3. Vitreous China Plumbing Fixtures: American Standard, Kohler, Eljer, Zurn.
4. Mop Sinks
 - a. Terrazzo: Crane, Creative Industries, Fiat, Florestone, Stern and Williams.
 - b. Molded Stone: Crane, Fiat, Florestone, Mustee, Swan Corp., Zurn.
5. Closet Seats: Church, Sperzel, Olsonite, Beneke, Centoco.
6. Shower Mixing Valves: Powers, Leonard, Lawler, Speakman, Bradley.
7. Stainless Steel Sinks: Elkay, Just, Metcraft, Southern Kitchens.
8. Surgical Scrub Sinks: American Standard, Steris, Whitehall, Acorn Engineering.
9. Emergency Showers or Eyewash: Speakman, Haws, Guardian, Encon, Bradley.
10. Electric Water Coolers: Elkay, Haws, Oasis, Halsey-Taylor.
11. Precast Shower Receptacles: Fiat, Stern and Williams, Swan Corp.
12. Acrylic/Fiberglass Prefabricated Showers and Tubs: Aquatic, Aqua Glass, Aquarius, American Bath, Kohler.
13. Carriers: Josam, Mifab, Smith, Wade, Watts, Zurn.
14. Supply Stop Valves: Brasscraft, McGuire, Nibco, Watts.

Plumbing Fixtures – General: Constructed or equipped with anti-siphon devices to prevent siphoning waste material into potable water supply system.

Escutcheons and Plates: Conceal all holes where pipes pass through walls, floors or ceilings; use plates or escutcheons.

Piping Exposed in Finished Areas (including fittings and trim): Chromium-plated or nickel-plated brass with polished bright surface.

Trim for Lavatories and Sinks: Provide with renewable cartridges.

Vitreous Caps: Provide for water closet bolts.

Sealant: Silicone-type. See Division 7 Section "Joint Sealants".

CHAIR CARRIERS

Carriers for Water Closets

15. Use cast iron couplings where required by Code.
16. Josam 12000 Series.

Carrier for Urinals: Josam 17800 or 17810.

Carriers for Lavatories: Josam 17100, 17100-76.

Carriers for Electric Water Coolers: Josam 17900 or 17905.

Carriers for Service Sinks: Josam 17720.

INSULATION AT HANDICAPPED (ADA-COMPLIANT) LAVATORIES

Insulation

17. Handicapped lavatories exposed waste, hot and cold water supply lines shall be insulated with a molded, flexible vinyl insulation system with all fasteners. Provide insulation for 1-1/4-inch waste offset drain, tailpiece, P-trap and waste arm and 3/8-inch supply tubing and 3/8-inch keyed stop valve. Color shall be white.
18. Manufacturers/Products
 - a. IPS Corp Truebro Lav-Guard 2.
 - b. Plumberex Pro-Extreme.
 - c. McGuire ProWrap.

PART 3 - EXECUTION

INSTALLATION

Sink manufacturer shall provide proper template to architectural woodwork supplier for cutting of countertop.

Plumber shall place sink in countertop and complete faucet and piping.

Install all fixtures in accordance with Manufacturer's recommendations.

All fixture support carriers shall be of the type necessary to permit adjustment to fit variations in construction. All grounds or special supports necessary for setting fixtures shall be

provided before plastering or other finished construction work is begun. All fixtures shall be hung at standard height unless otherwise indicated by the A/E.

Minimum fixture connection sizes are shown on the Drawings.

Provide chrome-plated brass escutcheons on all waste and supply piping penetrating the walls and floors for fixtures, including piping within cabinets.

Provide fixture carriers and required drainage fittings on all wall hung fixtures. Anchor carriers securely to floor.

Where plumbing fixtures abut to walls, floors, and countertops, seal all joints with sealant.

Seal floor sinks to wall and floor with building sealant. Color shall match fixture.

Provide anchors behind the wall for flush valve supply piping.

Adjust self-sustaining closet seats for proper operation and to sustain in any position.

Adjust electric water coolers flow for correct operation and temperature.

Insulate the hot and cold water and waste piping under handicapped lavatories.

Adjust shower mixing valves for correct leaving water temperature.

After all fixtures have been set and are ready for use, and before the Contractor leaves the job, he shall thoroughly clean all fixtures furnished and set by him, removing all stickers, rust stains and any other matter or discoloration of fixtures, leaving every part in new condition. He shall, further, adjust all flush valves and other fixture water tempering or balancing at supplies to give proper water flow of fixtures.

END OF SECTION 22 40 00

PUBLIC BUILDING COMMISSION OF CHICAGO

**BOOK 3 – VOLUME 2
TECHNICAL SPECIFICATIONS**

CONTRACT NO. C1611

**EMERGENCY MEDICAL SERVICES (EMS) ADDITION
701 N. KILBOURN AVENUE
CHICAGO, ILLINOIS 60651**

**NEW BUILDING ADDITION
PBC PROJECT #07215**

PUBLIC BUILDING COMMISSION OF CHICAGO



**Mayor Brandon Johnson
Chairman**

Ray Giderof
Acting Executive Director

Room 200
Richard J. Daley Center
50 West Washington Street
Chicago, Illinois 60602
312-744-3090
www.pbcchicago.com

ISSUED FOR BID ON JUNE 26, 2024

By
AECOM Services of Illinois, Inc.
303 E. Wacker Drive, Suite 1400
Chicago, IL 60601
312-373-7700

DIVISION 00 - PROCUREMENT AND CONTRACTING REQUIREMENTS

00 01 01	PROJECT MANUAL COVER PAGE	06/26/24
00 01 02	TABLE OF CONTENTS	07/12/24
00 01 11	SUPPLEMENTAL PROJECT INFORMATION.....	06/26/24

DIVISION 01 - GENERAL REQUIREMENTS

01 10 00	SUMMARY OF WORK.....	07/12/24
01 22 00	UNIT PRICES	06/26/24
01 23 00	ALTERNATES.....	06/26/24
01 25 00	SUBSTITUTION PROCEDURES	06/26/24
01 25 00.01	SUBSTITUTION REQUEST FORM	06/26/24
01 26 00	CONTRACT MODIFICATION PROCEDURES.....	06/26/24
01 26 13	REQUESTS FOR INTERPRETATION	06/26/24
01 29 00	PAYMENT PROCEDURES	06/26/24
01 31 00	PROJECT MANAGEMENT AND COORDINATION	06/26/24
01 32 00	CONSTRUCTION PROGRESS DOCUMENTATION	06/26/24
01 32 16	CONSTRUCTION PROJECT SCHEDULE.....	06/26/24
01 32 33	PHOTOGRAPHIC DOCUMENTATION	06/26/24
01 33 00	SUBMITTAL PROCEDURES	06/26/24
01 40 00	QUALITY REQUIREMENTS	06/26/24
01 42 20	REFERENCES.....	06/26/24
01 50 00	TEMPORARY FACILITIES AND CONTROLS.....	06/26/24
01 50 10	COMMISSION REPRESENTATIVE FIELD OFFICE	06/26/24
01 56 11	GENERAL DUST, FUME AND ODOR CONTROL	06/26/24
01 56 39	TEMPORARY TREE AND PLANT PROTECTION	06/26/24
01 57 13	LEED TEMPORARY EROSION AND SEDIMENT CONTROL	06/26/24
01 60 00	PRODUCT REQUIREMENTS	06/26/24
01 73 00	EXECUTION	06/26/24
01 73 29	CUTTING AND PATCHING.....	06/26/24
01 74 19	LEED CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL	06/26/24
01 77 00	CLOSEOUT PROCEDURES.....	06/26/24
01 78 23	OPERATION AND MAINTENANCE DATA.....	06/26/24
01 78 39	PROJECT RECORD DOCUMENTS	06/26/24
01 79 00	DEMONSTRATION AND TRAINING.....	06/26/24
01 81 13	LEED SUSTAINABLE DESIGN REQUIREMENTS	06/26/24
01 81 13A	LEED PROJECT CHECKLIST	06/26/24
01 81 13B	LEED MATERIALS.....	06/26/24
01 91 13	GENERAL COMMISSIONING REQUIREMENTS.....	06/26/24

DIVISION 02 - EXISTING CONDITIONS

02 41 19	SELECTIVE DEMOLITION.....	06/26/24
----------	---------------------------	----------

DIVISION 03 – CONCRETE

03 30 00	CAST-IN-PLACE CONCRETE	06/26/24
----------	------------------------------	----------

DIVISION 04 - MASONRY

04 22 00	CONCRETE UNIT MASONRY	06/26/24
----------	-----------------------------	----------

DIVISION 05 – METALS

05 12 00	STRUCTURAL STEEL FRAMING.....	06/26/24
05 31 00	STEEL DECK.....	06/26/24
05 40 00	COLD FORMED METAL FRAMING.....	06/26/24
05 50 00	METAL FABRICATIONS.....	06/26/24
05 51 00	MODULAR ROOFTOP STAIRS.....	06/26/24
05 51 13	METAL PAN STAIRS.....	06/26/24
05 52 13	PIPE AND TUBE RAILINGS.....	06/26/24

DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES

06 10 53	MISCELLANEOUS ROUGH CARPENTRY.....	06/26/24
06 16 00	SHEATHING.....	06/26/24
06 41 16	PLASTIC LAMINATE-CLAD ARCHITECTURAL CABINETS.....	06/26/24

DIVISION 07 - THERMAL AND MOISTURE PROTECTION

07 05 43	RAIN SCREEN ATTACHMENT SYSTEMS.....	06/26/24
07 11 13	BITUMINOUS DAMPPROOFING.....	06/26/24
07 21 00	THERMAL INSULATION.....	06/26/24
07 21 19	FOAMED-IN-PLACE INSULATION.....	06/26/24
07 21 29	ACOUSTIC SPRAY ON SYSTEM.....	06/26/24
07 27 15	SELF-ADHERING WATER-RESISTIVE AIR BARRIER MEMBRANE.....	06/26/24
07 42 13.13	FORMED METAL WALL PANELS.....	06/26/24
07 54 23	THERMOPLASTIC-POLYOLEFIN (TPO) ROOFING.....	06/26/24
07 60 00	SHEET METAL FLASHING AND TRIM.....	06/26/24
07 72 00	ROOF ACCESSORIES.....	06/26/24
07 81 00	APPLIED FIRE PROTECTION.....	06/26/24
07 84 13	PENETRATION FIRESTOPPING.....	06/26/24
07 84 43	JOINT FIRESTOPPING.....	06/26/24
07 92 00	JOINT SEALANTS.....	06/26/24
07 92 19	ACOUSTICAL JOINT SEALANT.....	06/26/24
07 95 13.16	EXPANSION JOINT COVER ASSEMBLIES.....	06/26/24

DIVISION 08 - OPENINGS

08 11 13	HOLLOW METAL DOORS AND FRAMES.....	06/26/24
08 14 16	FLUSH WOOD DOORS.....	06/26/24
08 31 13	ACCESS DOOR AND FRAMES.....	06/26/24
08 33 23	OVERHEAD COILING DOORS.....	06/26/24
08 41 13	ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS.....	06/26/24
08 44 13	GLAZED ALUMINIUM CURTAIN WALLS.....	06/26/24
08 71 00	DOOR HARDWARE.....	06/26/24
08 80 00	GLAZING.....	06/26/24
08 91 19	FIXED LOUVERS.....	06/26/24

DIVISION 09 - FINISHES

09 21 16.23	GYPSON BOARD SHAFT WALL ASSEMBLIES.....	06/26/24
09 22 16	NON-STRUCTURAL METAL FRAMING.....	06/26/24
09 29 00	GYPSON BOARD.....	06/26/24
09 30 13	CERAMIC TILING.....	06/26/24
09 65 13	RESILIENT BASE AND ACCESSORIES.....	06/26/24
09 67 23	RESINOUS FLOORING.....	06/26/24
09 68 13	TILE CARPETING.....	06/26/24

09 91 23 INTERIOR PAINTING 06/26/24
09 96 11 HIGH-PERFORMANCE COATINGS 06/26/24
09 96 53 SILICONE ELASTOMERIC COATINGS..... 06/26/24

DIVISION 10 – SPECIALTIES

10 14 23.16 ROOM IDENTIFICATION PANEL SIGNAGE 06/26/24
10 21 13.17 PHENOLIC-CORE TOILET COMPARTMENTS 06/26/24
10 22 39 FOLDING PANEL PARTITIONS 06/26/24
10 26 00 WALL AND DOOR PROTECTION 06/26/24
10 28 00 TOILET, BATH, AND LAUNDRY ACCESSORIES 06/26/24
10 44 16 FIRE EXTINGUISHERS 06/26/24
10 51 13 METAL LOCKERS 06/26/24

DIVISION 12 - FURNISHINGS

12 24 13 ROLLER WINDOW SHADES 06/26/24
12 36 61.16 SOLID SURFACING COUNTERTOPS..... 06/26/24
12 50 00 FURNITURE PACKAGE 06/26/24

DIVISION 13 - SPECIAL CONSTRUCTION

NOT APPLICABLE 06/26/24

DIVISION 14 - CONVEYING EQUIPMENT

14 21 23.16 MACHINE ROOMLESS ELECTRIC TRACTION PASSENGER ELEVATOR 06/26/24

Facility Services Subgroup

DIVISION 21 - FIRE SUPPRESSION

21 05 17 SLEEVES AND SLEEVE SEALS FOR FIRE SUPPRESSION PIPING 06/26/24
21 05 23 GENERAL-DUTY VALVES FOR FIRE PROTECTION PIPING 06/26/24
21 05 53 IDENTIFICATION FOR FIRE SUPPRESSION PIPING 06/26/24
21 11 00 FACILITY FIRE SUPPRESSION WATER SERVICE PIPING 06/26/24
21 13 13 WET-PIPE SPRINKLER SYSTEMS 06/26/24

DIVISION 22 – PLUMBING

22 05 01 COMMON WORK RESULTS FOR PLUMBING 06/26/24
22 05 07 EXCAVATION AND BACKFILL 06/26/24
22 05 13 COMMON MOTOR REQUIREMENTS FOR PLUMBING EQUIPMENT 06/26/24
22 05 19 METERS AND GAUGES FOR PLUMBING PIPING 06/26/24
22 05 23 GENERAL-DUTY VALVES FOR PLUMBING PIPING..... 06/26/24
22 05 29 HANGERS AND SUPPORTS FOR PLUMBING AND PIPING EQUIPMENT 06/26/24
22 05 48 VIBRATION CONTROLS FOR PLUMBING PIPING AND EQUIPMENT 06/26/24
22 05 53 IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT 06/26/24
22 05 61 PREPERATION OF PLUMBING SYSTEMS 06/26/24
22 05 93 PLUMBING SYSTEMS TESTING, ADJUSTING, AND BALANCING 06/26/24
22 07 00 PLUMBING PIPING INSULATION 06/26/24
22 08 00 COMMISSIONING FOR PLUMBING 06/26/24
22 11 16 DOMESTIC WATER PIPING 06/26/24
22 13 16 BUILDING SANITARY STORM DRAINAGE 06/26/24
22 13 31 ELEVATOR SUMP PUMP 06/26/24
22 20 00 FACITILY NATURAL GAS SYSTEM 06/26/24
22 33 00 DOMESTIC WATER HEATERS 06/26/24

22 40 00 PLUMBING FIXTURES 06/26/24

DIVISION 23 – MECHANICAL

23 05 00 GENERAL MECHANICAL REQUIREMENTS 06/26/24
 23 05 14 VARIABLE FREQUENCY DRIVES 06/26/24
 23 05 19 METERS AND GUAGES FOR HVAC PIPING..... 06/26/24
 23 05 23 GENERAL–DUTY VALVES FOR HVAC PIPING..... 06/26/24
 23 05 29 HANGERS, SLEEVES, AND SUPPORTS..... 06/26/24
 23 05 48 VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT 06/26/24
 23 05 53 IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT 06/26/24
 23 05 93 MECHANICAL SYSTEMS TESTING, ADJUSTING, AND BALANCING 06/26/24
 23 07 00 HVAC INSULATION 06/26/24
 23 08 00 COMMISSIONING FOR HVAC 06/26/24
 23 09 00 CONTROLS AND INSTRUMENTATION 06/26/24
 23 21 13 HYDRONIC PIPING 06/26/24
 23 21 23 HYDRONIC PUMPS..... 06/26/24
 23 23 00 REFRIGERANT PIPING..... 06/26/24
 23 25 00 HVAC WATER TREATMENT 06/26/24
 23 30 00 DUCTWORK AND ACCESORIES..... 06/26/24
 23 34 00 EXHAUST AND VENTILATING FANS 06/26/24
 23 36 16 TERMINAL BOXES – DDC CONTROL 06/26/24
 23 52 16 CONDENSING BOILERS..... 06/26/24
 23 64 26.13 AIR COOLED ROTARY SCREW WATER CHILLER 06/26/24
 23 73 43.19 OUTDOOR CUSTOM AIR HANDLING UNIT 06/26/24
 23 81 26 SPLIT SYSTEM AIR CONDITIONERS..... 06/26/24
 23 82 36 FINNED TUBE RADIATION HEATERS..... 06/26/24
 23 82 39.13 CABINET UNIT HEATERS 06/26/24

DIVISION 24 - RESERVED

NOT APPLICABLE 06/26/24

DIVISION 25 - INTEGRATED AUTOMATION

NOT APPLICABLE 06/26/24

DIVISION 26 - ELECTRICAL

26 05 19 LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES ... 06/26/24
 26 05 23 CONTROL-VOLTAGE ELECTRICAL POWER CABLES 06/26/24
 26 05 26 GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 29 HANGERS AND SUPPORT FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 33 RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS..... 06/26/24
 26 05 44 SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING 06/26/24
 26 05 53 IDENTIFICATION FOR ELECTRICAL SYSTEMS 06/26/24
 26 05 73.13 SHORT-CIRCUIT STUDIES..... 06/26/24
 26 05 73.16 COORDINATION STUDIES 06/26/24
 26 05 73.19 ARC-FLASH HAZARD ANALYSIS 06/26/24
 26 08 00 COMMISSIONING FOR ELECTRICAL 06/26/24
 26 09 13 ELECTRICAL POWER MONITORING..... 06/26/24
 26 09 43 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM 06/26/24
 26 22 13 LOW-VOLTAGE DISTRIBUTION TRANSFORMERS..... 06/26/24
 26 24 13 SWITCHBOARDS 06/26/24

26 24 16 PANELBOARDS 06/26/24
 26 27 13 ELECTRICITY METERING 06/26/24
 26 27 26 WIRING DEVICES 06/26/24
 26 28 13 FUSES 06/26/24
 26 28 16 ENCLOSED SWITCHES AND CIRCUIT BREAKERS 06/26/24
 26 29 13.03 MANUEL AND MAGNETIC MOTOR CONTROLLERS 06/26/24
 26 33 23.11 CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING 06/26/24
 26 51 19 LED INTERIOR LIGHTING 06/26/24
 26 52 13 EMERGENCY AND EXIT LIGHTING 06/26/24

DIVISION 27 - COMMUNICATIONS

27 00 01 COMMON WORK RESULTS FOR COMMUNICATIONS 06/26/24
 27 00 02 QUALITY ASSURANCE FOR COMMUNICATIONS 06/26/24
 27 00 03 OWNER'S STANDARDS DOCUMENT 06/26/24
 27 01 00 OPERATION AND MAINTENANCE OF COMMUNICATIONS 06/26/24
 27 05 01 BASIC MATERIALS & METHODS 06/26/24
 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS 06/26/24
 27 05 28 PATHWAYS FOR COMMUNICATIONS 06/26/24
 27 05 36 CABLE TRAYS FOR COMMUNICATIONS 06/26/24
 27 05 43 UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS... 06/26/24
 27 05 50 FIRESTOPPING FOR COMMUNICATIONS 06/26/24
 27 05 53 IDENTIFICATION FOR COMMUNICATIONS 06/26/24
 27 08 10 VERIFICATION TESTING OF STRUCTURED CABLING 06/26/24
 27 11 10 WALL LININGS FOR COMMUNICATION ROOMS 06/26/24
 27 11 16 CABINETS, RACKS, FRAMES AND ENCLOSURES 06/26/24
 27 11 23 CABLE MANAGEMENT AND LADDER RACK 06/26/24
 27 11 26 RACK MOUNTED POWER PROTECTION AND POWER STRIPS 06/26/24
 27 13 13 COPPER BACKBONE CABLING 06/26/24
 27 13 23 FIBER OPTIC BACKBONE CABLING 06/26/24
 27 15 13 COPPER HORIZONTAL CABLING 06/26/24
 27 15 43 FACEPLATES AND CONNECTORS 06/26/24
 27 41 00 AUDIO AND VIDEO SYSTEMS 06/26/24
 27 41 01 AUDIO AND VIDEO SYSTEMS CABLING 06/26/24
 27 41 03 AUDIO AND VIDEO SYSTEMS SOFTWARE DEVELOPMENT 06/26/24

DIVISION 28 - ELECTRONIC SAFETY AND SECURITY

28 00 01 COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY 06/26/24
 28 00 02 QUALITY ASSURANCE FOR ELECTRONIC SAFETY AND SECURITY 06/26/24
 28 00 03 OWNER 06/26/24
 28 01 00 OPERATION AND MAINTENANCE OF COMMUNICATIONS 06/26/24
 28 05 01 BASIC MATERIALS 06/26/24
 28 13 01 SECURITY ACCESS CONTROL SYSTEM 06/26/24
 28 13 02 SIMULATION TRAINING VIDEO RECORDING SYSTEM 06/26/24
 28 31 11 MULTIPLEX FIRE ALARM SYSTEM 06/26/24
 28 55 00 ENTRANCE SECURITY INTERCOM 06/26/24

Site and Infrastructure Subgroup

DIVISION 30 - RESERVED

NOT APPLICABLE 06/26/24

DIVISION 31 - EARTHWORK

31 10 00 SITE CLEARING 06/26/24

31 13 00 LANDSCAPE REMOVAL PRUNING 06/26/24

31 22 00 GRADING 06/26/24

31 23 16 EXCAVATION 06/26/24

31 23 17 EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES 06/26/24

31 23 18.13 SOIL, FILL, BACKFILL, CU STRUCTURAL SOIL AND CONSTRUCTION AND
DEMOLITION DEBRIS REMOVAL 06/26/24

31 23 18.14 CCDD AND UNCONTAMINATED SOIL DISPOSAL 06/26/24

31 23 23.01 FILL 06/26/24

31 23 23.25 ACCEPTANCE OF BACKFILL, TOPSOIL, CU STRUCTURAL SOIL 06/26/24

31 63 29 DRILLED CONCRETE SHAFTS 06/26/24

DIVISION 32 - EXTERIOR IMPROVEMENTS

32 12 16 ASPHALT PAVING 06/26/24

32 13 13 CONCRETE PAVING 06/26/24

32 31 00 ORNAMENTAL METAL FENCING 07/12/24

32 31 11 GATE OPERATORS 07/12/24

32 31 20 METAL FENCE SCREENING 06/26/24

32 92 01 SOD AND SEED 06/26/24

32 93 11 LANDSCAPE PLANTING 06/26/24

DIVISION 33 - UTILITIES

33 10 13 WATER SERVICE 06/26/24

33 41 00 SEWERAGE AND DRAINAGE 06/26/24

END OF TABLE OF CONTENTS

SECTION 23 05 00 – GENERAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Contractor supplied equipment.
2. Noise and vibration control.
3. Motors.
4. Packless expansion joints.
5. Alignment guides and anchors.
6. Grout.
7. Silicone sealants.
8. Escutcheons.

1.2 WORK INCLUDED

- A. The Work under this Section includes, but is not limited to, providing all labor, material, equipment, and services necessary for completion of all mechanical systems in a serviceable fully operational manner.
- B. All items of Work and systems shall be furnished and installed ready for satisfactory operation and all required apparatus and service shall be provided even though not specifically mentioned herein.
- C. The Contract Specifications and Contract Drawing Equipment Schedules list the equipment manufacturers selected for the basis of the Specifications and for the various individual equipment layouts on the Contract Drawings. Substitutions shall be made in accordance with General Conditions and as otherwise provided in the Contract Documents.
- D. The Drawings showing the layout, arrangements, sizes and principal connections to the equipment and apparatus are based on one particular type of equipment of an acceptable manufacturer. If equipment other than the particular type shown on the layout Drawings is used, it is the Contractor's sole responsibility to make all necessary modifications to related piping, ductwork, electrical and utility connections, apparatus and miscellaneous items to complete the Mechanical Work, ready for satisfactory operation required under these Specifications. The cost of making all the modifications shall be borne by this Contractor without extra cost to the Owner. In using such equipment, it is imperative that the equipment must fit the space and the access allotted, with the final layout to be approved by the Architect/Engineer (A/E). Follow the Drawings as closely as actual building construction permits.
- E. The Drawings show the principal engineering design elements of the mechanical installation. They are not intended as detailed construction installation drawings for the

Mechanical Work but as a complement to the Specifications to clarify the principal features of the mechanical systems. It is the intent of this Section that all equipment and devices, furnished and installed under this and other Sections, be properly connected and interconnected with other equipment so as to render the installation complete for successful operation, regardless of whether all the connections and interconnections are specifically mentioned in the Contract Specifications or shown on the Contract Drawings.

- F. Check the layout of the Work of this Division, as indicated on the Drawings. Determine exact locations by the dimensions of the equipment approved. Obtain written approval from the Design-Builder for any revised layout before equipment or material involved is installed. Consult the Architectural and Structural Drawings for all dimensions, locations of partitions, locations and sizes of structural supports, foundations, swings of door, and other detail information required for a correct installation of this Work.
- G. Examine all other Divisions of the Contract Documents for Work related to the Work of this Division. Cooperate to provide continuity of Work, to eliminate duplications, and to provide Mechanical Work in support of such related Work. Furnish to other trades and on schedule all information required for the execution of Mechanical Work.
- H. Any additional Work such as cutting, drilling, patching, excavating, moving of another trade's work because of delay in Mechanical Work or lack of information is a part of this Division and shall be performed without increase in Contract Price.
- I. Install and connect devices and equipment in accordance with the best engineering practice and the manufacturer's instructions and recommendations. Provide all incidental ductwork, piping, valves, connections, and all similar material recommended by the manufacturer, or required for proper operation and maintenance, complete without additional costs.
- J. Provide all necessary rigging, scaffolding, tools, tackle, labor and other materials or equipment which may be necessary for the completion of the Work.
- K. Furnish and install motor on proper frame designed by the equipment manufacturer.
- L. All control wiring associated with the mechanical systems shall be provided under Division 23. All wiring shall comply with Division 26 Standards.

1.3 SPECIFIED ELSEWHERE

- A. The following will be provided under other sections of the Specifications:
 - 1. Openings: Walls, floor, ceiling and roof opening specifically shown and identified on the Architectural/Structural Drawings will be provided under other Divisions. Openings not so identified that are required for Mechanical Work, or changes to such openings are part of the Work of this Mechanical Division.
 - 2. Curbs, Drains and Sleeves: Drains and roof sleeves provided under this Division shall be incorporated into the finished roofing and made watertight under another Division.

3. Equipment Bases: Concrete equipment bases, mounting slabs, and housekeeping pads specifically shown and identified on the Mechanical Drawings shall be provided under this Division. Supervise their installation. Those bases, not so identified and indicated on the Architectural and Structural Drawings, shall be provided under other Divisions. Cooperate and furnish dimensions, sleeves, inserts, hold-down bolts, and templates for their installation.
4. Painting: Painting of all exposed-to-view pipes, ducts, hangers, supports, and equipment, shall be performed under another Division. Under this Division, all manufactured equipment shall be furnished with factory-finished baked enamel, unless otherwise specified.
5. All power wiring associated with equipment provided under this Division shall be furnished, installed, and wired in accordance with Division 26. Under Division 23, provide installation instructions, locating dimensions, and wiring diagrams for the other trades. Supervise the installation and start-up and test the equipment.

1.4 RELATED WORK

- A. The Drawings, General Provisions of the Contract, General Conditions, General Requirements, Supplemental General Conditions and Division 01 through 26 all apply to the work in this Section.

1.5 DEFINITIONS

- A. Provide: Furnish, install and connect up complete and ready for operation of particular work referred to, unless specifically otherwise noted.
- B. Furnish: To purchase, procure, acquire and deliver complete with related accessories.
- C. Install: To erect, mount and connect for use complete with related accessories.
- D. Work: Labor, materials, equipment, apparatus, controls, accessories and other items required for proper and complete installation.
- E. Concealed: Embedded in masonry or other construction, installed in furred spaces, within double partitions or hung ceilings, in trenches, in crawl spaces or in enclosures.
- F. Exposed: Not installed underground or concealed as defined above.
- G. Accessible: Capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping, ductwork or going through doors or false ceilings.
- H. Words: Words used in the singular number shall include the plural sense and vice versa.
- I. Wiring: Wire or cable installed in conduit, with all required boxes, fittings, supports, connections, etc.

- J. Power Wiring: That wiring between the source of power and the current consuming device such as motors, equipment, heaters, etc. It includes the installation of such control devices in the power circuit such as pushbuttons, thermostats, key switches, timers, etc., which control loads for which no magnetic starter or contactor is provided for controls.
- K. Control Wiring: That wiring between control devices that does not provide the power circuit, regardless of voltage, when a magnetic starter or contactor is provided for control.

1.6 INTENT

- A. Furnish, erect, install, connect, clean, adjust, test and place in service all materials, equipment and systems in accordance with applicable codes, manufacturer's directions and recommendations for all work shown on the drawings and called for in the Specifications.
- B. Carefully examine the contract documents, visit the site, and thoroughly become familiar with the local conditions relating to the work. Failure to do so will not relieve the contractor from any obligations of the Contract.
- C. Should there be any discrepancies of a question of intent, refer the matter to the Design-Builder for a final decision before ordering any equipment/materials or before starting any related work.
- D. In case of conflict between project specifications and drawings, drawings govern unless the Design-Builder rules otherwise.
- E. Apparatus, devices, materials of work not specifically shown on drawings, but mentioned in the project specifications, or vice versa, or any incidental accessories and appurtenances necessary to make the work complete and ready for operation, even though not specified or shown on the drawings, shall be furnished and installed without additional expense to the Owner.
- F. It is the contractor's responsibility prior to bids to review all project documents.
- G. Project documents include architectural, structural, mechanical, control, plumbing, fire protection and electrical disciplines.

1.7 CODES AND STANDARDS

- A. Applicable Publications: Reference made herein to standards, Specifications, or codes, refer to the latest edition including all addenda, errata, or other revisions thereto, existing on the date of execution of the Contract.
- B. Local Codes and Ordinances: Install all Work in conformance with all applicable local Codes and state ordinances and statutes. Nothing in the Specifications or Drawings shall be construed to permit deviation from the governing codes. In case of conflict with local ordinances and statutes, the more stringent shall apply.

- C. Abbreviations: Refer to Division 01, Abbreviations and Symbols under Mechanical Sections make use of the following abbreviations in adopting applicable standards and codes as a part of Division 23:

1. ADC - Air Diffusion Council - Test Code
2. AGA - American Gas Association
3. AIA – American Institute of Architects
4. AMCA - Air Moving and Conditioning Association
5. ANSI - American National Standards Institute
6. API - American Petroleum Institute
7. ARI - Air Conditioning and Refrigeration Institute
8. AGA - American Gas Association
9. ASHRAE–American Society of Heating, Refrigeration and Air Conditioning Engineers
10. ASME - American Society of Mechanical Engineers
11. ASTM - American Society for Testing and Materials
12. AWS - American Welding Society
13. AWWA - American Water Works Association
14. EPA - Environmental Protection Agency
15. FM - Factory Mutual System
16. IMC – International Building Code
17. IPC – International Plumbing Code
18. IRI - Industrial Risk Insurers
19. MSS - Manufacturers Standardization Society
20. NACE – National Association of Corrosion Engineers
21. NEC - National Electric Code
22. NEMA - National Electrical Manufacturers Association
23. NFC - National Fire Code
24. NFPA - National Fire Protection Association
25. NPC - National Plumbing Code
26. NSF – National Sanitation Foundation
27. OSHA - Occupational Safety and Health Standards
28. PDI – Plumbing and Drainage Institute
29. SMACNA - Sheet Metal and Air Conditioning Contractor's National Association
30. UL - Underwriters Laboratories, Inc.
31. State and Local Fire Marshall
32. State and Local Inspection Authorities
33. Owner District's Fire Insurance Agency requirements
34. The Division 01 Sections "Regulatory Requirements" and Reference Standards of the Project Specifications

- D. Permits and Inspections

1. Obtain and pay for all permits, bonds, licenses, etc. required by the Local, State or other authority having jurisdiction over the work.
2. Arrange and pay for inspections required by the above when they become due as a part of the work of the Sections affected. Conceal no work until approved by these governing authorities. Present the Design-Builder with properly signed certificates of final inspection before the Design-Builder's acceptance of the Work.

3. Obtain and pay for all meters, gauges, instruments, and devices required by the governing authorities except as otherwise noted as part of the Work of the Sections affected.

1.8 QUALITY ASSURANCE

- A. Welding Qualifications: Qualify procedures and personnel in accordance with AWS D1.1/D1.1M.
- B. Pipe and Pressure-Vessel Welding Qualifications: Qualify procedures and operators in accordance with 2021 ASME Boiler and Pressure Vessel Code, Section IX.
- C. All materials furnished shall be new and shall comply with all applicable standards listed below.
- D. All materials or work found to be defective or not in strict conformity with the Contract Documents, or defaced or injured through any cause, shall be rejected and shall be removed by Contractor and satisfactory material and Work substituted without delay.
- E. Contractor shall protect his/her Work by keeping all piping, equipment, etc., capped or plugged, drained, or otherwise protected from injury by freezing, water damage, or stoppage from material, concrete, sand, or dirt and shall repair any such injury without additional charge to the User. Injury shall be interpreted to include scratches, discoloring and denting.
- F. Contractor will be held responsible for any damage caused by him/her to other Contractors' Work.
- G. Submit shop drawings and product data for all equipment as specified or scheduled. Update all drawings to "as-built" status on CD-Rom or flash drive and submit to Design-Builder.

1.9 SUBMITTALS

- A. Submit under provisions of Division 01 and as specified herein. The most stringent requirements shall apply.
- B. General: Within 15 calendar days after date of Contract Agreement, submit to the Design-Builder a typewritten list of all items of equipment and material proposed for installation on this project. Provide the specification page number, manufacturer's name, model number, size non-standard accessories specified or required, and any other information required to identify each item.
 1. Within 30 days after the Contractor has been given notice of approval of manufacturers, submit shop drawings of equipment and material proposed for this installation.
 2. If substitutions have been offered in lieu of specified materials and/or equipment they shall be in accordance with AIA Document A201.

- C. Shop Drawings: Submit shop drawings for all Work to be done under each of the Mechanical Sections and for all items and assemblies which are to be specifically fabricated for this Contract.
- D. The Engineer's review of Manufacturer's Drawings or Schedules shall not relieve the Contractor from responsibility for errors or omissions in Manufacturer's Drawing and deviations from the Contract Drawings or Specifications.
- E. Coordination and Fabrication Drawings: Prepare layout drawings of all system assemblies of this Contract including plumbing, heating, sprinkler piping, electrical and technology, mechanical and electrical room layouts with equipment and piping, ductwork installations, and control systems. Include completely dimensioned plans drawn to scale. Show elevations and sections indicating locations of all equipment, piping, ductwork, drains, controls, and other items with reference to columns, walls, slabs, beams, and to components of other systems and work of other trades. Floor plans shall be drawn at not less than 1/4 inch scale with a sign-off block including all disciplines and date. Tracing or reproduction of Construction Documents is not acceptable. Provide a minimum of one reproducible drawing and five prints of each drawing.
- F. Electronic files containing AutoCAD Floor Plans or Revit models are available through the Engineer. Cad drawing format shall be AutoCAD 2017 unless requested otherwise. Revit models shall be in the version in which they are created. The Contractor shall complete, sign, and submit a "Model Sharing Agreement" form which is available from AECOM by request. Fees may apply for these electronic files.
- G. Catalog Cuts: Submit manufacturer's data sheets and pictures of all standard manufactured items proposed for installation in this project. Clearly identify each item proposed, together with all required accessories and fittings, with tag numbers and specification page and line numbers. Include graphs, curves, or charts, as applicable, with the specified operating point clearly marked.
- H. Installation and Bolt Setting Diagrams: Submit complete installation instructions and bolt setting information for items of equipment furnished under Division 23 such as pumps, fans, compressors, tanks, filters, pressure vessels, etc.
- I. Wiring Diagrams: Provide specific wiring diagrams and instructions for all equipment, controls or devices which are furnished under Division 23 and are to be wired and connected by other trades. The diagrams and instructions shall not be of a general or typical nature, but shall be applicable and specific to this Contract.
- J. Samples: Where a Contractor proposes a manufacturer, material, or method differing from that specified, the Design-Builder may require samples illustrative of the manufacturer, material or method. Submit such samples as part of the shop drawing requirements, and shall include samples of insulation, special finishes, etc.
- K. Submittals shall be made in accordance with the General Conditions of the Contract and as otherwise required in the Contract Documents. In submitting shop drawings, illustrations and descriptive material for approval of the Design-Builder, the Contractor must clearly mark each shop drawing, catalog cut, pamphlet or specification sheet as follows, for purposes of identification and record:

1. Date: (as submitted)
2. Project Title:
3. Location of Project:
4. Branch of Work: (HVAC, Plumbing, Fire Protection, etc.)
5. Specification Paragraph & Page:
6. Submitted by: (Contractor Name)
7. Contract No.:

1.10 SUBSTITUTIONS

- A. Product substitutions shall be in accordance with the General Conditions, Supplemental General Conditions, Division 01 and as specified.
- B. The products, equipment, etc. scheduled on the Drawings or specified are the basis of design. Where more than one manufacturer is listed, the Contractor may use any of the acceptable manufacturers as the basis of their bids unless otherwise specified. However, the Contractor assumes all responsibility for changes to the design, installation, etc. as a result of the change, i.e.: power characteristics, physical size, etc.
- C. Any request for substitution to other than the specified acceptable manufacturers must be submitted to the Engineer in writing and shall include an adequate description of proposed change, reason(s) for requesting change and cost adjustment information. Substitutions not submitted in this manner will be rejected automatically. Substitution requests will only be considered for the following reasons:
 1. Specified manufacturer(s) is no longer in business.
 2. Specified product(s) cannot be delivered within the required project schedule.
 3. Alternate product(s) is of equal quality, but better value with savings offered to the Owner.

1.11 PROJECT RECORD DOCUMENTS

- A. Maintain Project Record Drawings during construction in accordance with General Conditions and as specified.
- B. Provide Project Record Drawings at completion of project. Shop drawings are not acceptable as record drawings unless they have been revised to reflect all field changes. Tracing or reproduction of the Contract Documents shall not be acceptable.
- C. Show the following information on the Project Record Drawings:
 1. All significant changes in plan, sections, elevations, and details, such as all relocation, or changes in ductwork and piping.
 2. All final locations of controls and final arrangement of electric circuits and any significant changes made in design as a result of change order or job conditions.
 3. Final location and arrangement of all mechanical equipment.

- D. Provide AutoCAD Version 2017 or later files, or Revit models on CD-Rom, or flash drive of all Project Record Drawings.

1.12 OPERATING AND MAINTENANCE MANUALS

- A. Submittals of operation and maintenance manuals shall be in accordance with General Conditions and as herein specified.
- B. Prepare and deliver to the Engineer, 3 complete sets of operating and maintenance manuals for all equipment listed in the Equipment Schedules and when specified by the Section in which the equipment is furnished. Provide all information pertinent to the equipment for preventive maintenance and for replacement of all expendable components. Manuals shall refer only to the actual equipment provided. All reference to alternative equipment shall be deleted. All such literature shall be bound in 3 new standard 3-ring binders and shall be submitted to the Engineer, along with an electronic (PDF) version.
- C. Include the items listed below and features as may be recommended by the manufacturers.
 - 1. Catalog information of the unit installed.
 - 2. Capacity and installation details.
 - 3. Wiring diagrams of electrical components.
 - 4. Special valves and control devices.
 - 5. Complete list of parts with reordering numbers.
 - 6. All points requiring lubrication, lubrication frequency and type of lubricant.
 - 7. Operating pressure and temperatures.
 - 8. Design pressures and temperatures.
 - 9. Relief devices and settings.
 - 10. Electrical characteristics of all motors.
 - 11. Operating curves of pumps and fans.
 - 12. Recommended spare parts list.
 - 13. Warranty Information.
- D. Prepare operating instructions, complete and explicit, including instructions for start-up, operating, and stopping. Underscore and emphasize critical points of operations and hazardous limit.
- E. Items which also must be included are make-up air units, coils, filters, unit heaters, heating and HVAC components, fans, motors, pumps, temperature control systems with a description of the sequence control, vibration isolation, etc.
- F. Include flow charts and wiring programs in the manuals indicating valve locations and control devices. Also include parts lists to be used for ordering replacement and repair parts.
- G. Arrange information in an orderly manner in accordance with the numbering system used for the project specification. Include a table of contents for each manual.
- H. Manual covers shall include the name of the project.

1.13 DELIVERY, STORAGE AND HANDLING

- A. Refer to the General Conditions, Standard Specifications and as specified in each individual section.

1.14 WARRANTY

- A. Except where otherwise specifically included in individual Sections, all mechanical systems shall be provided with the guarantees as follows.
- B. Guarantee all mechanical systems, equipment, materials, and workmanship to be free from defect for a period of 1 year from the date of final acceptance of the Work. Replace or repair in an approved manner any Work which may prove defective or not in compliance with the Contract Documents without additional cost to the Owner and without interference with the Owner's operation. There shall be a mandatory walk thru at 10 months to ensure all equipment/materials are performing as required.
- C. Deliver to the Design-Builder 3 copies of all manufacturer's or equipment suppliers' warranties as part of the O&M manuals.
- D. Make all adjustments required to ensure operation of the various systems in accordance with the intent of the Drawings and Specifications.
- E. It is specifically understood that all adjustments to ensure the proper operation of the systems shall cover a period of 12 months following acceptance of the Work, and the Contractors and/or their suppliers shall make all such adjustments required during this period without delay and without additional cost to the Owner.

1.15 TESTING, ADJUSTING AND BALANCING

- A. This contractor shall employ services of an independent firm to perform testing, adjusting and balancing.
- B. The independent firm will perform services specified in related section.
- C. Reports will be submitted by the independent firm to the Design-Builder indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.
- D. Test Pressures: Lines shall be tested according to the following schedule:

Line	Test Medium	Minimum Pressure	Minimum Time	Remarks
Heating Water	Water	125 lb.	24 Hours	No Drop
Condensate	Water	125 lb.	24 Hours	No Drop
Chilled Water	Water	125 lb.	24 Hours	No Drop

1.16 OPERATING INSTRUCTIONS TO OWNER

- A. Contractor shall furnish Design-Builder with a written statement from the Owner certifying acceptance of all the equipment, data and instructions of operation. Design-Builder will not approve the request for final payment until this certificate has been submitted.

PART 2 - PRODUCTS

2.1 EQUIPMENT SUPPLIED BY CONTRACTOR

- A. Contractor furnishing an item of equipment is responsible for the proper handling, setting, installation, start-up and initial operation.
- B. If Contractor is unfamiliar with the proper start-up and adjustment procedure of any equipment or system furnished by him/her, he/she shall include the services of a qualified representative of the manufacturer or vendor to provide start-up assistance and for instruction of the Owner's personnel.
- C. Contractor shall include all necessary allowances to insure that all equipment and systems furnished will be serviced as required during the guarantee period.
- D. When a manufacturer offers an extended warranty at additional cost, such extended warranty shall be included as alternate.

2.2 NOISE AND VIBRATION CONTROL

- A. Contractor shall make provisions in the installation of the Work that noises or vibrations will not be transmitted through foundations, floors, walls, columns, ducts and piping, so as to be objectionable in any manner. All equipment provided shall be selected and installed with this in view. If any equipment exceeds reasonable requirements as to quietness of operation and freedom from vibration when operating under continuous maximum demands, it shall be altered or replaced.
- B. Furnish and install vibration eliminators and isolation equipment for equipment, motors, and pumps, as indicated on the Drawings, and as specified in related section.
- C. The isolation and vibration eliminator manufacturer and Contractor shall be responsible for the selection of the proper units for their loadings, quantities, and each shall guarantee that each and every installation and their application shall have a vibration efficiency of 95% or greater. As a minimum, provide types of vibration eliminators as indicated on the Drawings and specified in related section.
- D. Submit shop drawings to the Design-Builder for review of all isolation equipment with dimensions and other data as recommended and prepared by the isolation equipment manufacturer.

2.3 MOTORS

- A. Motor Requirements, General:

1. Content includes motors for use on alternating-current power systems of up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.
2. Comply with requirements in this Section except when stricter requirements are specified in equipment schedules or Sections.
3. Comply with NEMA MG 1 unless otherwise indicated.

B. Motor Characteristics:

1. Duty: Continuous duty at ambient temperature of 40 deg C and at altitude of 3300 ft. above sea level.
2. Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.

C. Polyphase Motors:

1. Description: NEMA MG 1, Design B, medium induction motor.
2. Efficiency: Premium Efficient, as defined in NEMA MG 1.
3. Service Factor: 1.15.
4. Multispeed Motors: Variable torque.
 - a. For motors with 2:1 speed ratio, consequent pole, single winding.
 - b. For motors with other than 2:1 speed ratio, separate winding for each speed.
5. Rotor: Random-wound, squirrel cage.
6. Bearings: Regreasable, shielded, antifriction ball bearings suitable for radial and thrust loading.
7. Temperature Rise: Match insulation rating.
8. Insulation: Class F.
9. Code Letter Designation:
 - a. Motors 15 Hp and Larger: NEMA starting Code F or Code G.
 - b. Motors Smaller Than 15 Hp: Manufacturer's standard starting characteristic.
10. Enclosure Material: Cast iron for motor frame sizes 324T and larger; rolled steel for motor frame sizes smaller than 324T.

D. Additional Requirements for Polyphase Motors:

1. Motors Used with Reduced-Voltage and Multispeed Controllers: Match wiring connection requirements for controller with required motor leads. Provide terminals in motor terminal box, suited to control method.

2. Motors Used with Variable-Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.
 - a. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time-rise pulses produced by pulse-width-modulated inverters.
 - b. Premium-Efficient Motors: Class B temperature rise; Class F insulation.
 - c. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
 - d. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

E. Single-Phase Motors:

1. Motors larger than 1/20 hp must be one of the following, to suit starting torque and requirements of specific motor application:
 - a. Permanent-split capacitor.
 - b. Split phase.
 - c. Capacitor start, inductor run.
 - d. Capacitor start, capacitor run.
2. Multispeed Motors: Variable-torque, permanent-split-capacitor type.
3. Bearings: Prelubricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.
4. Motors 1/20 hp and Smaller: Shaded-pole type.
5. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal-protection device will automatically reset when motor temperature returns to normal range.

F. Electronically Commutated Motors:

1. Microprocessor-Based Electronic Control Module: Converts 120 V single-phase AC power to three-phase DC power to operate the brushless DC motor.
2. Three-phase power motor module with permanent magnet rotor.
3. Circuit board or digital speed controller/LED display.
4. Building Automation System Interface: Via Digital Serial Interface (DSI).

2.4 EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

A. Performance Requirements:

1. Compatibility: Provide products suitable for piping service fluids, materials, working pressures, and temperatures.
2. Capability: Provide products and installations that will accommodate maximum axial movement as scheduled or indicated on Drawings.

B. Packless Expansion Joints:

1. Rubber Union Connector Expansion Joints:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

- 1) Amber/Booth Company, Inc.; a VMC Group Company.
 - 2) Flex-Hose Co., Inc.
 - 3) Flo Fab Inc.
 - 4) Metraflex Company (The).
 - b. Source Limitations: Obtain rubber union connector expansion joints from single manufacturer.
 - c. Material: Twin reinforced-rubber spheres with external restraining cables.
 - d. Minimum Pressure Rating: 150 psig at 170 deg F unless otherwise indicated.
 - e. End Connections for NPS 2 (DN 50) and Smaller: Threaded.
 - f. End Connections for Greater than NPS 2 (DN 50): Flanged.
2. Flexible-Hose Packless Expansion Joints:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Flex-Hose Co., Inc.
 - 2) Flex-Weld; a division of Kelco.
 - 3) Flexicraft Industries.
 - 4) Metraflex Company (The).
 - b. Source Limitations: Obtain flexible-hose packless expansion joints from single manufacturer.
 - c. Description: Manufactured assembly with inlet and outlet elbow fittings and two flexible-metal-hose legs joined by long-radius, 180-degree return bend or center section of flexible hose.
 - d. Flexible Hose: Corrugated-metal inner hoses and braided outer sheaths.
 - e. Expansion Joints for Copper Tubing NPS 2 (DN 50) and Smaller: Copper-alloy fittings with solder-joint end connections.
 - 1) Retain one of first two subparagraphs below, or both, to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.
 - 2) Bronze hoses and single-braid bronze sheaths with 450 psig at 70 deg F and 340 psig at 450 deg F ratings.
 - 3) Bronze hoses and double-braid bronze sheaths with 700 psig at 70 deg F and 500 psig at 450 deg F ratings.
 - f. Expansion Joints for Steel Piping NPS 2-1/2 to NPS 6 (DN 65 to DN 150): Carbon-steel fittings with flanged end connections.
 - 1) Retain one of first two subparagraphs below, or both, to suit pressure and temperature requirements of systems in which these devices are installed. If retaining both, indicate location of each on Drawings.
 - 2) Stainless steel hoses and single-braid, stainless steel sheaths with 200 psig at 70 deg F and 145 psig at 600 deg F ratings.
 - 3) Stainless steel hoses and double-braid, stainless steel sheaths with 275 psig at 70 deg F and 200 psig at 600 deg F ratings.

C. Alignment Guides and Anchors:

1. Alignment Guides:
 - a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1) Amber/Booth Company, Inc.; a VMC Group Company.
 - 2) Flex-Hose Co., Inc.
 - 3) Flex-Weld; a division of Kelco.

- 4) Metraflex Company (The).
 - b. Source Limitations: Obtain alignment guides from single manufacturer.
 - c. Description: Steel, factory-fabricated alignment guide, with bolted two-section outer cylinder and base for attaching to structure; with two-section guiding slider for bolting to pipe. Provide dielectric spacer for use with copper tubing/piping.
2. Anchor Materials:
 - a. Steel Shapes and Plates: ASTM A36/A36M.
 - b. Bolts and Nuts: ASME B18.10 or ASTM A183, steel hex head.
 - c. Washers: ASTM F844, steel, plain, flat washers.
 - d. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.
 - 1) Stud: Threaded, stainless steel.
 - 2) Expansion Plug: Stainless steel.
 - 3) Washer and Nut: Stainless steel.

2.5 ESCUTCHEONS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. BrassCraft Manufacturing Co.; a Masco company.
 2. Mid-America Fittings, LLC; A Midland Industries Company.
 3. ProFlo; a Ferguson Enterprises, Inc. brand.
- B. Escutcheon Types:
 1. One-Piece, Steel Type: With polished, chrome-plated finish and setscrew fastener.
 2. One-Piece, Deep-Pattern Type: Deep-drawn, box-shaped steel with polished, chrome-plated finish and spring-clip fasteners.
 3. One-Piece, Stamped-Steel Type: With polished, chrome-plated finish and spring-clip fasteners.
 4. Split-Plate, Stamped-Steel Type: With polished, chrome-plated finish; concealed hinge; and spring-clip fasteners.
- C. Floor Plates:
 1. Split Floor Plates: Steel with concealed hinge.

2.6 GUARDS

- A. All belts, pulleys, chains, gears, couplings, projecting set screws, key and other rotating parts shall be fully enclosed and properly guarded.
- B. Guards shall be constructed of not less than 1-inch x 1-inch x 1/8-inch structural steel angles and 1/2-inch diamond mesh enclosure or equally suitable enclosure, all of hot-dipped galvanized fabrication.
- C. Guards shall be secured to the driven machines or to foundations of floors by heavy galvanized structural angle supports and anchor bolts. Braces or supports secured to motors will not be permitted and braces and/or supports must not "bridge" the sound and vibration isolators.
- D. Guards shall be designed with adequate provision for movement of motor required to adjust belt tension. Means shall also be provided to permit lubrication, use of speed counters and other maintenance and testing operation with guard in place.

2.7 MAINTENANCE MATERIALS, SERVICE AND SPARE PARTS

- A. This contractor shall be responsible for continued maintenance of all equipment furnished under this contract. This contractor shall, at the time of Owner acceptance, provide the Facilities planning Office with a report detailing the following information:
 - 1. Dates equipment arrived at the job site.
 - 2. Installation date.
 - 3. Dates of maintenance at start-up and at periodic maintenance.
 - 4. Dates of lubrication changes as applicable and specific name, manufacturer and type of lubrication.
- B. Refer to the General Conditions and to the individual Sections for additional requirements.

PART 3 - EXECUTION

3.1 SAFETY PRECAUTIONS DURING INSTALLATION

- A. Contractor shall take all measures to ensure safe installation of all Work and to prevent injury to persons or damage to property in compliance with OSHA and all applicable regulations.
- B. Contractor shall erect whatever scaffolds, platforms, supports, or other required construction to safely protect his/her own workers and other persons at the site.
- C. Such scaffolds, platforms, etc., shall be designed and constructed by Contractor who shall be solely responsible for their adequacy and safety. Design-Builder or Owner is not responsible for ascertaining the adequacy of any temporary structures used or erected by the Contractor.

3.2 INTERRUPTIONS AND TIE-INS

- A. Any interruptions and tie-ins to existing systems that are necessary for installation of the new Work shall be performed and completed in coordination with the Design-Builder. Provide 2 days written notice prior to any tie-in or connection to existing active systems. Any work requiring shut down of systems serving occupied areas shall occur during off hours, unless otherwise scheduled by mutual agreement.

3.3 MODIFICATIONS AND INTERFERENCES

- A. Contractor shall carefully check and become familiar with the Architectural, Structural, Electrical and all Mechanical Drawings and Details and make note of all locations where walls, partitions, ceilings, and structural members are called for to be furred or closed-in.
- B. Modifications to the arrangement of the piping and ductwork systems may be required to suit structural conditions, or to avoid interference with the Work of other trades. Contractor shall furnish all offsets, additional fittings, etc., as required to meet installation conditions whether detailed on the Drawings or not.
- C. Any conflicting information in the Specifications or on the Drawings shall be called to the attention of the Design-Builder for clarification before proceeding with fabrication or erection of the parts affected.

3.4 COOPERATION OF CONTRACTORS

- A. Each Contractor, in the event of separate contracts in laying out his/her work, shall cooperate with other Contractors on the work so as to avoid any interference with their work. If this is not done, the Design-Builder reserves the right to make such changes in the work as are necessary to avoid interferences and such changes will not be considered as cause for additional compensation or extension of time for the Contractor.

3.5 WORK PRIORITY OVER OTHER TRADES

- A. Work in cooperation with one another to fit piping and ductwork into structure as job conditions may demand. All final decisions as to right of way and run of pipe, ducts, to be made by the Design-Builder. In general, priority is to be arranged as follows:
 - 1. Recessed lighting fixtures.
 - 2. Sheet metal ductwork.
 - 3. Sprinkler heads and sprinkler water lines.
 - 4. Plumbing waste lines, downspouts and vents.
 - 5. Refrigeration lines.
 - 6. Plumbing water lines.
 - 7. Electrical conduit.

3.6 EQUIPMENT PADS

- A. Provide four-inch minimum concrete housekeeping pads for all floor mounted equipment.

3.7 ARRANGEMENT AND ALIGNMENT

- A. All equipment, ductwork, piping, etc. shall be arranged and aligned in accordance with the Drawings. Elevations, where given, must be held. Floor elevations, where given, are to high points of floor. Dimensions must be held as closely as possible. All dimensions are to be field-checked for accuracy before fabrication.
- B. Install all equipment, ductwork, piping, etc. straight and direct as possible, generally forming right angles with, or running parallel with, walls or adjacent ductwork, piping, etc. All ductwork, piping, etc. shall be neatly spaced with risers and drops running plumb and true.
- C. Run ductwork, piping, etc. in wall chases, shafts, hung ceilings, recesses, etc., where same are provided. Do not run in floor slab fill unless specifically so noted on Drawings. Ductwork, piping, etc. shall not be covered or closed until testing is completed.
- D. Drawings, in general, are made to scale. All dimensions shall be checked in the field by the Contractor before final connections are fabricated.
- E. Drawings are, in general, diagrammatic and the exact locations shall be determined by the Contractor from field measurements. The actual arrangement, when erected, shall follow the general locations shown on the Drawings as far as practicable. The installation shall be neat in appearance and convenient to operate.
- F. Installations shall be coordinated with other Work to avoid blocking building openings, light fixtures, etc. and shall not interfere with access to valves or equipment. Equipment, ductwork, piping, etc. shall be installed to provide working clearance for operation and maintenance.

3.8 ALIGNMENT OF ROTATING EQUIPMENT

- A. All pumps, fans, etc. or similar equipment directly connected to motors by means of flexible couplings must be perfectly aligned after installation by the use of a dial indicator and the Work of alignment must be performed by a craftsman skilled in the Work.
- B. Belted equipment shall be aligned so that the grooves of the driver pulley are truly aligned with those of the driven sheave, and the belts must be in the proper tension, free from flutter. In multi-belt drives, all belts must be operated at the same plane. Flutter in any 1 belt will be cause to reject the entire set, as the original installation of belts must be in matched sets.

- C. All equipment provided with high capacity belt drives must be conveniently tagged and so identified for future servicing and replacement of belts.
- D. Before any rotating equipment is put in operation for testing purposes, it shall be properly lubricated with lubricants recommended by the manufacturer, and they shall be further lubricated before the equipment is turned over to the Owner.

3.9 CLEARANCES

- A. Install ductwork, piping, etc. to provide minimum clearance of at least one (1) inch between extreme projections of piping, flanges, fittings, valves, allowing for insulation, expansion, etc.

3.10 EXPANSION

- A. Special attention shall be given to the installation of ductwork, piping, etc. which have an appreciable movement so that they will not hit other ducts, pipes, structural members, etc. under actual operating conditions.
- B. Provide flexible connections or expansion compensators where ducts, pipes, etc. cross building expansion joints.

3.11 LOCATION OF VALVES AND PIPING COMPONENTS

- A. System components which require observation, operation, or maintenance such as valves, gages, controls, strainers, dirt pockets, cleanouts, unions and flanges, etc., shall be located, whenever possible, so as to be readily accessible. They shall not be concealed in chases or above ceilings without provision for access. Valves which require frequent operation, or which may require emergency operation, and which are 10'-0" from normal working level, should be installed with appropriate provisions such as chain wheels or extension stems.
- B. Install all valves with stems in either an upright (preferred) or horizontal position. Control valves shall be installed with top works upward unless specifically shown otherwise.
- C. Globe valves should be installed to seat against the direction of flow.
- D. Make provisions for draining all low points of all piping systems, whether indicated on the Drawings or not, using a globe or ball valve and iron pipe thread to hose thread adapter with cap. Drains shall not be less than 3/4 inch, subject to sizes indicated on Drawings.

3.12 DRAINAGE AND VENTING

- A. Where ducts, pipes, etc. are purposely pitched for drainage or venting, an accurate grade shall be maintained. Lines shall be supported in such a manner as to prevent deflection sufficient to pocket the lines.

3.13 PIPE SIZE DESIGNATIONS

- A. All pipe sizes referred to in these Sections should be interpreted as IPS (iron pipe size) unless specifically designated otherwise, such as "O.D." for tubing.

3.14 CUTTING AND PATCHING

- A. All cutting, repairing, fitting, and refinishing of in-place construction required for the installation of the Work of a Section, shall be included as part of the Work of that section except as specifically shown on Drawings or hereinafter specified.
- B. Work shall be performed by craftsmen skilled in their respective trades.
- C. Match existing conditions in color, materials, and texture.

3.15 DUCTWORK PIPE AND EQUIPMENT IDENTIFICATION

- A. Piping identification shall be as specified in related section. Equipment identification consistent with the markings on the equipment schedule shall be made following finished painting with paint or stencil letters or numerals as approved by the Design-Builder.

3.16 CLEANING - GENERAL AREA

- A. Contractor shall assist in maintaining the premises in an orderly fashion at all times, providing continuous clean-up during the construction period. Contractor shall remove all cartons, containers, and crates as soon as the contents have been removed and shall also remove all debris caused by Work as soon as possible. Deposit all discarded materials in a suitable refuse container and prevent these materials from being scattered by the elements. All cartons and debris shall be removed from the premises and site at the sole expense of Contractor.
- B. Contractor shall stack all construction materials associated with his/her Work in areas so as to avoid congestion and interference.
- C. At the completion of the work, the Contractor shall clean all of his/her work and equipment free from dust and other foreign matter and shall leave the work in good housekeeping condition, in a manner acceptable to the Design-Builder.

3.17 WIRING DIAGRAMS

- A. Contractors shall provide each piece of electrically connected, controlled, or operated equipment with specific wiring diagrams and instructions. Diagrams and instructions shall not be of a general or typical nature but applicable only to the specific job. The diagrams and instructions used to install the equipment shall be identical to that included in the "Operations and Maintenance Manuals".

3.18 SYSTEM START UP

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify the Design-Builder 7 working days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, or for other conditions which may cause damage.
- D. Verify that tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer. Check ratings of overload relays for each starter.
- E. Verify wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.
- G. When called for in individual Specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.
- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.19 DEMONSTRATION AND INSTRUCTIONS

- A. Provide the services of a competent supervisor or technician to instruct the Owner's personnel in the operation of each piece of equipment/systems installed as specified in the individual sections. Include not less than the time listed for each of the systems. Where required by the individual section of the specifications, provide the services of factory trained specialists to instruct the Owner's personnel in the operation of the equipment/system so specified.
- B. Demonstrate operation and maintenance of products to Owner's personnel, 2 weeks prior to date of completion. Provide an over/outline of the purpose and operation of all equipment installed under this contract.
- C. Demonstrate Project equipment and instruct in a classroom environment for up to 10 people, located at the project site and instructed by a qualified manufacturer's representative who is knowledgeable about the Project. Provide documents for all attendees.
- D. For equipment or systems requiring seasonal operation, perform demonstration for other season within 6 months.
- E. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual in detail with the Owner's personnel in detail to explain all aspects of

operation and maintenance. Training shall include review of temperature control drawings and schematics.

- F. Demonstrate start-up, operation, control, adjustment, normal & unoccupied operations, system trouble-shooting, step by step procedure for determining the source of problems on the system level, component trouble-shooting description of diagnostic procedures for determining the source of the problems on the component level, servicing & maintenance instructions of required procedures for weekly, monthly, and annual preventive checks and timely repairs, sources of spare parts and special tools, and shut-down of each item of equipment at agreed time at designated location.
- G. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.
- H. The amount of time required for instruction on each item of equipment and system is that specified in individual sections.
- I. Training shall include a question and answer period.
- J. Training shall include special requirements of tenants for equipment's function.
- K. Training shall include any special issues to maintain warranties.
- L. Training shall include relevant health and safety issues and concerns, and special safety features.
- M. Training shall include Integral Controls Programming, trouble shooting, alarms, manual operation, and interface with Integral Controls.
- N. Training shall include Building Automation Controls Programming, trouble shooting, alarms, manual operation, and interface with Integral Controls.
- O. Training shall include interaction with other systems, and operation during power outage and fire.
- P. Training shall include common trouble shooting issues and methods, control system warnings and error messages including using the control system for diagnosis.
- Q. Digitally record all instructional sessions and demonstrations. Provide two DVD's/CD-Rom, labeled with all pertinent information to identify specific equipment or systems, and include in the O & M's.

3.20 LUBRICATION

- A. During the commissioning process and prior to testing, all equipment shall be properly lubricated in accordance with the manufacturer's instructions. One set of tools necessary for lubrication shall be provided by this Contractor.
- B. Except for small electrical motors which, under NEMA Standards, are equipped with lifetime lubrication, all bearings on large motors and mechanical equipment shall be equipped with lubrication fittings at all service points, accessibly located. Oil fill and

drain line extensions shall be provided where necessary for convenient servicing of equipment.

3.21 TESTING

- A. Testing all equipment/systems installed shall be the responsibility of the trade installing the Work under the supervision of an Engineer employed by the Contractor except as specified. The Owner shall employ services of an independent firm to perform testing, adjusting and balancing:
 - 1. The independent firm will perform services specified in related section.
 - 2. Reports will be submitted by the independent firm to the Design-Builder indicating observations and results of tests and indicating compliance or non-compliance with the requirements of the Contract Documents.
- B. Furnish all gages, instruments, test equipment and personnel required for the tests. Adjust all equipment to perform with the least possible noise and vibration consistent with its duty. Quietness of operation of all equipment is a requirement. Any equipment producing noise that is abnormal, in the opinion of the Design-Builder, shall be repaired or removed and replaced with satisfactory equipment at no additional expense.
- C. Operate the system and make all adjustments in control and equipment and complete necessary balancing to deliver not less than the air or fluid quantities shown on the Drawings for each equipment item.

3.22 TOOLS

- A. On completion of the Work, the Contractor shall furnish and deliver to the Owner any special tools and instrumentation that may be required for the proper servicing or routine testing of any equipment furnished under this Contract.

3.23 ESCUTCHEONS APPLICATION

- A. Escutcheons for New Piping:
 - 1. Piping with Fitting or Sleeve Protruding from Wall: One piece, deep pattern.
 - 2. Chrome-Plated Piping: One piece, steel or split-plate steel with polished, chrome-plated finish.
 - 3. Insulated Piping:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.
 - 4. Bare Piping at Wall and Floor Penetrations in Finished Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.

5. Bare Piping at Ceiling Penetrations in Finished Spaces:
 - a. One piece, steel with polished, chrome-plated finish.
 - b. One piece, stamped steel or split plate, stamped steel with concealed hinge with polished, chrome-plated finish.

- B. Install floor plates for piping penetrations of equipment-room floors.

- C. Install floor plates with ID to closely fit around pipe, tube, and insulation of piping and with OD that completely covers opening.
 1. New Piping and Relocated Existing Piping: Split floor plate.
 2. Existing Piping to Remain: Split floor plate.

END OF SECTION 23 05 00

SECTION 23 05 14 – VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Work Includes:

1. Provide variable frequency drives (VFDs) as specified herein.
2. The VFD shall consist of a pulse-width-modulating (PWM) inverter for positive speed control for standard NEMA design B induction motors used in HVAC applications. The VFDs will be manufactured by Eaton, Danfoss, Toshiba, Yaskawa, ABB, or Cutler Hammer, and shall be UL-listed.

1.3 SUBMITTALS

- A. Shop Drawings: Fabrication drawings indicating materials of construction, unit configurations, dimensions, field connection details, support details and installation details.
- B. Product Data
 1. All product items specified.
 2. Manufacturer's literature and cut sheets.
 3. Wiring diagrams.
 4. Weights.
 5. Temperature/ambient requirements.
 6. Noise and sound data.
- C. Contract Close-Out Information
 1. Operating and maintenance data.
 2. Training video.
 3. Warranties.

1.4 WARRANTY

- A. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory-certified service technician. Start-up services shall include checking for verification or proper operation and installation for the VFD, its option, its interface wiring to the building automation system, and programming of any critical frequency rejection points.
- B. The VFD shall be warranted by the manufacturer for a period of 36 months from date of shipment. The warranty shall include parts and labor.

PART 2 - PRODUCTS

2.1 GENERAL

- C. VFD Description: Variable-frequency motor controller, consisting of power converter that employs pulse-width-modulated inverter, factory built and tested in an enclosure, with integral disconnecting means and overcurrent and overload protection; listed and labeled by an NRTL as a complete unit; arranged to provide self-protection, protection, and variable-speed control of one or more three-phase induction motors by adjusting output voltage and frequency.
- D. VFD systems shall be microprocessor-based and fully transistorized with a conservatively rated 3-phase, full-wave diode bridge input and a PWM sine-coded output waveform. The input diode bridge shall be protected against line noise by a total harmonic distortion below 35 percent fundamental drive current. This can be accomplished through reduced harmonic technology (RHT) or 5 percent line reactors. The output transistors must be of the insulated gate bipolar transistor (IGBT) type to facilitate noiseless motor operation. The VFDs shall be tested and rated for a minimum of a 20-year mean time between failure (MTBF). Provide manufacturer's typical test results or calculations with submittal to verify MTBF.
- E. To minimize electrical and acoustical noise, and to eliminate low-speed cogging, a minimum switching frequency of 15 kHz shall be used. The VFD shall not "cog" at frequencies above 1.5 Hz. There shall be no sudden frequency shifts as the output frequency is varied between 1.5 and 60hz.
- F. The VFDs input displacement power factor shall be 0.98 or better over the entire operating frequency and load range. Efficiency shall be measured at 96 percent minimum at rated load. Provide manufacturer's typical test results or calculations with submittal to verify efficiency and power factor.
- G. All VFDs shall have, but shall not be limited to, the following protective features:
 - 1. Solid state output ground fault protection shall be provided.

2. Adaptive electronics motor overload protection shall be provided which shall protect both the motor and the VFD at all frequencies. Electronic thermal overload circuits which only properly protect the motor at full speed shall not be acceptable. The VFD shall sense the load and speed and shall recalibrate the thermal trip curve to ensure low-speed motor protection. The initial trip point shall be adjustable from at least 40 percent of the VFD continuous rating to account for motor magnetizing current.
 3. Input surge protection shall be performed by MOVs (metal oxide varistors) in accordance with ANSI Specification C62.41.
- H. Opto-coupled isolated control inputs shall be provided. The motor speed shall be directly proportional, or inversely proportional to 0-10 VDC, 4-20 ma, and variable resistance signals. In addition, the VFD shall have independent settings adjustable on the fly for input reference offset (positive and negative) and gain to facilitate signal setting/matching.
- I. VFD operation options shall be programmable, and shall include, at a minimum, the following functions:
1. User-definable speed upon lost reference signal. Drive to indicate fault upon lost signal.
 2. The standard protocol shall be BACNET. Each individual drive shall have the protocol in the base VFD. The use of third-party gateways and multiplexers is not acceptable. All protocols shall be "certified" by the governing authority. Use of non-certified protocols is not allowed.
 3. Serial communication capabilities shall include, but not be limited to; run-stop control, speed set adjustment, proportional/integral/derivative PID control adjustments, current limit, acceleration/deceleration time adjustments, and lock and unlock the keypad. The drive shall have the capability of allowing the DDC to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), percent torque, power (kW), kilowatt hours (resettable), operating hours (resettable), and drive temperature. The DDC shall also be capable of monitoring the VFD relay output status, digital input status, and all analog input and analog output values. All diagnostic warning and fault information shall be transmitted over the serial communications bus. Remote VFD fault reset shall be possible. The following additional status indications and settings shall be transmitted over the serial communications bus – keypad "Hand" or "Auto" selected the ability to change the PID set point. The DDC system shall also be able to monitor if the motor is running in the VFD mode over serial communications. A minimum of 15 field parameters shall be capable of being monitored.
 4. The VFD shall allow the DDC to control the drive's digital and analog outputs via the serial interface. This control shall be independent of any VFD function. For example, the analog outputs may be used for modulating chilled water valves or cooling tower bypass valves. The drive's digital (relay) outputs may be used to actuate a damper, open a valve or control any other device that requires a maintained contact for operation. In addition, all of the drive's digital and analog inputs shall be capable of being monitored by the DDC system.
- J. The VFD shall provide the following operational features:

1. "Speed search" transfer. The VFD shall have the ability to start from bypass or fault trip into a spinning load from 100 percent forward to 100 percent reverse rotation without stopping the motor or creating a fault condition. The VFD shall match the motor's speed and then drive the motor to its proper speed reference.
2. Programmable current limit.
3. Programmable, "intelligent" auto-restart function. Intelligent auto-restart precludes any attempt to restart in the event of trips typically indicative of component failure.
4. Drive must have power loss ride-through capability, for units 5 HP and larger. In the event of a loss of three-phase power lasting 2 seconds or less, the VFD must have the ability to regain operation without nuisance trips.
5. Critical Frequency Rejection Points: Drives shall be capable of programming up to 3 frequency rejection points to protect the driven equipment from continuous operation at harmful resonance frequencies.

K. The following fault conditions shall cause the VFD to shut down without damage and shall be annunciated via alpha-numeric fault diagnostic (remote annunciation shall be available with a form 'c' fault contact):

1. Overload (blow fuse any or all legs/loss of phase)
2. Instantaneous over current trip (short circuit)
3. DC bus overvoltage
4. DC bus under voltage, phase loss protection
5. Excessive ambient, VFD heat sink over temperature
6. Ground fault input
7. Internally diagnosed, control failure
8. Motor thermal overload
9. VFD thermal overload
10. Programmable "shear pin" current trip

2.2 PROGRAMMING/OPERATOR STATION

- A. Include alpha-numeric display of frequency reference, output frequency, output current (accurate +/-3 percent, regardless of output frequency), output voltage, DC bus voltage, output power (kW), input terminal status, output thermal status, LED lamp check, and EEPROM number.
- B. Alpha-numeric display of faults. Up to 4 sequential faults shall be retained in non-volatile memory (maintained even after removal of input power). All system information (voltage levels, current levels, etc.) shall be stored for the previous 3 seconds before the last fault in 160 nsec intervals to aid in diagnostics.
 1. Remote Indicating Circuit Terminals: Mode selection, controller status, and controller fault.
- C. VFD systems located outdoors shall be mounted in a NEMA 3R stainless steel enclosure. VFD systems located in indoor wet/damp rooms or indoor rooms with water systems such as chiller or boiler rooms shall be mounted in a NEMA 12 enclosure. All enclosures shall be provided with the following additional equipment requirements:

1. High short-circuits current rating (65kA) including a high interrupting capacity disconnect switch with through-the-door handle and circuit breakers for each circuit.
 2. Door-mounted digital operator control station.
 3. Door-interlocked input circuit breaker OCPD with flange-mounted pad-lockable door-mounted operating handle.
 - a. Disconnect Rating: Not less than 115 percent of VFD input current rating.
 - b. Disconnect Rating: Not less than 115 percent of NFPA 70 motor full-load current rating or VFD input current rating, whichever is larger.
 - c. Auxiliary Contacts: NO or NC, arranged to activate before switch blades open.
 - d. Auxiliary contacts "a" and "b" arranged to activate with circuit-breaker handle.
 - e. Alarm contact that operates only when circuit breaker has tripped.
 4. Three (3) contactor bypass to fully isolate the VFD. The VFD must be able to be run for testing purposes while the motor is operating in the bypass mode.
 - a. NORMAL/BYPASS selector switch.
 - b. HAND/OFF/AUTO selector switch.
 - c. NORMAL/TEST Selector Switch: Allows testing and adjusting of VFD while the motor is running in the bypass mode.
 5. Output 3-phase current sensing overload relay to provide motor protection in either the VFD or bypass mode.
- D. VFD systems shall be full load tested prior to shipment.
- E. DV/DT – All VFDs operating multiple motors are required to have a DV/DT filter. All VFDs operating a single motor with a wire distance of more than 100 feet are also required to have a DV/DT filter. The DV/DT filter will limit the rated voltage rise over time to prevent the breakdown of motor winding insulation and reduce the motor operating temperature. The DV/DT filter can be mounted internally to the VFD enclosure or supplied externally in close proximity to the VFD. If supplied externally, the DV/DT filter shall be mounted in a NEMA enclosure matching the VFD NEMA enclosure type. The DV/DT filter shall be UL listed.

PART 3- EXECUTION

3.1 EXAMINATION

- F. Examine VFD before installation. Reject VFDs that are wet, moisture damaged, or mold damaged.
- G. Examine roughing-in for conduit systems to verify actual locations of conduit connections before VFD installation.

- H. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the work.
- I. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. All equipment shall be installed per manufacturer's recommendations.
- B. Label all control components to match the control and wiring diagrams.
- C. All motors controlled with VFDs shall be provided with a shaft grounding system to electrically insulate bearings to prevent damage due to stray shaft currents.
- D. Wall-Mounting Controllers: Install with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished floor, unless otherwise indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall.
- E. Roof-Mounting Controllers: Install VFD on roofs with tops at uniform height and with disconnect operating handles not higher than 79 inches above finished roof surface unless otherwise indicated, and by bolting units to curbs or mounting on freestanding, lightweight, structural-steel channels bolted to curbs. Seal roof penetrations after raceways are installed.
- F. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- G. Install fuses in each fusible-switch VFD.
- H. Install fuses in control circuits if not factory installed.
- I. Install heaters in thermal-overload relays. Select heaters based on actual nameplate full-load amperes after motors are installed.
- J. Install, connect, and fuse thermal-protector monitoring relays furnished with motor-driven equipment.
- K. Comply with NECA 1.

3.3 CONTROL WIRING INSTALLATION

- A. Install wiring between VFDs and remote devices and facility's central-control system.
- B. Bundle, train, and support wiring in enclosures.
- C. Connect selector switches and other automatic-control devices where applicable.

1. Connect selector switches to bypass only those manual and automatic control devices that have no safety functions when switches are in manual-control position.
2. Connect selector switches with control circuit in both manual and automatic positions for safety type control devices such as low- and high-pressure cutouts, high temperature cutouts, and motor-overload protectors.

3.4 IDENTIFICATION

- A. Identify VFDs, components, and control wiring.
 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label each VFD with engraved nameplate.
 3. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for VFDs, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of VFD units.

3.5 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections with the assistance of a factory-authorized service representative.
- D. Acceptance Testing Preparation:
 1. Test insulation resistance for each VFD element, bus, component, connecting supply, feeder, and control circuit.
 2. Test continuity of each circuit.
- E. Tests and Inspections:
 1. Inspect VFD, wiring, components, connections, and equipment installation. Test and adjust controllers, components, and equipment.
 2. Test insulation resistance for each VFD element, component, connecting motor supply, feeder, and control circuits.
 3. Test continuity of each circuit.
 4. Verify that voltages at VFD locations are within 10 percent of motor nameplate rated voltages. If outside this range for any motor, notify Design-Builder before starting the motor(s).
 5. Test each motor for proper phase rotation.

6. Perform tests according to the Inspection and Test Procedures for Adjustable Speed Drives stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
7. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
8. Perform the following infrared (thermographic) scan tests and inspections, and prepare reports:
 - a. Initial Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each VFD. Remove front panels so joints and connections are accessible to portable scanner.
 - b. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each VFD 11 months after date of Substantial Completion.
 - c. Instruments and Equipment: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.
9. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.

F. VFDs will be considered defective if they do not pass tests and inspections.

G. Prepare test and inspection reports, including a certified report that identifies the VFD and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6 STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

3.7 ADJUSTING

A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.

B. Set field-adjustable switches, auxiliary relays, time-delay relays, timers, and overload-relay pickup and trip ranges.

- C. Adjust the trip settings of instantaneous-only circuit breakers and thermal-magnetic circuit breakers with adjustable, instantaneous trip elements. Initially adjust to 6 times the motor nameplate full-load amperes and attempt to start motors several times, allowing for motor cool-down between starts. If tripping occurs on motor inrush, adjust settings in increments until motors start without tripping. Do not exceed 8 times the motor full-load amperes (or 11 times for NEMA Premium Efficient motors if required). Where these maximum settings do not allow starting of a motor, notify Design-Builder before increasing settings.
- D. Set the taps on reduced-voltage autotransformer controllers.
- E. Set field-adjustable circuit-breaker trip ranges.
- F. Set field-adjustable pressure switches.

3.8 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace VFDs whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.9 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, reprogram, and maintain VFDs.

END OF SECTION 23 05 14

SECTION 23 05 19 – METERS AND GAUGES FOR HVAC PIPING

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

SUMMARY

This Section includes the following types of meters and gauges:

1. Temperature gauges and fittings.
2. Pressure gauges and fittings.

Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 21, 22 and 23 sections.

QUALITY ASSURANCE

UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

SUBMITTALS

Shop Drawings: Each equipment and material item specified.

Product Data: Product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

Samples: Not required for review.

Contract Close-Out Information

3. Maintenance data for each type of meter and gauge in each building for inclusion in Operating and Maintenance Manuals specified in Division 01, and Division 23 Section "Common Work Results for HVAC".
4. Portable test plug test kit and portable meter receipts as described in this Section.

PART 2 - PRODUCTS**MANUFACTURERS**

Subject to compliance with requirements, provide either the named products or comparable products by the following:

1. Mercury-In-Glass Thermometers
 - a. Marshalltown Instruments, Inc.
 - b. Terice (H.O.) Co.
 - c. Weiss Instruments, Inc.

2. Thermometer Wells: Same as thermometers.
 - a. Insertion Dial Thermometers.
 - b. Ashcroft Dresser Industries/Instrument Div.
 - c. Terice (H.O.) Co.
 - d. Weiss Instruments, Inc.

3. Pressure Gauges
 - a. Ametek, U.S. Gauge Div.
 - b. Ashcroft Dresser Industries/Instrument Div.
 - c. Marsh Instrument Co., Unit of General Signal.
 - d. Marshalltown Instruments, Inc.
 - e. Terice (H.O.) Co.
 - f. Weiss Instruments, Inc.

4. Pressure Gauge Accessories: Same as for pressure gauges.
 - a. Water Orifice-Type Measurement System.
 - b. Armstrong Pumps, Inc.
 - c. Bell & Gossett, ITT, Fluid Handling Div.

5. Test Plugs
 - a. MG Piping Products Co.
 - b. Peterson Equipment Co., Inc.
 - c. Sisco, A Spedco, Inc. Co.
 - d. Terice (H.O.) Co.
 - e. Watts Regulator Co.
 - f. Flow Design, Inc.

THERMOMETERS, GENERAL

Accuracy: Plus or minus 1% of range span or plus or minus one scale division to maximum of 1.5% of range span.

6. Scale Range: Temperature ranges for services listed as follows:
7. Domestic Hot Water: 30 deg to 240 deg with 2 deg scale divisions (0 deg to 115deg C with 1 deg scale divisions).
8. Domestic Cold Water: 0 deg to 100 deg F with 2 deg scale divisions (minus 18 deg to 38 deg C with 1 deg scale divisions).
9. Heating Hot Water: 30 deg to 300 deg F with 2 deg scale divisions (0 deg to 150 deg C with 1deg scale divisions).

MERCURY-IN-GLASS THERMOMETERS

Case: Diecast, aluminum finished in baked epoxy enamel, glass front, spring-secured, 9 inches long.

Adjustable Joint: Finished to match case, 180-degree adjustment in vertical plane, 360-degree adjustment in horizontal plane, with locking device.

Tube: Red reading, mercury-filled magnifying lens.

Scale: Satin-faced, non-reflective aluminum, with permanently etched markings.

Stem: Copper-plated steel, aluminum or brass, for separable socket, length to suit installation.

DIAL-TYPE INSERTION THERMOMETERS

Type: Bimetal stainless steel case and stem, 1-inch diameter dial, dust and leakproof, 1/8-inch diameter tapered-end stem with nominal length of 5 inches.

THERMOMETER WELLS

Brass or stainless steel, pressure-rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

PRESSURE GAUGES

Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube-type, bottom connection.

Case: Drawn steel or brass, glass lens, 4-1/2-inch diameter.

Connector: Brass, 1/4-inch NPS.

Scale: White coated aluminum, with permanently etched markings.

Accuracy: Plus or minus 1% of range span.

Range: Conform to the following:

10. Vacuum: 30 inch Hg to 15 psi
11. All fluids: 2 times operating pressure

PRESSURE GAUGE ACCESSORIES

Siphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

FLOW METERS, GENERAL

Flow rate of elements and meters shall be same as connected equipment or system.

WAFER ORIFICE-TYPE FLOW ELEMENTS

Type: Differential-pressure wafer-type orifice insert flow elements designed for installation between pipe flanges.

Construction: Cast iron body, brass valves with integral check valves and caps, and calibrated nameplates. Elements shall be pressure-rated for 300 psig and 25 deg F (120 deg C).

METERS

Portable Meters: Differential-pressure gauge and two 12-foot hoses in carrying case with handle.

Scale: 0-100 ft. of water unless otherwise indicated.

Accuracy: Plus or minus 0.5% of full scale.

Each meter shall be furnished complete with operating instructions.

TEST PLUGS

Test plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and two self-sealing valve-type core inserts suitable for inserting a 1/8 inch O.D. probe assembly from a dial-type thermometer or pressure gauge. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.

Core Material: Conform to the following for fluid and temperature range:

12. Air, Water, Oil, and Gas, 20 deg to 200 deg F (minus 7 deg to 93 deg C):
Neoprene
13. Air and Water, minus 30 deg to 275 deg F (minus 35 deg to 136 deg C): EPDM

Ranges of pressure gauge and thermometers shall be approximately two times systems operating conditions.

PART 3 - EXECUTION

THERMOMETER INSTALLATION

Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

Install in the following locations and elsewhere as indicated:

1. At inlet and outlet of each hydronic boiler and chiller

Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

INSTALLATION OF PRESSURE GAUGES

Install pressure gauges in piping tee with pressure gauge valve, located on pipe at most legible position.

Install in the following locations, and elsewhere as indicated:

2. At suction and discharge of each pump.
3. At discharge of each pressure-reducing valve.
4. At building water service entrance.

Pressure Gauge Needle Valves: Install in piping tee with snubber. Install siphon in lieu of snubber for steam pressure gauges.

INSTALLATION OF TEST PLUGS

Test Plugs: Install in piping tee where indicated, located on pipe at most legible position. Secure cap.

5. Install test plugs adjacent to each piping point where a temperature sensing device is required by control specifications.

Test Kit: Provide test kit consisting of one pressure gauge, gauge adapter with probe, two bimetal dial thermometers, and carrying case. Turn over to Owner at completion of job

and obtain written receipt. Forward copy of receipt to A/E as part of close-out documents.

INSTALLATION OF FLOW-MEASURING ELEMENTS AND METERS

General: Install flow meters for piping systems located in accessible locations at most legible position.

Locations: Install flow measuring elements in the following locations and elsewhere as indicated:

6. At discharge of each inline pump.

Differential-Pressure-Type Flow Elements: Install minimum straight lengths of pipe upstream and downstream from element as prescribed by the manufacturer's installation instructions.

Install wafer orifice-type element between two Class 125 pipe flanges, ANSI B16.1 (cast iron) or ANSI B16.24 (bronze).

7. Install connections for attachment to portable flow meters in a readily accessible location.

Meters for Use with Flow Elements: Install meters on wall or bracket in accessible location.

8. Install connections, tubing, and accessories between flow elements and meters as prescribed by the manufacturer's installation instructions.

Window Flow Meters: Install in vertical upward position with impact tube mounted in bushing centered on pipe with 10 pipe diameters upstream and 5 pipe diameters downstream of straight unrestricted piping for 1-1/4 inch and smaller, 20 pipe diameters upstream and 10 pipe diameters downstream for 1-1/2 inch AND LARGER. Calibrate meter after installation in accordance with manufacturer's installation instructions.

PORTABLE METERS

Provide one portable meter as described in Part 2 of this Section. Turn over to Owner at completion of job and obtain written receipt. Forward copy of receipt to A/E as part of close-out documents.

ADJUSTING AND CLEANING

Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

CONNECTIONS

Piping installation requirements are specified in other sections of ***Division 21, 22 and 23***. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

Install meters and gauges piping adjacent to machine to allow servicing and maintaining of machine.

END OF SECTION 23 05 19

SECTION 23 05 23 – VALVES FOR HVAC PIPING

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

SUMMARY

This Section includes valves for the following systems:

1. Heating Water.
2. Chilled Water.
3. Makeup Water.
4. Cooling Coil Condensate Drain Water.

SUBMITTALS

Shop Drawings: Schedule indicating proposed valve for each application.

Product Data

5. Manufacturer's cut sheets and/or literature.
6. Performance Data

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information

7. Valve chart indicating valve identification number, valve type, service, manufacturer and model number, and location of valve.
8. Operating and maintenance manuals.

QUALITY ASSURANCE

Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.

ASME Compliance

9. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
10. ASME B31.1 for power piping valves.
11. ASME B31.9 for building services piping valves.

Factory test all Valve Bodies, Shells and Seats per MSS requirements as a minimum.

Iron Body Valves

12. Pressure-Containing Parts: ASTM A126, Grade B.
13. Face-to-Face and End-to-End Dimensions: ANSI B16.10.
14. Design, Workmanship, Materials, Testing: MSS-SP-70, 71, 85.

Butterfly Valves

15. Face-to-Face and End-to-End Dimensions: MSS-SP-67.

Valve Stems: ATM B371, Alloy C69400; ASTM B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.

Valve-End Connections

16. Flanged: With flanges according to ASME B16.1 for iron valves.
17. Solder Joint: With sockets according to ASME B 16.18.
18. Threaded: With threads according to ASME B1.20.1.
19. Grooved: With grooves according to Victaulic published dimensions.

Valve Bypass and Drain Connections: MSS SP-45.

Pressure Casting shall be free of impregnating materials, no welding of iron allowed.

Manufacturer's name or trademark and working pressure stamped or cast into body.

Valves shall be rated at least 20% over the maximum system working pressure and not less than required for system temperatures.

PART 2 - PRODUCTS

GENERAL REQUIREMENTS FOR VALVES

Valve Sizes shall be the same as upstream piping unless otherwise indicated.

Valve Bypass and Drain Connections: MSS SP-45.

Combination Balancing and Shutoff Valves.

1. Install where shown on Drawings. Combination Balance and Shutoff Valves shall be designed and used only for balancing. A separate isolation valve shall be provided.

2. Provide a means for connecting to a portable differential pressure meter for readout. A portable pressure gauge, hoses and flow curves shall be provided in a portable test kit.
3. On sizes 2-1/2 inches and larger, valve size, capacity and operating pressure must comply with ASME boiler and pressure vessel code: section IV.
4. Refer to manufacturer's recommendations for upstream and downstream straight piping lengths.

Coil Piping Packages/Coil Hook Ups

5. Contractor has the option to use factory assembled valve packages in lieu of individual valves and ports as shown on the drawings at any terminal unit connections.
6. Shall only be provided on pipes 2 inches and smaller.
7. All components shall be rated for 125 psig working pressure and shall be full-port (full-bore) design.
8. The order and arrangement of components shall be consistent with the Drawings.
9. Each individual component shall meet the specification requirements for components of a field-assembled system.
10. Refer to the 230900 - HVAC Instrumentation and Controls specification for the Control valves.
11. Refer to the 232116 – Hydronic Specialties specification for additional requirements.
12. Acceptable manufacturers: Victaulic/Tour Andersson.

HVAC SYSTEMS (heating water, chilled water, make-up water and cooling coil condensate drain) WITH OPERATING TEMPERATURES UP TO 200 DEG F.

Start/Stop Flow; 2 Inches and Smaller

13. Type: 2-piece full port ball.
14. Minimum ANSI Class: 150 SWP (600 WOG).
15. Body Material: Cast bronze (ASTM B 584).
16. Seal Material: Reinforced PTFE.
17. Ends: Threaded or soldered for copper piping.
18. Ball Material: 316 stainless steel.
19. Stem Material: 316 stainless steel.
20. Operator: Hand lever.

Start/Stop Flow; 2-1/2 Inches and Larger

21. Type: Butterfly.
22. Minimum ANSI Class: 150 WOG.
23. Body Material: Cast iron.
24. Seat Material: EPDM.
25. Ends: Full lug flange.
26. Disc Material: Aluminum bronze.
27. Stem Material: 416 stainless steel.

28. Operator: 10-position hand lever for less than 6 inches, gear actuator for 6 inches and larger.
29. Other: Valves and Seats shall be rated for 150 psi shutoff during dead-end service, without downstream piping or flange.
 - a. Option for grooved piping systems: 300 psi CWP suitable for bi-directional and dead-end service at full rated pressure. Body shall be grooved end ductile iron conforming to ASTM A536. Disc shall be offset from the stem centerline to allow full 360 degree seating. Seat shall be pressure responsive EPDM. Valve bearings shall be TFE lined fiberglass, and stem seals shall be of the same grade elastomer as the valve seat.
 - b. 2-1/2" through 12": Victaulic Style 300 MasterSeal™.
 - c. 14" through 24": Victaulic AGS Style W761 300 MasterSeal™.

Prevent Back Flow; 2 Inches and Smaller

30. Type: Check – Horizontal swing or vertical lift.
31. Minimum ANSI Class: 125 SWP (200 WOG).
32. Body Material: Bronze (ASTM B 62).
33. Disc Material: Reinforced PTFE.
34. Ends: Threaded or Soldered for copper piping.
35. Cap: Threaded.

Prevent Back Flow; 2-1/2 Inches and Larger

36. Type: Swing check.
37. Minimum ANSI Class: 125 SWP (200 WOG).
38. Body Material: Cast iron (ASTM A 126).
39. Disc Material: Cast iron (ASTM A 126).
40. Seat Ring Material: Bronze (ASTM B 62).
41. Ends: Flanged.
42. Cap: Bolted.
43. Option for grooved piping systems: Black enamel coated ductile iron body, ASTM A-536, Grade 65-45-12, elastomer encapsulated ductile iron disc suitable for intended service, stainless steel spring and shaft, welded-in nickel seat, 300 psi.
 - a. 2-1/2" through 12": Victaulic Series 716 (Or Series 779 with Venturi taps).
 - b. 14" through 24": Victaulic AGS Style W715.

Prevent Back Flow; 2-1/2 Inches and Larger

44. Type: Globe body silent check valve.
45. Minimum ANSI Class: 125 SWP.
46. Body Material: Cast iron (ASTM A 48, Class 35).
47. Disc Material: Cast iron with bronze face rings.
48. Ends: Flanged or wafer.
49. Seat Material: Bronze (ASTM B584).
50. Plug Material: Bronze (ASTM B584).

51. Spring Material: Stainless steel T304 (ASTM A 276).

Acceptable Manufacturers: Milwaukee, Hammond, Crane, NIBCO, Victaulic or Mueller.

Regulate/Balance Flow; 2 Inches and Smaller

52. Type: Combination balancing and shutoff valve (calibrated Y-Pattern globe).
53. Minimum Pressure: 300 psi.
54. Body Material: Non-Ferrous (DZR) Brass alloy.
 - a. Wetted brass surfaces shall be of a suitable material that when tested to the ISO 6509 / AS 2345 standards for dezincification resistance (DZR), the materials shall not exceed the maximum 100 micron average depth.
55. Ends: Flanged, threaded or soldered for copper piping.
56. Seat Seal Material: EPDM.

57. Stem and Seat Material: Non-Ferrous (DZR) Brass alloy.
 - a. Wetted brass surfaces shall be of a suitable material that when tested to the ISO 6509 / AS 2345 standards for dezincification resistance (DZR), the materials shall not exceed the maximum 100 micron average depth.
58. Operator: 4-Turn hand wheel with hidden memory stop.
59. NOTE: Ball type valves not acceptable as balancing device.

Regulate/Balance Flow; 2-1/2 Inches and Larger

60. Type: Combination balancing and shutoff valve (venturi globe type).
61. Minimum Pressure: 300 psi.
62. Body Material: Ductile iron.
63. Ends: Flanged, grooved or threaded.
64. Seat Seal Material: EPDM.
65. Stem and Seat Material: Non-Ferrous (DZR) Brass alloy.
 - a. Wetted brass surfaces shall be of a suitable material that when tested to the ISO 6509 / AS 2345 standards for dezincification resistance (DZR), the materials shall not exceed the maximum 100 micron average depth.
66. Operator: Multi-turn handwheel with hidden memory stop.
67. NOTE: Butterfly type valves not acceptable as balancing device.

Acceptable Combination Balancing and Shutoff Valves are: Victaulic/Tour Anderson

PART 3 - EXECUTION

STORAGE, HANDLING, AND EXAMINATION

Use the following precautions during storage:

1. Maintain valve end protection.
2. Store valves indoors and maintain at higher than ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent disc movement during shipping and handling.

Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.

Examine threads on valve and mating pipe for form and cleanliness.

Examine mating flange faces for conditions that might cause leakage. Check bolting for proper size, length, and material. Verify that gasket is of proper size, that its material composition is suitable for service, and that it is free from defects and damage.

Do not attempt to repair defective valves; replace with new valves.

VALVE INSTALLATION

Install valves at locations shown on the Drawings, per the Specifications and in accordance with manufacturer's written instructions.

Locate valves for easy access and provide separate support where necessary.

Service/isolation valve shall be provided at every piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown and minimal disruption to the piping service.

Install Combination Balancing and Shutoff Valves at each branch connection to return main.

Install Start/Stop flow valve for isolation at each branch connection to supply main.

Install check valves at each pump discharge and elsewhere as required to control flow direction.

All check valves should be installed in a location that has smooth and laminar flow conditions.

For swing type check valves, locate valve a minimum of 10 pipe diameters downstream of a reciprocating pump or other turbulence inducing device such as an elbow or tee. Locate elbows, reductions, etc. a minimum of 5 pipe diameters downstream of valve.

For silent type check valves, locate valve a minimum of 4 pipe diameters downstream of a reciprocating pump or other turbulence inducing device such as an elbow or tee. Locate elbows, reductions, etc. a minimum of 3 pipe diameters downstream of valve.

Install valves in horizontal piping with the hand wheel and stem at or above center of pipe.

Install valves in position to allow full stem movement.

Valves installed in copper lines shall be provided with screwed or flanged adapters with a union installed downstream and within 12 inches of the valve.

Install chainwheels on operators for all valves located with the lowest portion of its handwheel or lever at 10 feet or more above finished floor. Extend chains to 5 feet above finished floor.

Install safety valves at hot-water generators and elsewhere as required by ASME Boiler and Pressure Vessel Code. Install drip-pan elbow on safety-valve outlet and pipe without valves to the outdoors; and pipe drain to nearest floor drain or as indicated on Drawings. Comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01, for installation requirements.

Install check valves for proper direction of flow and as follows:

3. Swing Check Valves: In horizontal position with hinge pin level.
4. Lift Check Valves: With stem upright and plumb.

ADJUSTING

Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and balancing. Replace valves if persistent leaking occurs.

END OF SECTION 23 05 23

SECTION 23 05 29 – HANGERS, SLEEVES, AND SUPPORTS

PART 1 - GENERAL

RELATED DOCUMENTS

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes but is not limited to: Pipe hanger and supports, Pipe and equipment anchors and Pipe sleeves.

QUALITY ASSURANCE

Pipe Hanger Standards: Manufacturers Standardization Society (MSS) SP-58, SP-89, and SP-69, as referenced.

SMACNA.

Seismic applications listed within SMACNA that are not usable within a given structure, shall be resolved through engineered adaptations or alteration. Whenever possible these adaptations or alternations shall use SMACNA approved components, so as to maintain compliance and uniformity with SMACNA's engineering standards and design principles. In all cases, and prior to installation, these adaptations or alternations shall be engineered in accordance with standard engineering practices by a qualified, registered structural engineer, and shall be submitted to project structural engineer and mechanical engineer for their review and approval.

SUBMITTALS

Shop Drawings: Miscellaneous steel layout. Indicate all point loads where miscellaneous steel is supported by structural members, Brace spacing, layout, connection method and details.

Product Data: Catalog cuts and performance data.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information: Operating and maintenance data, Warranty.

PART 2 - PRODUCTS

ACCEPTABLE MANUFACTURERS

Pipe Hangers: Elcen Metal Products Co., B-Line Systems Inc., Carpenter and Paterson Inc., Anvil.

Concrete Anchors: Phillips, Hilti, and Powers.

Insulated Pipe Supports: Pipe Shields Inc., Anvil, Power Piping.

Pipe and Equipment Anchors: Shop-fabricated, Field-fabricated.

Sleeves: Shamrock Industries, "Crete-sleeve" plastic hole forms, Proset Systems Inc., "Proset" fire-safe pipe penetrations, Shop for field fabricated.

Sleeves, Pre-Manufactured Fire and Smoke Wall Barrier: Pipe Shields, Inc.

PIPE HANGERS AND SUPPORTS

Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Cadmium plated carbon steel, adjustable swivel split ring. Use PVC coated or copper plated for copper piping.

Hangers for Pipe Sizes 2 to 4 Inches and Cold Pipe Sizes 6 Inches and Over: Carbon steel, adjustable, clevis type. Use copper plated for copper piping.

Hangers for Hot Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.

Hangers for piping that gets insulated shall be sized to allow insulation to be continuous through hangers.

Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods; cast iron roll and stand for hot pipe sizes 6 inches and over.

Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.

Vertical Support: Steel riser clamp.

Floor Support for Pipe Sizes to 4 Inches and All Cold Pipe Sizes: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

Shield for Insulation Piping 16 gage galvanized steel shield over minimum 12 inches long at pipe support. 360-degree insulated saddle system consisting of a factory assembled

2.5 PCF density 25/50 Flame/Smoke rated phenolic foam pipe insulation with .02 perm rated vapor retender film with self-sealing lap. Buckaroos model 255OFS or equal.

HANGER RODS AND ATTACHMENTS

Steel Hanger Rods: Threaded both ends, threaded one end, and continuous threaded. Use cadmium plated rods where unconcealed or exposed to the elements.

Minimum pipe hanger rod sizes are as follows:

Pipe Size	Rod Diameter
Up to 2 Inches	3/8 Inch
2-1/2 Inches & 3 Inches	1/2 Inch
4 Inches	5/8 Inch
6 Inches	3/4 Inch
8 Inches to 12 Inches	7/8 Inch
14 Inches to 18 Inches	1 Inch
20 Inches to 30 Inches	1-1/4 Inch

Beam Clamps (up to 8-inch diameter pipe): Top beam clamp, steel jaw, hook rod with nut and spring washer steel eye-bolt. C-clamps by themselves are expressly prohibited unless otherwise approved by Structural Engineer

INSERTS

Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

PIPE SLEEVES AND SEALANTS

Sleeves – General: Sleeve all piping passing through walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping. Box out openings larger than 14 inch diameter.

Sleeves, Steel Pipes: Use in following locations:

1. Fire-rated and smoke-rated construction.
2. Structural steel members (when approved by Design-Builder).
3. Floors: Galvanized.
4. Concrete walls.
5. Mechanical rooms, tunnels, and stairwells.
6. Polyethylene hole forms (Crete-Sleeve): Optional use in poured concrete walls and floors.

Sleeves for Future Work: Same as for this work.

Sleeves in Other Locations: As detailed. If not detailed, use 18 ga galvanized sheet metal or 24 ga spiral duct.

Sleeves for Plastic Piping

- 7. Provide pipe sleeves for all plastic-type piping (PVC, CPVC and polypropylene) at fire-rated assembly and floor slab penetrations.
- 8. Size sleeves per following schedule:

Pipe Size (In.)	Sleeve Size (In.)	Extension Beyond Barrier (Ft.)
1 or less	3	2
1-1/4 to 2	4	2
3	5	3
4	6	4

- 9. Extend sleeve listed distance beyond wall or floor on both sides.
- 10. Insulate plastic pipe with minimum 1 inch thick calcium silicate or 2400 deg F aluminasilica within sleeve length.

Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc.

- 11. Bare Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
- 12. Insulated Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
 - a. Insulated chilled water and DX lines: Type CS-CW.
 - b. Other insulated pipes: Type CS.
- 13. Plastic Pipe through Fire Walls and Floors: Type WFB with 1-inch-thick calcium silicate insulation encased in metal sleeve extension 2 ft. either side of fire-rated walls or floor.

Sleeve Sizes

- 14. Length: Ends flush with finished surfaces.
- 15. Diameter
 - a. Minimum 3 inch.
 - b. Minimum 1 inch larger than pipe and pipe insulation.
 - c. In concrete, 1-1/2 inch larger than pipe.
 - d. Diameter suitable for construction tolerances and to receive sealant, when indicated.

Sealants: Seal annular space around piping.

- 16. For fire- and smoke-rated floors, walls and partitions: Use UL-listed firestopping material that maintains fire-rated wall and floor integrity. Provide proper material for each typical application as described by manufacturer.

17. Acceptable Manufacturers: Dow Corning "Fire Stop", Nelson "Flameseal", 3M "Fire Barrier", Pipe Shields Inc., Model WFB, DFB, or QDFB Series, Proset Systems.
18. For Non-Rated Walls and Partitions: Use mineral or glass fiber insulation.
19. For Exterior and Foundation Walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

PART 3 - EXECUTION

GENERAL

Structural Considerations

1. Steel or concrete roof/floor system, including slabs or roof deck shall be in place and complete before installation of any mechanical piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe Hanger Loading."
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers to bottom of concrete filled floor deck, except by permission of Design-Builder. Permission from Design-Builder will only be provided when required due to construction schedule timing issues. If permission from Design-Builder is provided, Powers BANG-IT concrete insert or approved equal shall be used.
5. Attach hangers to beams whenever possible.

Install piping systems with approved hangers and supports to prevent sagging, warping and vibration of piping systems. Install pipe hangers and supports to allow for expansion, contraction, and drainage of piping. Place hangers and supports close to valves, vertical riser drops, heavy equipment, specialties, and each piping change of direction. At first elbow of equipment run out piping risers and horizontal piping within 10 feet of all circulating base mounted pumps having 4-inch or larger piping connections, shall have piping at same supported with flexible spring hangers.

Connect hanger rods to approved "I" beams or channel clamps, concrete inserts or expansion shields. Provide all concrete inserts and structural members required for the proper support of the piping systems with proper approved distribution of weight.

Do not weld to structural steel without special permission of the Design-Builder. Do not use wooden plugs for any form of fastening.

Space pipe hangers for horizontal piping as indicated, unless otherwise directed. Provide pipe hangers with the minimum rod sizes shown, complete with full length machined threads, and adjusting and lock nuts.

Run piping substantially as shown on the Drawings. Run pipe as directly as possible, avoiding unnecessary offsets and interferences, maintaining maximum headroom and

concealed in all rooms or areas, except mechanical equipment rooms, unless otherwise noted. Coordinate exact locations of mains, risers and runouts in the field with the various Trade Contractors and the Design-Builder.

Arrange pipe lines to give ample room for pipe insulation. Run piping parallel to or at right angles with the lines of the building.

Assemble and install piping without undue strain and stress and with provision for expansion, contraction and structural settlement. Do not cut or notch structural members unless adequate provision is made with the approval of the Design-Builder. Anchors shall be approved by the Design-Builder before they are used.

PIPE HANGERS AND SUPPORTS

For standard steel and copper piping, locate hangers at each change of direction as well as within remaining lengths spaced at or within following maximum limits:

Pipe Diameter	Steel Liquid	Steel Vapor	Copper Liquid	Copper Vapor
1/2 - 1 inch	7 ft.	8 ft.	5 ft.	6 ft.
1-1/4 - 2 inch	7 ft.	9 ft.	7 ft.	9 ft.
2-1/2 - 3 inch	11 ft.	12 ft.	9 ft.	12 ft.
3-1/2 - 4 inch	12 ft.	12 ft.	11 ft.	12 ft.
5 - 6 inch	12 ft.	12 ft.	12 ft.	12 ft.
8 - 30 inch	12 ft.	12 ft.	12 ft.	12 ft.

For Schedule 40 or Schedule 80 PVC piping, locate hangers at each change of direction and space at or within the following maximum limits:

Schedule 40 or 80 PVC		
Pipe Diameter	Liquid	Vapor
1/2 - 1 inch	3 Ft.	3 Ft.
1-1/4 - 2 inch	3 Ft.	3 Ft.
2-1/2 - 3 inch	6 Ft.	6 Ft.
3-1/2 - 4 inch	7 Ft.	7 Ft.
5 - 6 inch	8 Ft.	8 Ft.
8 - 14 inch	12 Ft.	12 Ft.

Provide a hanger within 1 foot or less of each horizontal elbow and valves that are above 3 inches in size. If spacing between horizontal elbows (or plugged tees used as elbows) is less than 6 feet, provide only 1 hanger located between the elbows. No hanger size or requirements shall ever be less than the minimum recommended by the Mechanical Contractor's Association of America, Inc.

For piping of other materials, space hangers according to manufacturer's recommendations.

Pipe Hanger Loading

- 6. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 inch	610 lb.
1/2 inch	1,130 lb.
5/8 inch	1,810 lb.
3/4 inch	2,710 lb.

- 7. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

Trapeze Hangers: Suspend trapeze hangers from concrete inserts of approved structural clips. Construct trapeze hangers of galvanized angle iron, channels or other structural shapes with flat surfaces for point of support.

Vertical Pipe Supports: Support all vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.

Concrete Inserts: Provide individual or continuous slot concrete inserts for use with hangers for piping and equipment exposed in finished areas, and as required. Provide concrete inserts in time for installation in concrete.

DUCT HANGERS

Install necessary hanger rods and angle iron support brackets to properly support, ductwork, insulation, reinforcing, and external loads. Fiction clamps are excluded as upper attachment devices.

Max spacing of supports to be as follows:

Rectangular Duct		
1/2 x Duct Perimeter (Inches)	Rod Diameter (Inches)	Spacing (Feet)
Less than 72	3/8	10
72 to 120	3/8	8
120-192	1/2	5

Round Ducts		
Duct Perimeter (Inches)	Rod Diameter (Inches)	Spacing (Feet)
Through 24	1/4	12
25 through 36	3/8	12
37 through 50	1/2	12

- 8. Use a pair of rods, 1 on each side of ductwork. Rods to be uncoated, hot-rolled steel.

9. OPTION: 1 inch wide sheet metal straps may be used on sizes up to 22 inches wide (or 22 inches in diameter), 1 sheet metal gauge (minimum) thicker than ductwork being supported.

ANCHORS

All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase.

Pipe Anchors: Provide as indicated and required to permit complete installation of system. Do not anchor piping to plaster or gypsum wallboard partition walls. Provide anchoring devices at locations indicated. Do not use powder driven fasteners, expansion nails, or friction spring clamps.

SLEEVES

Coordinate location of any opening in structural systems with Design-Builder and other trade contractors.

Maintain rating of fire- and smoke-rated construction.

Set sleeves plumb or level, in proper position, tightly fitted into the work.

Set all sleeves with ends flush with finished wall and ceiling surfaces.

Seal around all pipes and use firestopping for all mechanical penetrations through floor slabs, fire rated walls and partitions, and at each floor level in vertical mechanical service shafts. Install firestopping as described in manufacturer's installation instructions.

Seal around all sleeves.

Fill openings made by others for piping penetrations, with same construction as work opening is in, or construction of equivalent fire or smoke rating.

MISCELLANEOUS STEEL

Piping Contractor (or Heating Contractor, as applicable) to provide all miscellaneous steel as required to accommodate pipe supports and hangers.

Provide Shop Drawings detailing miscellaneous steel layout and connection to structural members. Indicate all point loads where miscellaneous steel is supported by structural members.

All miscellaneous steel to be galvanized steel. Repair galvanized steel at field cuts and connections.

END OF SECTION 23 05 29

SECTION 23 05 48 - VIBRATION CONTROL FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.1 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.
- B. Refer to Division 23 Section "Hangars, Sleeves, and Supports" for additional requirements

1.2 DESCRIPTION OF WORK

- A. Furnish and install vibration control devices, materials, and related items. Perform all work as shown on the Drawings and as specified herein to provide complete vibration isolation systems in proper working order.
- B. Description of Systems
 - 1. Vibration isolators and hangers.
 - 2. Bases and rails.
 - 3. Isolation pads.
 - 4. Resilient penetration sleeve/seal and lateral guides.

1.3 QUALITY ASSURANCE

- A. Comply with ASHRAE, ASTM, and AASHO standards.
- B. A Practical Guide to Noise and Vibration Control for HVAC Systems, by M.E. Schaffer, and published by the American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc., Atlanta, GA 30329.

1.4 SUBMITTALS

- A. Shop Drawings
 - 1. Steel rails, steel base frames, and concrete inertia bases showing all steel work, reinforcing, vibration isolator mounting attachment method, and location of equipment attachment bolts.
 - 2. Special details necessary to convey complete understanding of the work to be performed.
- B. Product Data

1. A complete description of products to be supplied, including product data, dimension, specifications, and installation instructions.
2. Detailed selection data for each vibration isolator supporting equipment, including:
 - a. The equipment identification mark.
 - b. The isolator type.
 - c. The actual load.
 - d. The static deflection expected under the actual load.
 - e. Specified minimum static deflection.
 - f. The additional deflection to solid under actual load.
 - g. The ratio of spring height under actual load to spring diameter.
3. Spring Isolators
 - a. Spring diameter.
 - b. Deflection.
 - c. Compressed spring height.
 - d. Solid spring height.
 - e. Point location of each isolator.
 - f. Load at each point.
 - g. Field static deflection.
 - h. Horizontal loading and bolt requirements.
 - i. Indicate all bases and rail clearances.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Closeout Information

1. Operating and maintenance data.
2. Guarantees.

1.5 SPEED AND BALANCE REQUIREMENTS FOR ROTATING EQUIPMENT

- A. Fans and other rotating mechanical equipment shall not operate at speeds in excess of 80% of their true critical speed.
- B. Vertical vibration of rotating equipment shall not be greater than the levels indicated. The vibration shall be measured on the equipment or steel frame equipment base when the equipment is mounted on its vibration isolation mounts. If the equipment has an inertia base, the allowable vibration level is reduced by the ratio of the equipment weight alone to the equipment weight plus the inertia base weight.

Equipment Speed	Vibration Displacement (MILS Peak-to-Peak)
Under 600 rpm	4
600 to 1000 rpm	3
1000 to 2000 rpm	2
Over 2000 rpm	1

- C. Should any rotating equipment cause excessive noise or vibration, the Contractor shall be responsible for rebalancing, realignment, or other remedial work required to reduce noise and vibration levels. Excessive is defined as exceeding the manufacturer's specifications for the unit in question.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Sound, Vibration and Seismic Control Devices
 - 1. Amber/Booth Co.
 - 2. Mason Industries, Inc.
 - 3. Kinetics Noise Control.
 - 4. The VMC Group.
- B. Sealants for acoustical purposes as described in this section are to be one of the non-setting sealants indicated below or an approved equivalent.
 - 1. Acoustical sealant D.A.P.
 - 2. BR-96 Pecora.
 - 3. Acoustical sealant Tremco.
 - 4. Acoustical sealant U.S.G.

2.2 GENERAL

- A. Provide piping and equipment isolation systems as specified and/or as indicated on Drawings.
- B. Select vibration isolators in accordance with weight distribution to produce reasonably uniform deflection.
 - 1. Provide vibration isolation equipment including mountings, hangers, structural steel bases, and welded concrete pouring forms from a single manufacturer or vibration isolation equipment supplier.
- C. Coat all vibration isolation systems exposed to moisture and an outdoor environment as follows:
 - 1. All steel parts to be hot-dip galvanized.
 - 2. All bolts to be cadmium-plated.
 - 3. All springs to be cadmium-plated and neoprene-coated.
- D. Coordinate the requirements of this Section with those of Division 23 Section "Seismic Restraint".
- E. Coordinate the size, location, and special requirements of vibration isolation equipment and systems with other trades. Coordinate equipment plan dimensions with size of housekeeping pads.

- F. Provide vibration isolators of the appropriate sizes and proper loading to meet the specified deflection requirements.
- G. Supply and install any incidental materials needed to meet the requirements stated herein, even if not expressly specified or shown on the Drawings, without claim for additional payment.
- H. Verify correctness of equipment model numbers and conformance of each component with manufacturer's specifications.

2.3 VIBRATION ISOLATORS AND HANGERS

- A. Equipment Mounting Isolators
 - 1. Type 1 Isolators: Double-deflection neoprene mountings.
 - a. Minimum static deflection: 0.35 inch.
 - b. Steel top plate and base plate completely embedded in color-coded neoprene stock.
 - c. Friction pads both top and bottom to eliminate the need for bolting.
 - d. Where bolting is required, provide bolt holes in base plate and tapped holes in top plate.
 - e. Mason Industries, Type ND; or Vibration Mountings & Controls, Type RD.
 - 2. Type 2 Isolators: Spring-type.
 - a. Free-standing and laterally stable, without any housings, snubbers, or guides.
 - b. Provide 1/4-inch neoprene acoustical friction pads between baseplate and support.
 - c. Provide mounting with leveling bolts that must be rigidly bolted to equipment.
 - d. Spring diameter: Not less than 0.8 of compressed height of spring at rated load.
 - e. Spring to have minimum additional travel to solid equal to 50% of rated deflection.
 - f. Mason Industries, Type SLF.
 - 3. Type 3 Isolators: Spring-type with vertical limit stop.
 - a. Equal to Type 2 isolator, except that mountings shall incorporate a resilient vertical limit stop to prevent spring extension during weight changes.
 - b. Installed and operating heights to be the same.
 - c. Maintain a minimum clearance of 1/2-inch around restraining bolts and between housing and spring so as not to interfere with spring action.
 - d. Limit stops to be out of contact during normal operations.
 - e. Mason Industries, Type SLR.
 - 4. Type 4 Isolators: Neoprene wafer pads.

- a. Durometer or hardness to suit application.
- b. Square waffle pattern on 1/2-inch centers.
- c. Standard pads thickness: 5/16 inch; provide optional pad thickness to suit application.
- d. Provide natural rubber, hycar, butyl, silicone or other elastomers as prior approved material.
- e. Provide type "W" adhesive, both sides, for all non-bolted applications.
- f. Mason Industries, Type "W", "WMW", "WML", or "WM".

B. Vibration Hangers

1. Type 5 Isolators: Steel spring-type hanger.
 - a. Steel spring and 0.3 inch deflection neoprene element in series.
 - b. Neoprene element to be molded with a rod isolation bushing that passes through the hanger box.
 - c. Springs to have a minimum additional travel to solid equal to 50% of rated deflection.
 - d. Spring diameters and hanger box lower hole sizes shall be large enough to permit hanger rod to swing through a 30-degree arc before contacting the hole and short circuiting the spring.
 - e. Mason Industries, Type 30N.
2. Type 6 Isolators: Precompressed steel spring-type hanger.
 - a. Equal to Type 5, except spring is precompressed to rated deflection, so piping or equipment are maintained at a fixed elevation during installation.
 - b. Provide a release mechanism to free spring after installation is complete and hanger is subjected to its full load.
 - c. Mason Industries, Type PC30N.
3. Type 7 Isolators: Steel spring in neoprene cup-type hanger.
 - a. Steel spring located in a neoprene cup manufactured with a grommet to prevent short circuiting of hanger rod.
 - b. Provide steel washer in cup to properly distribute load on neoprene and prevent its extrusion.
 - c. Spring diameters and hanger box lower hole sizes shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting the hole and short circuiting the spring.
 - d. Spring to have a minimum additional travel to solid equal to 50% of rated deflections.
 - e. Provide an eye bolt on spring end and provision to attach housing to flat iron duct straps.
 - f. Mason Industries, Type W30.
4. Type 8 Isolators: Double-deflection neoprene-type hanger.
 - a. Minimum static deflection: 0.40 inch
 - b. Elements to be color-coded neoprene stock for easy identification of rated load capacity.

- c. Provide hanger for direct attachment to flat iron duct straps.
- d. Mason Industries, Type WHD.

2.4 BASES AND RAILS

A. Type A: Integral structural steel base.

- 1. Rectangular, except for equipment which may require "T" or "L"-shaped.
- 2. Perimeter Members: Beams with a minimum depth equal to 1/10 of the longest dimension of the base.
- 3. Beam depth need not exceed 14 inches, provided that deflection and misalignment are kept within acceptable limits as determined by the manufacturer.
- 4. Provide height-saving brackets in all mounting locations to provide a base clearance of 1 inch.
- 5. Mason Industries, Type WF.

B. Type B: Steel rail.

- 1. Provide steel members welded to height-saving brackets to cradle equipment having legs or bases that do not require a complete supplementary base.
- 2. Members must be sufficiently rigid to prevent strains in the equipment.
- 3. Mason Industries, Type ICS.

C. Type C: Structural steel and concrete base.

- 1. Rectangular structural beam or channel concrete forms for floating foundations.
- 2. Minimum Base Depth: 1/12 of longest dimension of the base, but not less than 6 inches.
- 3. Base depth need not exceed 12 inches unless specially recommended by base manufacturer for mass or rigidity.
- 4. Bases for Split-Case Pumps: Large enough to provide support for suction and discharge base ells.
- 5. Provide minimum concrete reinforcement consisting of 1/2-inch bars or angles welded in place on 6-inch centers running both ways in a layer 1-1/2 inch above bottom, or additional steel as is required by structural conditions.
- 6. Provide steel members to hold anchor-bolt sleeves when anchor bolts fall in concrete locations.
- 7. Provide height-saving brackets in all mounting locations to maintain a 1-inch clearance below the base.
- 8. Mason Industries, Type K (Type BMK).

D. Type D: Curb-mounted base.

- 1. Factory-assembled isolation base that fits over roof curb and under the isolated equipment.
- 2. Provide extruded aluminum top member to overlap bottom member to provide water run-off independent of the seal.
- 3. Provide cadmium-plated springs with a 1-inch minimum deflection with 50% additional travel to solid.

4. Spring Diameter: Not less than 0.8 of spring height at rated load.
5. Provide resilient snubbers in corners with minimum clearance of 1/4-inch for wind resistance.
6. Provide a weather seal of continuous closed-cell sponge material both above and below base and a waterproof flexible ductlike EPDM connection.
7. Foam or other contact seals are not acceptable at spring cavity closure.
8. Mason Industries, Type CMAB.

2.5 ISOLATION PADS

A. Type IP1: Field-assembled for equipment mounting.

1. Construction: 4 inch thick, 3,000 psig, concrete pad poured over a 4-inch precompressed glass fiber isolation pad.
2. Glass Fiber Pads
 - a. Inorganic inert material with loading capacity up to 500 psig.
 - b. Covered with an elastomeric coating to increase vibration dampening and to protect media.
3. Concrete Caps
 - a. 9 sq. ft. in area or less: Reinforced with 6 x 6 x 6 x 6 mesh.
 - b. Larger than 9 sq. ft. in area: Reinforced with No. 4 rebar 12 inch o.c. each way.
4. Provide concrete caps with beveled edges.

B. Type IP2: Field-assembled for equipment isolation bases.

1. Isolation Bases: Field-assembled concrete pads provided by General Contractor. See Division 03 and structural drawings.
2. Provide isolation bases with an isolation joint to isolate pad from floor slab. See Division 03.
3. Make isolation bases 1 foot larger each way than equipment mounting base or skid, and size in accordance with approved equipment shop drawings.
4. Make isolation bases minimum 1'-2" thick with top of pad 4 inches above finished floor slab.
5. Reinforce isolation bases as indicated in specifications and drawings.
6. Type IP2 isolation pads provided by General Contractor and coordinated by mechanical work.

2.6 RESILIENT PENETRATION SLEEVE/SEAL

- ### A.
- Resilient penetration sleeve/seals are to be field-fabricated from a pipe or sheet metal section that is 1 inch larger in each dimension than the penetrating element and is used to provide a sleeve through the construction penetrated.

- B. Sleeve to extend 1 inch beyond the penetrated construction on each side. The annular space between the sleeve and the penetrating element to be packed tightly with fire-stop-rated glass fiber or mineral wool to within 1/4 inch of the ends of the sleeve.
- C. The remaining 1/4-inch space on each side is to be filled with acoustical sealant to form an airtight seal. The penetrating element is to be able to pass through the sleeve without contacting the sleeve.
- D. Alternatively, prefabricated fire-rated sleeves accomplishing the same result are acceptable.

2.7 RESILIENT LATERAL GUIDES

- A. These units shall be the standard product of the vibration isolation mounting manufacturer, incorporating neoprene isolation elements which are specifically designed for providing resilient lateral bracing of vertically rising ducts or pipes.
- B. Resilient lateral guides shall be one of the following products:
 - 1. Mason Industries, Type ADA.
 - 2. Peabody Noise Control, Type RGN.
 - 3. Vibration Mounting & Controls, Type MDPA.
 - 4. Approved equal guides (custom made) by Amber/Booth or Korfund Dynamics.

2.8 FLEXIBLE PIPE CONNECTORS

- A. Spherical Rubber Connector
 - 1. Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners, and Kevlar tire cord frictioning. Any substitutions must have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable.
 - 2. Sizes 2-inches and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16 inches to 24 inches may be single sphere.
 - 3. Sizes 3/4 inch to 1-1/2 inch may have threaded two-piece bolted flange assemblies, one sphere and cable retention.
 - 4. Connectors shall be rated at 250 psi up to 170 deg F with a uniform drop in allowable pressure to 215 psi at 250 deg F in sizes through 14 inches. 16 inches through 24 inches single sphere minimum ratings are 180 psi at 170 deg F and 150 psi at 250 deg F. Higher rated connectors may be used to accommodate service conditions. All expansion joints must be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3/1.
 - 5. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.
 - 6. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods need only be used in unanchored

pipng locations where the manufacturer determines the installation exceeds the pressure requirement without control rods.

7. If control rods are used, they must have 1/2-inch-thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi maximum on the washer area.
8. Submit two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at typical blade passage frequencies on this or a similar product by the same manufacturer.
9. All expansion joints shall be installed on the equipment side of the shut-off valves. Expansion joints shall be SAFEFLEX SFDEJ, SFEJ, SFDCR, or SFU and Controls Rods CR as manufactured by Mason Industries, Inc. or approved equal.

B. Flexible Pipe Hoses: Type FPH, stainless-steel-type.

1. Stainless steel braid and carbon steel fittings.
2. Sizes 3-Inch and Larger: Flanged.
3. Sizes 2-1/2-Inch and Less: Male nipples.
4. Mason Industries, Type BSS; or Vibration Mountings, Type MFP.

C. Flexible Hose Expansion Loop

1. Shall be manufactured complete with two parallel sections of corrugated metal hose, compatible braid, 180-degree return bend, with inlet and outlet connections. Field fabricated loops shall not be acceptable.
2. Flexible loops shall be capable of movement in the $\pm X$, $\pm Y$, and $\pm Z$ planes.
3. Flexible hose expansion loops shall impart no thrust loads to system support, anchors or building structure.
4. All flexible hose expansion loops shall be manufactured in accordance with the documented manufacturers weld procedure specifications. The procedure qualification record shall be used to document the execution of this procedure and shall follow the general "guidelines" of ASME Section IX. Each individual welder shall conform to the in-house procedure qualification record and be qualified prior to each production lot. The testing of each individual welder shall be documented in a welding procedure qualification record.
5. Corrugated Hose
 - a. Stainless Steel (Type 304, 321, 316)
 - b. Bronze
6. Braid
 - a. 304 Stainless Steel braid shall be used for any series 300 stainless steel hose.
 - b. Bronze braid shall be used for any bronze hose.
7. Fittings Materials of construction and end fitting type shall be consistent with pipe material and equipment / pipe connection fittings. Copper fittings shall not be attached to stainless steel hose.
8. Flexible hose expansion loops shall have a factory supplied hanger / support lug located at the bottom of the 180deg return.

9. Flexible hose expansion loops shall be furnished with a plugged FPT to be used for a drain or air release vent.
 - a.

Loop Size	FPT Size
1" – 6"	3/8"
8" and Larger	1/2"
10. Flexible hose expansion loop(s) shall be rated with an operating pressure in accordance with the table below. The operating pressure shall be based on burst pressure with a 4 to 1 safety factor.
11. Install and guide per manufacturer's recommendations.
12. The Metraflex Company Metraloop, or equal.

2.9 FLEXIBLE DUCT CONNECTIONS

- A. Flexible duct connections shall be UL/FM-approved, fabricated from coated fabric (or loaded vinyl as called for on the drawings). The clear space between connected parts shall be a minimum of 3 inch and the connection shall have 1.5 inch minimum of slack material. Connections shall be suitable for not less than 10 inch w.c. operating static pressure.

PART 3 - EXECUTION

3.1 APPLICATION

A. General

1. Install all vibration control equipment in accordance with manufacturer's installation instructions and as specified.
2. All vibration control equipment shall be selected as specified and sized in accordance with weight distribution, pull or torque imposed by shop-drawing-approved equipment being isolated.
 - a. Minimum static deflections may be revised subject to prior approval.
 - b. The static deflection of all isolators specified herein are the minimum acceptable deflections for the mounts under actual load. Isolators selected on the basis of rated deflection are not acceptable and will be disapproved.
 - 1) Provide revised vibration control equipment to match revised or substituted equipment.
3. Locations of all vibration isolation equipment shall be selected for ease of inspection and adjustment as well as for proper operation.
 - a. All vibration isolators to be aligned squarely above or below mounting points of the supported equipment.

- b. Isolators for equipment with bases to be located on the sides of the bases which are parallel to the equipment shaft unless this is not possible because of physical constraints.
- c. Locate isolators to provide stable support for equipment, without excess rocking. Consideration to be given to the location of the center of gravity of the system and the location and spacing of the isolators.
- d. If a housekeeping pad is provided, the isolators shall bear on the housekeeping pad and the isolator base plate shall rest entirely on the pad.
- e. Hanger rods for vibration isolated support to be connected to structural beams or joists, not from the floor slab between beams and joists. Provide intermediate support members as necessary.
- f. Vibration isolation hanger elements to be positioned as high as possible in the hanger rod assembly, but not in contact with the building structure, and so that the hanger housing may rotate a full 360 degrees about the rod axis without contacting any object.
- g. Parallel running pipes may be hung together on a trapeze which is isolated from the building. Isolator deflections must be the largest determined by the provisions for pipe isolation. Do not mix isolated and non-isolated pipes on the same trapeze.
- h. No pipes or equipment are to be supported from other pipes or equipment.
- i. Resiliently isolated pipes are not to contact the building construction or other equipment.
- j. Adjust all leveling bolts and hanger rod bolts so that the isolated equipment is level and in proper alignment with connecting ducts or pipes.

B. Major Equipment

- 1. Unless otherwise shown or specified, all floor-mounted major equipment shall be set on 4-inch-high concrete housekeeping pads. See architectural or structural Drawings for details.
- 2. Flexible duct connections are to be installed at all fan unit intakes, fan unit discharges, and wherever else shown on the Drawing.
- 3. Flexible pipe connections, are to be installed at all pipe connections to vibration isolated equipment in the positions shown on the Drawings.

C. Resilient Pipe Hangers and Supports

- 1. Isolation hangers shall be used for all piping in equipment rooms and up to 50 feet from vibrating equipment. To avoid reducing the effectiveness of equipment isolators, at least the first three hangers from the equipment shall provide the same deflection as the equipment isolators, with a maximum limitation of 2-inch deflection; the remaining hangers shall be spring or combination spring and rubber with 0.75-inch deflection. The first two hangers adjacent to the equipment shall be the precompressed type, to prevent load transfer to the equipment flanges when the piping system is filled.
- 2. Floor-supported piping in equipment rooms and adjacent to isolated equipment shall use vibration isolators. The first two adjacent floor supports shall be the restrained spring type, with a blocking feature that prevents load transfer to equipment flanges as the piping is filled or drained. Where pipe is subjected to large thermal movement, a slide plate (PTFE, graphite, or steel) shall be installed

- on top of the isolator, and a thermal barrier shall be used when rubber producers are installed directly beneath steam or hot water lines.
3. Where lateral support of pipe risers is required within the specified limits, this is to be accomplished by use of resilient lateral guides.
 4. Pipes within the specified limits (three support positions) that penetrate the building construction are to be isolated from the building structure by use of resilient penetrating sleeve/seals.
 5. Drain piping connected to vibration isolated equipment shall not contact the building structure or other non-isolated system unless it is resiliently isolated.

3.2 VIBRATION ISOLATORS

- A. Use Type 1 isolators for equipment mounted on floors other than grade-supported floor slabs.
 1. Utility fans, 5 hp or less.
 2. Air compressors, 3 hp or less.
 3. Minimum static deflections, 0.35 inch.
- B. Use Type 2 isolators for equipment mounted on all floors.
 1. Utility fans, 7-1/2 hp and larger.
 2. All SWSI and DWDI blowers.
 3. All vane axial type fans.
 4. All packaged air handling units.
 5. Minimum static deflections, 0.75 inch.
- C. Use Type 2 isolators for equipment mounted on floors other than grade-supported floor slabs.
 1. Air compressors, 15 hp and larger.
 2. All pumps, 30 hp and larger.
 3. Minimum static deflections, 1.5 inch.
- D. Use Type 3 isolators for equipment mounted on floors other than grade-supported floor slabs.
 1. Screw-type chillers, 60 tons and larger.
 2. All boilers.
 3. Minimum static deflections, 1.5 inch.
- E. Use Type 4 isolation pads for equipment mounted on grade supported floor slabs.
 1. Air compressors.
 2. Chillers.
 3. Boilers.
 4. Utility fans, 5 hp or less.
 5. Minimum static deflections, 0.3 inch.
- F. Use Type 5 vibration hangers for suspended equipment.

1. Individual runs of piping, 3-inch and smaller.
2. In-line fans, 3 hp and smaller.
3. In-line pumps, 2 hp and smaller.
4. Fan coil units, 1 hp and smaller.
5. Minimum static deflections, 0.3 inch.

G. Use Type 6 vibration hangers for suspended equipment.

1. Trapeze-type pipe hangers.
2. Individual runs of piping, 4 inch through 6 inch.
3. Inline fans, 5 hp through 7-1/2 hp.
4. Inline pumps, 3 hp through 5 hp.
5. Fan coil units, 1-1/2 hp and larger.
6. Minimum static deflection, 1.5 inch.

H. Use Type 6 or Type 7 vibration hangers for suspended equipment.

1. Trapeze-type pipe hangers.
2. Individual runs or piping, 8 inch and larger.
3. In-line fans, 10 hp and larger.
4. In-line pumps, 7-1/2 hp and larger.
5. Package air handling units.
6. Minimum static deflection, 2.5 inch.

I. Use Type 8 vibration hangers for suspended equipment.

1. In-line fans 1/2 hp or smaller.
2. Fan coil units 1/2 hp or smaller.
3. Utility fans 1/2 hp or smaller.
4. Minimum static deflection, 0.40 inch.

3.3 BASES AND RAILS

A. Use Type A integral structural steel bases for equipment mounted on floors other than grade-supported floor slabs.

1. Package air handling unit fan cabinets, 15 hp and larger.
2. SWSI and DWDI blowers, 5 hp through 15 hp.
3. Utility fans, 7-1/2 hp through 10 hp.

B. Use Type B structural rails for equipment mounted on floors other than grade supported floor slabs.

1. Package air handling unit fan cabinets, 10 hp and smaller.
2. Screw-type chillers, 50 tons and smaller.

C. Use Type C concrete platforms for equipment mounted on floors other than grade supported floor slabs.

1. Air compressors, 15 hp and larger.

2. All base-mounted pumps, 30 hp and larger.
- D. Use Type C concrete platforms for equipment mounted on all floors.
1. SWSI and DWDI blowers, 20 hp and larger.
 2. Utility fans, 15 hp and larger.
- E. Use Type D curb mounted isolation system for equipment mounted on roofs.
1. Rooftop units, 50 tons and larger.
 2. Roof-mounted air handling units, 50 tons and larger.
 3. Condensing units, 25 tons and larger.
 4. Utility fans, 7-1/2 hp and larger.

3.4 ISOLATION PADS

- A. Use Type IP1 isolation pads for equipment mounted on floors other than grade-supported floor slabs.
1. Air compressors, 5 hp through 10 hp.
 2. All base-mounted pumps, 25 hp and less.
- B. Use Type IP2 isolation pads for equipment mounted on grade.
1. Boilers.
 2. Chillers.
 3. Pump groups where one pad serves two or more pumps.
 4. Flue gas economizers supported from the floor.

3.5 FLEXIBLE PIPE CONNECTIONS

- A. Use Type FPC flexible connectors in piping systems.
1. Pump Suction and Discharge
 - a. Exception: When three or more mechanical grooved pipe (Victaulic type) couplings are used at each pump suction or discharge side.
 2. Chiller Inlet and Outlet
 - a. Exception: When three or more mechanical grooved pipe (Victaulic type) couplings are used at each chiller evaporator and condenser outlet and inlet.
 3. Building expansion joints.
- B. Use Type FPH flexible hose in piping systems.
1. Air compressor discharge piping.
 2. Vacuum pump suction piping.

3. Fuel oil pump suction and discharge piping.
- C. Install flexible pipe connections and flexible hoses on equipment side of equipment isolation valves.
- D. Provide flexible connectors and flexible hose to suit the application.
 1. Indicate specific applications on shop drawings.
- E. Use Type Flexible Hose Expansion Loop at thermal expansion piping loops.

3.6 FLEXIBLE DUCT CONNECTIONS

- A. Sheet metal ducts or plenum openings shall be squarely aligned with the fan discharge, fan intake, or adjacent duct section prior to installation of the flexible connection, so that the clear length is approximately equal all the way around the perimeter. Flexible duct connections shall not be installed until this provision is met. The fan unit or adjacent duct section shall be able to move 1 inch in any direction without causing metal-to-metal contact or stretching taut the flexible connection.

3.7 HORIZONTAL PIPE ISOLATION

- A. First three pipe hangers in the main lines near mechanical equipment shall be vibration isolation hanger.
- B. First three floor-mounted pipe supports shall rest on Type 3 isolators.
- C. If piping is connected to equipment located in basements and hangs from structure under occupied spaces, the first three hangers shall have 0.75 inch deflection for pipe sizes up to and including 3 inch; 1.5 inch deflection for pipe sizes up to and including 6 inch; and 2.5 inch deflection thereafter.
- D. Locate hanger as close to overhead supports as is practical.

END OF SECTION 23 05 48

SECTION 23 05 53 – IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT**PART 1 - GENERAL****RELATED DOCUMENTS**

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work of this Section includes, but is not limited to:

1. Piping identification.
2. Valve identification.
3. Equipment identification.

QUALITY ASSURANCE

Piping System Identification: ANSI A13.1-2015, "Scheme for the Identification of Piping Systems."

SUBMITTALS

Shop Drawings: Not required for review.

Product Data: Manufacturer's cut sheets and/or literature.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Closeout Information: Valve chart showing valve numbers, type, and location.

PART 2 - PRODUCTS**ACCEPTABLE MANUFACTURERS**

Pipe, Valve, and Equipment Markers:

1. Craftmark Identification Systems.
2. W. H. Brady Co.
3. EMED Company, Inc.
4. Kolbi Industries, Inc.

- 5. 3M Co.
- 6. Seton Name Plate Corp.

PIPE MARKERS

Conform to ANSI A13.1-2015.

- 7. Pressure-sensitive vinyl (self-sticking) material.
- 8. Mechanically Fastened Type: Snap-on or strap-on.
 - a. For dirty greasy, oily pipe where pressure-sensitive markers may not perform satisfactorily.
- 9. Provide with direction of flow arrows.
- 10. Size of Letters Legend

Outside Diameter of Pipe or Pipe Covering	Length of Color Field	Size of Letters and Arrows
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inch	24 inch	2-1/2 inch
Over 10 inch	32 inch	3-1/2 inch

VALVE TAGS

Brass or Anodized Aluminum Type

- 11. Brass: Minimum 19 ga, polished, 1-1/2-inch diameter with following lettering:
 - a. Service: 1/4-inch stamped black filled letters.
 - b. Valve numbers: 1/2-inch stamped black filled letters.
- 12. Aluminum: 2-inch diameter, 0.032-inch thick, with following lettering:
 - a. Service: 1/4-inch engraved letters.
 - b. Valve numbers: 1/2-inch engraved letters.

Valve Tag Fasteners: 4-ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

EQUIPMENT NAME PLATES

1/16-inch rigid plastic "Setonply," "Emedolite," or bakelite with 4 edges beveled, or engraved aluminum with black enamel background and natural aluminum border and letters.

- 13. Two 3/8-inch mounting holes.
- 14. Lettering size: Minimum 1/2 inch high.
- 15. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

CHART AND DIAGRAM FRAMES

Extruded aluminum with plexiglass or glass windows.

PART 3 - EXECUTION

VALVE AND EQUIPMENT IDENTIFICATION

The naming/numbering/tagging convention used must be a coordinated effort between the Mechanical Contractor, Controls Contractor, Owner, Design-Builder, and A/E and must be approved by all parties prior to implementation. The naming/numbering/tagging convention must be consistent and reflected through the building automation control system, charts, diagrams, tagging and O&M manuals.

Designate all equipment, valves, and dampers by distinguishing numbers and letters on charts and/or diagrams.

1. Tag and locate following equipment items:
 - a. Valves.
 - b. Dampers.
 - c. Air Handling unit.
 - d. Heat Exchangers.
 - e. Pumps.
 - f. Fans.
 - g. Computer Room units.
 - h. Fan Coil units.
 - i. Chillers.
 - j. Boilers.
 - k. Terminal Boxes.
 - l. Condensing Units.

Install tags on all devices with numbers and letters corresponding to charts.

Fasten tags securely to devices with tag fasteners in manner for easy reading.

Attach equipment nameplates in conspicuous location on item of equipment or apparatus such as starters, pumps, fans, HVAC units and control panels.

2. Secure nameplates with self-tapping screws, or nuts and bolts.

For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

Furnish 4 charts including device number, location (room number, department) and purpose.

3. Mount 1 chart in frame and secure on wall in location directed by Design-Builder.
4. Include remaining 3 sets in "Operation and Maintenance Manuals."

Provide all devices located above ceilings with additional identification.

5. Use access panel markers (metal-tack-style) for acoustical tile ceilings, or engraved plastic style, 3/4 inch square, for mounting on panel door.
6. Coordinate with the Design-Builder on identification method and color codes.

PIPE IDENTIFICATION

Locate pipe markers as follows:

7. Next to each valve and fitting, except on plumbing fixtures and equipment.
8. At each branch or riser take-off.
9. At each passage through walls, floors, and ceilings.
10. At each pipe passage to underground.
11. On all horizontal pipe runs every 20 feet, at least once in each room and each story traversed by piping system.
12. Identify piping contents, flow direction, supply and return.

Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

SERVICE ABBREVIATIONS

General

- | | | |
|-----|-----|--------------------------|
| 13. | CHS | Chilled Water Supply |
| 14. | CHR | Chilled Water Return |
| 15. | D | Drain |
| 16. | PC | Pumped Condensate |
| 17. | HWS | Heating Hot Water Supply |
| 18. | HWR | Heating Hot Water Return |
| 19. | RS | Refrigerant Suction |
| 20. | RL | Refrigerant Liquid |
| 21. | HS | Heat Pump Supply |
| 22. | HR | Heat Pump Return |

CONTROL SEQUENCE OF OPERATION AND DIAGRAMS

Provide HVAC control and systems sequence of operations and diagrams in wall mounted frames.

23. Mount framed diagrams in conspicuous, easily accessible places in equipment rooms housing appropriate HVAC system.

Diagrams and instructions may be reduced in size, provided they are easily readable.

END OF SECTION 23 05 53

SECTION 23 05 93 – MECHANICAL SYSTEMS TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION OF WORK

Work Includes

1. Furnishing all labor, materials, tools, equipment, and services to test, balance and adjust all mechanical systems as indicated, in accord with provisions of Contract Documents.
2. Complete coordination with work of all other trades.

Test, balance, and adjust following mechanical systems:

3. Air distribution systems.
4. Air moving equipment.
5. Circulating water systems, Heating and Chilled Water.
6. Instrumentation and control system.
7. Direct Expansion (D/X) Refrigeration system
8. Heating systems
9. Cooling Systems
10. Exhaust hoods.

QUALITY ASSURANCE

Agency Qualifications: Independent balance and testing agency, member of the Associated Balance Council (AABC) or the National Environmental Balancing Bureau (NEBB).

Balancing Standards: AABC requirements and recommendations.

RESPONSIBILITIES OF TESTING AND BALANCING AGENCY WORK

Schedule work with trades involved.

Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.

Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.

Prepare and submit test reports.

RESPONSIBILITIES OF HEATING CONTRACTOR'S WORK

Startup systems and keep in correct operation during balancing operations.

Make personnel accessible to provide necessary adjustments and corrections to systems as directed by balancing agency.

Maintain accessibility to test locations and devices requiring adjustment.

Add dampers required for correct air balance as recommended by the Air Balance Agency.

Provide additional sets of pulleys and belts as recommended by the Air Balance Agency.

Provide to the Test and Balance Agency a complete set of approved Shop Drawings and submittals and a posted set of Mechanical Drawings, indicating any and all changes to the Contract Documents.

JOB CONDITIONS

Balance at time directed by Construction Manager (CM)/ Design-Builder

11. If balancing is not performed during peak cooling season, demonstrate satisfactory balancing during next peak cooling season.
12. If balancing is not performed during peak heating season, demonstrate satisfactory balancing during next peak heating season.

GUARANTEE

Provide extended warranty of 90 days, after completion of test and balance work, during which time the CM/Design-Builder may, at their discretion, request recheck or resetting of any equipment or system which is not performing satisfactorily. Provide technicians to assist as required in making such tests.

SUBMITTALS

Shop Drawings: Not required for review.

Product Data: Not required for review.

Samples: Not required for review.

Reference Submittals: Qualifications of balancing agency and sample report forms.

Contract Closeout Information

13. Balancing Reports

- a. Use forms similar to AABC latest edition.
- b. Report to include the following:
 - 1) All specified data.
 - 2) All equipment nameplate information.
 - 3) All traverse readings.
 - 4) Line sketch/diagram indicating location of traverses.
 - 5) Static pressure profiles.
 - 6) AABC equipment data sheets.
 - 7) Fan and pump curves.
 - 8) Temperature readings (all air and water streams)

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

GENERAL

Accurately calibrate and maintain all test instruments in good working order.

1. If requested, conduct tests of instruments in presence of CM/Design-Builder.

If requested, conduct balancing tests in presence of CM/Design-Builder.

Do not begin balancing until system(s) have been completed and are in good working order.

Record all inspections, tests, and adjustments.

AIR BALANCING METHODS

Balance each air system that is serviced by air filters, using artificial static loading of system, to demonstrate, test and obtain system design pressure drop data.

2. Provide dirty filter pressure drop conditions on system.
3. Do not use high efficiency filters (75% and above) in testing and balancing.
4. Static pressure losses may be simulated by using wood or sheet steel blanking plates in high efficiency filter racks and housings.
5. Do not install blanking plates within 2 feet of any low efficiency filter unit or rack.

AIR BALANCE TESTING PROCEDURE

Perform tests and balance system in accord with the following.

Test and adjust equipment capacity to design requirements and record RPM.

Test motor load amperes and fan rotations.

Make pitot tube traverse of main supply ducts and obtain design CFM at fans. Provide fan curves and plots.

Test system static pressure, suction and discharge.

Test and adjust system for design CFM outside and return air:

6. Maximum outside air setting.
7. Minimum outside air setting.

Test and adjust system for design CFM outside air.

Test coil entering air temperatures:

8. Dry bulb deg F heating and cooling.
9. Wet bulb deg F cooling.

Test Leaving Air Temperatures

10. Dry bulb deg F heating and cooling.
11. Wet bulb deg F cooling.

Adjust all main supply and return air ducts to proper design CFM.

Adjust all zones to proper design CFM, supply and return.

Test and adjust each diffuser, grille, and register to within 10% of design requirements.

12. Identify location and area of each grille, diffuser, and register.
13. Identify and list size, type and manufacturer of diffusers, grilles, and registers.
14. Use manufacturer's ratings on all equipment to make required calculations.
15. Readings and tests of diffusers, grilles, and registers shall include required FPM velocity and test resultant velocity, required CFM and test resultant CFM after adjustments.
16. Adjust all diffusers, grilles, and registers to minimize drafts.

In cooperation with control manufacturer's representative, set automatically operated dampers to operate as indicated.

17. Check all controls for proper calibration and list all controls requiring adjustment by control installers.

Balance supply, return, and exhaust air to provide the designed pressure relationships to adjacent areas.

Make any changes in pulleys, belts, and dampers, to achieve capacity.

Check fire dampers and smoke dampers for correct operation and damper position.

Adjust special equipment fans to CFM requirements as indicated.

List all mechanical nameplate and specifications of fans.

WATER BALANCE PROCEDURE - PHASE ONE

Complete air balancing before commencing water balancing.

Open all valves to full open position. Close coil bypass stop valves. Set mixing valve to full coil flow.

Check operation of all relief valves.

Examine water in system and determine if water has been treated and cleaned.

Checks pump rotation.

Check expansion tanks to determine they are not air-bound.

Check for installation and proper operation of air valves.

Set temperature controls for all coils at maximum cooling. Check for full closure of all automatic bypass valves at coil and chiller. Use similar procedure for checking bypass valves on hot water coils at maximum heat setting.

Check operation of automatic bypass valves.

WATER BALANCE PROCEDURE - PHASE TWO

Ensure start-up strainers have been removed.

Set pumps to specified gallons per minute delivery.

Adjust water flow of chilled water to supply main.

Adjust water flow of hot water to supply main.

Check chilled water entering temperatures and return water temperatures at mains. Reset to correct design temperatures.

Check water temperatures at inlet side of cooling and heating coils. Record temperature difference from source.

Balance each chilled water and hot water coil.

WATER BALANCE PROCEDURES - PHASE THREE

After completing coil balancing, test hot and chilled water pressures and flows at the pumps and re-adjust if required.

Adjust Coil Bypass Valves: Install pressure gages on coil, read pressure drop through coil at flow rate for maximum cooling, and again for maximum heating.

18. Set pressure drop across bypass valve to match coil maximum flow pressure drop.
19. Adjust flow rate through each coil in coil banks.

Check following at each cooling and heating unit.

20. Inlet water temperatures.
21. Leaving water temperatures.
22. Pressure drop of each coil.
23. Pressure drop across bypass valve.
24. Pump operating suction and discharge pressures and final total dynamic head.
25. Water metering device readings.

List all mechanical specifications of pumps.

Record nameplate and actual operating amperages of pump motor.

OPERATING TEST

After systems are balanced, conduct operating test of not less than 8 hours' duration each for heating and cooling systems to demonstrate to satisfaction of the CM/Design-Builder that systems comply with requirements of plans and specifications, and that all equipment and controls are functioning properly.

END OF SECTION 23 05 93

SECTION 23 07 00 – HVAC INSULATION

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

SUMMARY

Section Includes

1. Duct Insulation.
2. Pipe Insulation.
3. Equipment Insulation.
4. Insulation Adhesive.
5. Insulation Sealant.
6. Insulation Mastic.
7. Insulation Jacketing.

QUALITY ASSURANCE

All testing and ratings shall meet the standards set in ASTM E-84, NFPA 255, and UL 723.

Indoor insulation shall have a flame-spread rating not exceeding 25 and a smoke developed rating not exceeding 50. Outdoor insulation shall have a flame-spread rating not exceeding 75 and a smoke developed rating not exceeding 150.

Insulation accessories shall have the same or better ratings as the insulation product they serve.

Insulation values shall be in accordance with the State Energy Codes.

Maximum insulation temperature limits must exceed maximum fluid working temperatures.

DELIVERY, STORAGE, AND HANDLING

Packaging: Insulation material containers shall be marked by manufacturer with flame and smoke ratings, and maximum use temperature.

Protection: Leave insulation boxed and stored until time for use. Elevate and cover material to avoid moisture, dust, and physical abuse.

COORDINATION

Coordinate size and location of supports, hangers, and insulation shields with ductwork and piping installer.

Coordinate clearance requirements with piping installer for piping insulation application and ductwork installer for duct insulation application, and equipment installer for equipment insulation application. Before preparing piping and ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

Coordinate installation and testing of heat tracing.

SCHEDULING

Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 - PRODUCTS**MANUFACTURERS**

Fiberglass Insulation: Owens-Corning, Knauf, CertainTeed, Johns Manville, and Manson.

Closed-cell Insulation: Aeroflex, Armacell, and K-flex.

Adhesive: Foster, Johns Manville, and 3M.

Sealant: Foster, Boss Products, and Dow Chemical.

Mastic: Foster.

Aluminum Jacketing: Ideal Products, Pabco, and RPR Inc.

PVC Jacketing: Proto, and Johns Manville.

GENERAL

Products shall not contain asbestos, lead, mercury, or mercury compounds and be HCFC free.

Use of water-soluble treatments is prohibited.

TYPES OF INSULATION

- Type 1: Fiberglass heavy-density insulation with all service jacket and pressure sealing lap adhesive on longitudinal and butt strips. Jacket vapor membrane shall have an installed vapor permeance of not more than 0.09 perms. Staple and seal with pressure-sealing lap adhesive on longitudinal and butt strips. Thermal conductivity (k-value) not greater than 0.23 at mean temperature of 75 deg F.
- Type 2: Flexible closed cell elastomeric thermal pipe insulation. Thermal conductivity (k-value) not greater than 0.27 at 75 deg F. Indoor insulation shall have a flame-spread rating not exceeding 25 and a smoke developed rating not exceeding 50.
- Type 3: Flexible fiberglass duct wrap laminated to foil-reinforced kraft vapor membrane facing with 2 inch stapling flange. 1.0 pcf density with thermal conductivity (k-value) not greater than 0.27 at 75 deg F. Vapor membrane shall be less than 0.09 perms.
- Type 4: Semirigid fiberglass industrial board with foil scrim kraft vapor membrane facing. 3.0 pcf density with thermal conductivity (k-value) not greater than 0.23 at 75 deg F. Vapor membrane shall be less than 0.09 perms.
- Type 5: Rigid fiberglass industrial board with foil scrim kraft vapor membrane facing. 6.0 pcf density with thermal conductivity (k-value) not greater than 0.22 at 75 deg F. Vapor membrane shall be less than 0.09 perms.
- Type 6: Flexible closed cell elastomeric thermal sheet insulation. Thermal conductivity (k-value) not greater than 0.27 at 75 deg F. Indoor insulation shall have a flame-spread rating not exceeding 25 and a smoke developed rating not exceeding 50.

TYPES OF JACKETING

- Type 1: PVC jacket. 0.030-inch-thick ultraviolet-resistant PVC jacket. Jacket is to be self-extinguishing and have zero fuel contribution.
- Type 2: Aluminum jacket. 0.016-inch-thick aluminum jacket with "Pittsburgh Seam." Seal between metal jacket and sleeve.
- Type 3: Rubberized bitumen membrane. 0.060 inch thick. Designed with a cross laminated high strength polyethylene laminated to raw aluminum. This film is then laminated to rubberized bitumen compound with a release liner. Self-healing if punctured, UV stable, and will expand and contract with the mechanical system. "Alumaguard" / "Alumaguard Lite" as manufactured by Polyguard. Install a layer of "Alumaguard" on the top & sides of duct and "Alumaguard Lite" on the bottom. For cold weather installations the "Alumaguard LT" as manufactured by Polyguard, can be used. Install per manufacturer's instructions.

FITTINGS AND VALVES

- Premolded PVC covers over molded insulation. Insulation same thickness as on adjoining pipe. Insulation shall have a flame-spread rating not exceeding 25 and a smoke-developed rating not exceeding 50.

SCHEDULE OF INSULATION

System Type	Fluid Temperature Range (F)	Insulation Type	Insulation Thickness					
			1" and smaller	1" to 1-1/4"	1-1/2" to 3"	4" to 6"	8" and larger	Duct or Equip.
Hydronic Piping								
Heating Water	100 – 200	1	1.5	1.5	2.0	2.0	2.0	N/A
Chilled Water	40 – 60	1 or 2	0.5	0.5	1.0	1.0	1.0	N/A
Cooling Coil Condensate	40 – 60	1 or 2	0.5	0.5	1.0	1.0	1.0	N/A
Make-up Water	40 – 60	1 or 2	0.5	0.5	1.0	1.0	1.0	N/A
Refrigerant	Below 40	1 or 2	0.5	1.0	1.0	1.5	1.5	N/A
Duct								
Supply	45 – 120	3 (*C)	N/A	N/A	N/A	N/A	N/A	1.5
(*A) Return	70 – 95	3 (*C)	N/A	N/A	N/A	N/A	N/A	1.0
Outside Air	-20 – 120	3 (*C)	N/A	N/A	N/A	N/A	N/A	2.0
(*B) Relief Air	70 – 95	3 (*C)	N/A	N/A	N/A	N/A	N/A	1.0
(*B) Exhaust	70 – 95	3 (*C)	N/A	N/A	N/A	N/A	N/A	1.0
Equipment								
Heating Water Tanks	100 – 200	4 or 5	N/A	N/A	N/A	N/A	N/A	1.5
Heating Water Heat Exchangers	100 – 200	4 or 5	N/A	N/A	N/A	N/A	N/A	1.5
Heating Water Air Separators	100 – 200	4 or 5	N/A	N/A	N/A	N/A	N/A	1.5
Chilled Water Pumps	40 – 60	4, 5, or 6	N/A	N/A	N/A	N/A	N/A	1.0
Chilled Water Tanks	40 – 60	4, 5, or 6	N/A	N/A	N/A	N/A	N/A	1.0
Chilled Water Heat Exchangers	40 – 60	4, 5, or 6	N/A	N/A	N/A	N/A	N/A	1.0
Chilled Water Air Separators	40 – 60	4, 5, or 6	N/A	N/A	N/A	N/A	N/A	1.0
Note: For piping and ductwork exposed to outdoor temperatures, increase thickness by 0.5 inches.								
*A: Only ductwork/Piping in non-air-conditioned areas (Including: Shafts, Ceiling space with roof above, and Attics) or ductwork/Piping exposed to outdoor temperatures.								
*B: Only ductwork/Piping exposed to outdoor temperatures or ductwork from plenum at louver (or other outside opening) back to motorized or backdraft damper.								
*C: For visible rectangular ductwork (non-mechanical rooms) or ductwork installed outside use Type 4 or Type 5 insulation. For mechanical rooms use Type 4 or Type 5 insulation for rectangular ductwork with bottom of duct elevation below 10 feet A.F.F.								

EXPOSED INDOOR PIPING LESS THAN 10 FEET ABOVE NEAREST WALKING SURFACE

Cover piping insulation with Type 1 or Type 2 Jacketing.

OUTDOOR PIPING

Cover piping insulation with Type 2 Jacketing.

OUTDOOR DUCTWORK

Cover ductwork insulation with Type 3 Jacketing. For the top of rectangular ductwork, under the jacketing provide tapered insulation centered on the duct to slope to the sides for drainage. Tapered insulation shall run the entire length of duct.

PART 3 - EXECUTION

EXAMINATION

Examine substrates and conditions for compliance with requirements for installation and other conditions affecting performance of insulation application.

Verify that systems and equipment to be insulated have been tested and are free of defects.

Verify that surfaces to be insulated are clean and dry.

Proceed with installation only after unsatisfactory conditions have been corrected.

PREPARATION

Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

GENERAL INSTALLATION REQUIREMENTS

Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of equipment, ducts and fittings, and piping including fittings, valves, and specialties.

Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of equipment, duct system, and pipe system as specified in schedule of insulation.

Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

Install insulation with longitudinal seams at top and bottom of horizontal runs.

Install multiple layers of insulation with longitudinal and end seams staggered.

Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

Keep insulation materials dry during application and finishing.

Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

Install insulation with least number of joints practical.

Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.

1. Install insulation continuously through hangers and around anchor attachments.
2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

Apply insulation with duct and pipe surfaces at room temperature.

Make insulation continuous except through fire-rated walls/floors. Do not leave gaps in insulation at sleeves, hangers, anchors, supports, etc.

Insulate all fittings, valve bodies, flanges, and other pipe accessories.

Install insulation with factory-applied jackets as follows:

5. Draw jacket tight and smooth.
6. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches o.c.
7. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 3 inches o.c.
 - a. For below ambient services, apply vapor-barrier mastic over staples.
8. Cover joints and seams with tape as recommended by insulation material manufacturer to maintain vapor seal.

9. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct and pipe flanges and fittings.

Cut insulation in a manner to avoid compressing insulation more than 75 percent of its nominal thickness.

Finish installation with systems at operating conditions. Repair joint separations and cracking due to thermal movement.

Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

For insulation at hangers and bracing, see Division 23 Section "Hangers and Supports for HVAC Piping and Equipment."

EQUIPMENT INSULATION INSTALLATION

Pipe and Tank Insulation Installation for Tanks and Vessels: Secure insulation with adhesive and anchor pins and speed washers.

10. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of tank and vessel surfaces.
11. Groove and score insulation materials to fit as closely as possible to equipment, including contours. Bevel insulation edges for cylindrical surfaces for tight joints. Stagger end joints.
12. Protect exposed corners with secured corner angles.
13. Install adhesively attached or self-sticking insulation hangers and speed washers on sides of tanks and vessels as follows:
 - a. Do not weld anchor pins to ASME-labeled pressure vessels.
 - b. Select insulation hangers and adhesive that are compatible with service temperature and with substrate.
 - c. On tanks and vessels, maximum anchor-pin spacing is 3 inches from insulation end joints, and 16 inches o.c. in both directions.
 - d. Do not overcompress insulation during installation.
 - e. Cut and miter insulation segments to fit curved sides and domed heads of tanks and vessels.
 - f. Impale insulation over anchor pins and attach speed washers.
 - g. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
14. Secure each layer of insulation with stainless-steel or aluminum bands. Select band material compatible with insulation materials.
15. Where insulation hangers on equipment and vessels are not permitted or practical and where insulation support rings are not provided, install a girdle network for securing insulation. Stretch prestressed aircraft cable around the diameter of vessel and make taut with clamps, turnbuckles, or breather springs. Place one circumferential girdle around equipment approximately 6 inches from

each end. Install wire or cable between two circumferential girdles 12 inches o.c. Install a wire ring around each end and around outer periphery of center openings, and stretch prestressed aircraft cable radially from the wire ring to nearest circumferential girdle. Install additional circumferential girdles along the body of equipment or tank at a minimum spacing of 48 inches o.c. Use this network for securing insulation with tie wire or bands.

16. Stagger joints between insulation layers at least 3 inches.
17. Install insulation in removable segments on equipment access doors, manholes, handholes, and other elements that require frequent removal for service and inspection.
18. Bevel and seal insulation ends around manholes, handholes, ASME stamps, and nameplates.
19. For equipment with surface temperatures below ambient, apply mastic to open ends, joints, seams, breaks, and punctures in insulation.

Flexible Elastomeric Thermal Insulation Installation for Tanks and Vessels: Install insulation over entire surface of tanks and vessels.

20. Apply 100 percent coverage of adhesive to surface with manufacturer's recommended adhesive.
21. Seal longitudinal seams and end joints.

Insulation Installation on Pumps

22. Fabricate metal boxes lined with insulation. Fit boxes around pumps and coincide box joints with splits in pump casings. Fabricate joints with outward bolted flanges. Bolt flanges on 6-inch centers, starting at corners. Install 3/8-inch-diameter fasteners with wing nuts. Alternatively, secure the box sections together using a latching mechanism.
23. Fabricate boxes from galvanized steel, at least 0.050 inch thick.
24. For below ambient services, install a vapor barrier at seams, joints, and penetrations. Seal between flanges with replaceable gasket material to form a vapor barrier.

DUCT INSULATION INSTALLATION

Flexible fiberglass duct wrap installations: Secure insulation with adhesive and anchor pins and speed washers.

25. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
26. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
27. Install anchor pins and speed washers on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

- b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
- 28. Impale insulation over anchors and attach speed washers.
 - 29. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.
 - 30. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
 - 31. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. Secure with steel band at end joints and spaced a maximum of 18 inches o.c.
 - 32. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
 - 33. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
 - 34. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

Semi-rigid and rigid fiberglass board installations: Secure board insulation with adhesive and anchor pins and speed washers.

- 35. Apply adhesives according to manufacturer's recommended coverage rates per square foot, for 100 percent coverage of duct and plenum surfaces.
- 36. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.
- 37. Space anchor pins as follows:
 - a. On duct sides with dimensions 18 inches and smaller, along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.
 - b. On duct sides with dimensions larger than 18 inches. Space 16 inches o.c. each way, and 3 inches maximum from insulation joints. Apply additional pins and clips to hold insulation tightly against surface at cross bracing.
 - c. Anchor pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
 - d. Do not overcompress insulation during installation.
- 38. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

39. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation segment with 1/2-inch staples, 1 inch o.c., and cover with pressure-sensitive tape having same facing as insulation.
40. Apply insulation on rectangular duct elbows and transitions with a full insulation segment for each surface. Groove and score insulation to fit as closely as possible to outside and inside radius of elbows. Apply insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
41. Insulate duct stiffeners, hangers, and flanges that protrude beyond the insulation surface with 6-inch-wide strips of the same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with anchor pins spaced 6 inches o.c.
42. Apply vapor-retarder mastic to open joints, breaks, and punctures for insulation indicated to receive vapor retarder.

PIPE INSULATION INSTALLATION

Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:

43. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity, unless otherwise indicated.
44. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.
45. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
46. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
47. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below ambient services, provide a design that maintains vapor barrier.

48. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is thicker.
49. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below ambient services and a breather mastic for above ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
50. For services not specified to receive a field-applied jacket except for flexible elastomeric and polyolefin, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
51. Stencil or label the outside insulation jacket of each union with the word "UNION." Match size and color of pipe labels.

Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes, vessels, and equipment. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

Install removable insulation covers at locations indicated. Installation shall conform to the following:

52. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
53. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
54. Construct removable valve insulation covers in same manner as for flanges except divide the two-part section on the vertical center line of valve body.
55. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.
56. Unless a PVC jacket is indicated in field-applied jacket schedules, finish exposed surfaces with a metal jacket.

PIPING CELLULAR-GLASS INSULATION INSTALLATION

Insulation Installation on Straight Pipes and Tubes

57. Secure each layer of insulation to pipe with wire or bands and tighten bands without deforming insulation materials.

58. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
59. For insulation with factory-applied jackets on above ambient services, secure laps with outward clinched staples at 6 inches o.c.
60. For insulation with factory-applied jackets on below ambient services, do not staple longitudinal tabs but secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

Insulation Installation on Pipe Flanges

61. Install preformed pipe insulation to outer diameter of pipe flange.
62. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
63. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of cellular-glass block insulation of same thickness as pipe insulation.
64. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

Insulation Installation on Pipe Fittings and Elbows

65. Install preformed sections of same material as straight segments of pipe insulation when available. Secure according to manufacturer's written instructions.
66. When preformed sections of insulation are not available, install mitered sections of cellular-glass insulation. Secure insulation materials with wire or bands.

Insulation Installation on Valves and Pipe Specialties

67. Install preformed sections of cellular-glass insulation to valve body.
68. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
69. Install insulation to flanges as specified for flange insulation application.

PIPING FLEXIBLE ELASTOMERIC INSULATION INSTALLATION

Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

Insulation Installation on Pipe Flanges

70. Install pipe insulation to outer diameter of pipe flange.
71. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
72. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.

73. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

Insulation Installation on Pipe Fittings and Elbows

74. Install mitered sections of pipe insulation.
75. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

Insulation Installation on Valves and Pipe Specialties

76. Install preformed valve covers manufactured of same material as pipe insulation when available.
77. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
78. Install insulation to flanges as specified for flange insulation application.
79. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

END OF SECTION 23 07 00

SECTION 23 08 00 - COMMISSIONING OF HVAC&R

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes commissioning process requirements for Heating Ventilating Air Conditioning and Refrigeration (HVAC&R) systems, assemblies, and equipment.
- B. Provide documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel. Work with the Commissioning Authority and in cooperation with other members of the commissioning team to ensure compliance.
- C. Refer to Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS for commissioning requirements.
- D. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for commissioning process requirements.
 - 2. Division 23 Sections related to Testing, Adjusting and Balancing (TAB).
 - 3. Division 23 Sections related to Building Direct Digital Control (DDC) System.

1.3 COMMISSIONING

- A. This section governs the commissioning of HVAC&R systems.
- B. The following systems and equipment shall be commissioned, where applicable.
 - 1. Building Automation System
 - 2. Central Heating and Cooling Plant Equipment
 - 3. Air Handling Units
 - 4. Terminal Air Units
 - 5. Finned Tube Radiant Heaters
 - 6. Exhaust Fans
 - 7. Convection Radiant Heaters
 - 8. Radiant Ceiling Panels
 - 9. Cabinet Unit Heaters
 - 10. Hydronic, Refrigerant, and Condensate Piping
 - 11. Pumps

12. Mechanical Identification
13. Ductwork Construction, Insulation and Testing
14. Split System and Type Cooling System

- C. Refer to Division 01. Section 01 91 13, "General Commissioning Requirements" for the Work related to commissioning of these systems.

PART 2 - PRODUCTS: NOT USED

PART 3 - EXECUTION: NOT USED

END OF SECTION 23 08 00

SECTION 23 09 00 – CONTROLS AND INSTRUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All work of this Division shall be coordinated and provided by the single Building Management System (BMS) Contractor.
- B. The work of this Division shall be scheduled, coordinated, and interfaced with the associated work of other trades. Reference the Division 23 Sections for details.
- C. The work of this Division shall be as required by the Specifications, Point Schedules and Drawings.
- D. If the BMS Contractor believes there are conflicts or missing information in the project documents, the Contractor shall promptly request clarification and instruction from the design team.
- E. The BMS Contractor shall be responsible for obtaining existing main building temperature controls system submittals and field verification as required to facilitate the addition of new controls network componentry and devices.

1.2 DEFINITIONS

- A. Analog: A continuously variable system or value not having discrete levels. Typically exists within a defined range of limiting values.
- B. Binary: A two-state system where an “ON” condition is represented by one discrete signal level and an “OFF” condition is represented by a second discrete signal level.
- C. Building Management System (BMS): The total integrated system of fully operational and functional elements, including equipment, software, programming, and associated materials, to be provided by this Division BMS Contractor and to be interfaced to the associated work of other related trades.
- D. BMS Contractor: The single Contractor to provide the work of this Division. This Contractor shall be the primary manufacturer, installer, commissioner and ongoing service provider for the BMS work.
- E. Control Sequence: A BMS pre-programmed arrangement of software algorithms, logical computation, target values and limits as required to attain the defined operational control objectives.
- F. Direct Digital Control: The digital algorithms and pre-defined arrangements included in the BMS software to provide direct closed-loop control for the designated equipment and controlled variables. Inclusive of Proportional, Derivative and Integral control

algorithms together with target values, limits, logical functions, arithmetic functions, constant values, timing considerations and the like.

- G. BMS Network: The total digital on-line real-time interconnected configuration of BMS digital processing units, workstations, panels, sub-panels, controllers, devices and associated elements individually known as network nodes. May exist as one or more fully interfaced and integrated sub-networks, LAN, WAN or the like.
- H. Node: A digitally programmable entity existing on the BMS network.
- I. BMS Integration: The complete functional and operational interconnection and interfacing of all BMS work elements and nodes in compliance with all applicable codes, standards and ordinances so as to provide a single coherent BMS as required by this Division.
- J. Provide: The term “Provide” and its derivatives when used in this Division shall mean to furnish, install in place, connect, calibrate, test, commission, warrant, document and supply the associated required services ready for operation.
- K. PC: Personal Computer from a recognized major manufacturer
- L. Furnish: The term “Furnish” and its derivatives when used in this Division shall mean supply at the BMS Contractor’s cost to the designated third party trade contractor for installation. BMS Contractor shall connect furnished items to the BMS, calibrate, test, commission, warrant and document.
- M. Wiring: The term “Wiring” and its derivatives when used in this Division shall mean provide the BMS wiring and terminations.
- N. Install: The term “Install” and its derivatives when used in this Division shall mean receive at the jobsite and mount.
- O. Protocol: The term “protocol” and its derivatives when used in this Division shall mean a defined set of rules and standards governing the on-line exchange of data between BMS network nodes.
- P. Software: The term “software” and its derivatives when used in this Division shall mean all of programmed digital processor software, preprogrammed firmware and project specific digital process programming and database entries and definitions as generally understood in the BMS industry for real-time, on-line, integrated BMS configurations.
- Q. The use of words in the singular in these Division documents shall not be considered as limiting when other indications in these documents denote that more than one such item is being referenced.
- R. Headings, paragraph numbers, titles, shading, bolding, underscores, clouds and other symbolic interpretation aids included in the Division documents are for general information only and are to assist in the reading and interpretation of these Documents.
- S. The following abbreviations and acronyms may be used in describing the work of this:
 - ADC - Analog to Digital Converter

AHJ	-	Authority Having Jurisdiction
AI	-	Analog Input
AN	-	Application Node
ANSI	-	American National Standards Institute
AO	-	Analog Output
ASCII	-	American Standard Code for Information Interchange
ASHRAE	-	American Society of Heating, Refrigeration & Air Conditioning Engineers
AWG	-	American Wire Gauge
BTL	-	BACnet Testing Laboratories
CPU	-	Central Processing Unit
CRT	-	Cathode Ray Tube
DAC	-	Digital to Analog Converter
DDC	-	Direct Digital Control
DI	-	Digital Input
DO	-	Digital Output
EEPROM	-	Electrically Erasable Programmable Read Only Memory
EMI	-	Electromagnetic Interference
FAS	-	Fire Alarm Detection and Annunciation System
GUI	-	Graphical User Interface
HOA	-	Hand-Off-Auto
ID	-	Identification
IEEE	-	Institute of Electrical and Electronics Engineers
I/O	-	Input/Output
IT	-	Information Technology
LAN	-	Local Area Network
LCD	-	Liquid Crystal Display
LED	-	Light Emitting Diode
MCC	-	Motor Control Center
NC	-	Normally Closed
NIC	-	Not In Contract
NO	-	Normally Open
OWS	-	Operator Workstation
OAT	-	Outdoor Air Temperature
PC	-	Personal Computer
RAM	-	Random Access Memory
RF	-	Radio Frequency
RFI	-	Radio Frequency Interference
RH	-	Relative Humidity
ROM	-	Read Only Memory
RTD	-	Resistance Temperature Device
SPDT	-	Single Pole Double Throw
SPST	-	Single Pole Single Throw
XVGA	-	Extended Video Graphics Adapter
TBA	-	To Be Advised
TCP/IP	-	Transmission Control Protocol/Internet Protocol
TTD	-	Thermistor Temperature Device
UPS	-	Uninterruptible Power Supply
VAC	-	Volts, Alternating Current
VAV	-	Variable Air Volume
VDC	-	Volts, Direct Current

WAN - Wide Area Network

1.3 BMS DESCRIPTION:

- A. The Building Any and all components of the BMS that are connected via field bus or IP network, including the network controllers, field controllers, application specific controllers, server and user interface software, system and controller programming tools and software applications shall be designed, engineered, and tested to work together as a complete building management system, and shall be manufactured by the same BMS manufacturer. Systems that use or require network controllers, field controllers, application specific controllers, server and user interface software, programming tools and software from more than one BMS manufacturer shall not be accepted.
- B. Any and all components of the BMS that are connected via field bus or IP network, including the network controllers, field controllers, application specific controllers, server and user interface software, system and controller programming tools and software applications shall be designed, engineered, and tested to work together as a complete building management system, and shall be manufactured by the same BMS manufacturer. Systems that use or require network controllers, field controllers, application specific controllers, server and user interface software, programming tools and software from more than one BMS manufacturer shall not be accepted.
- C. All points of user interface shall be on standard PCs that do not require the purchase of any special software from the BMS manufacturer for use as a building operations terminal. The primary point of interface on these PCs will be a standard Web Browser.
- D. Where necessary and as dictated elsewhere in these Specifications, Servers shall be used for the purpose of providing a location for extensive archiving of system configuration data, and historical data such as trend data and operator transactions. All data stored will be through the use of a standard data base platform: Microsoft SQL Server Express or Microsoft SQL Server as dictated elsewhere in this specification.
- E. The work of the single BMS Contractor shall be as defined individually and collectively in all Sections of this Division specification together with the associated Point Sheets and Drawings and the associated interfacing work as referenced in the related documents.
- F. The BMS work shall consist of the provision of all labor, materials, tools, equipment, software, software licenses, software configurations and database entries, interfaces, wiring, tubing, installation, labeling, engineering, calibration, documentation, samples, submittals, testing, commissioning, training services, permits and licenses, transportation, shipping, handling, administration, supervision, management, insurance, temporary protection, cleaning, cutting and patching, warranties, services, and items, even though these may not be specifically mentioned in these Division documents which are required for the complete, fully functional and commissioned BMS.

- G. Provide a complete, neat and workmanlike installation. Use only manufacturer employees who are skilled, experienced, trained, and familiar with the specific equipment, software, standards and configurations to be provided for this Project.
- H. Manage and coordinate the BMS work in a timely manner in consideration of the Project schedules. Coordinate with the associated work of other trades so as to not impede or delay the work of associated trades.
- I. The BMS as provided shall incorporate, at minimum, the following integrated features, functions and services:
 - 1. Operator information, alarm management and control functions.
 - 2. Enterprise-level information and control access.
 - 3. Information management including monitoring, transmission, archiving, retrieval, and reporting functions.
 - 4. Diagnostic monitoring and reporting of BMS functions.
 - 5. Offsite monitoring and management access.
 - 6. Energy management
 - 7. Standard applications for terminal HVAC systems.
 - 8. Integration or monitoring connections to all other systems provided by others as identified in the sequence of operations.

1.4 QUALITY ASSURANCE

- A. General:
 - 1. The Building Management System Contractor shall be the primary manufacturer-owned branch office that is regularly engaged in the engineering, programming, installation and service of total integrated Building Management Systems.
 - 2. The BMS Contractor shall be a recognized national manufacturer, installer and service provider of BMS.
 - 3. The Building Management System (BMS) installer shall be a BMS manufacturer-owned branch office, or an independent controls contractor who is factory trained and authorized by the BMS manufacturer to sell, service and support the Building Management System specified herein.
 - 4. Independent controls contractors who are authorized by the BMS manufacturer must provide a letter written and signed by a company officer of the specific BMS manufacturer. This document must be dated within the 30 days prior to bid submittal and must state that they are currently a "direct authorized representative" in good standing for the BMS manufacturer for the building management system products described and listed in this specification, that they have "direct purchasing access" to all of the BMS manufacturer's controllers, servers, software and components and technical support, and that they will continue to be an Authorized representative with this access for the duration of the installation and warranty phases of project.
 - 5. If an independent controls contractor is to be considered via addendum, the contractor must provide a letter written by a company officer of the specific BMS manufacturer with the following verbiage; "should this contractor fail to provide a complete and operational system (as judged by the Design-Builder), the Manufacturer will complete the project to the Design-Builder's satisfaction at no

additional cost to the Owner". This letter must be dated within 30 days prior to bid submittal and provided to the engineer along with the other supporting documentation at the time of request for equivalence.

6. The BMS Contractor shall have a branch facility within a 100-mile radius of the job site supplying complete maintenance and support services on a 24 hour, 7-day-a-week basis. The BMS Contractor shall have at this facility at least eight (8) factory trained, directly employed and full time technical staff, spare parts inventory, and all necessary test and diagnostic equipment.
7. As evidence and assurance of the contractor's ability to support the Owner's system with service and parts, the contractor must have been in the BMS business for at least the last ten (10) years and have successfully completed total projects of at least 10 times the value of this contract in each of the preceding five years.
8. The Building Management System architecture shall consist of the products of a manufacturer regularly engaged in the production of Building Management Systems, and shall be the manufacturer's latest standard of design at the time of bid.

B. Workplace Safety and Hazardous Materials

1. Provide a safety program in compliance with the Contract Documents.
2. The BMS Contractor shall have a corporately certified comprehensive Safety Certification Manual and a designated Safety Supervisor for the Project.
3. The Contractor and its employees and subtrades shall comply with federal, state and local safety regulations.
4. The Contractor shall ensure that all subcontractors and employees have written safety programs in place that covers their scope of work, and that their employees receive the training required by the OSHA rules that have jurisdiction for at least each topic listed in the Safety Certification Manual.
5. Hazards created by the Contractor or its subcontractors shall be eliminated before any further work proceeds.
6. Hazards observed but not created by the Contractor or its subcontractors shall be reported to either the General Contractor or the Design-Builder within the same day. The Contractor shall be required to avoid the hazard area until the hazard has been eliminated.
7. The Contractor shall sign and date a safety certification form prior to any work being performed, stating that the Contractors' company is in full compliance with the Project safety requirements.
8. The Contractor's safety program shall include written policy and arrangements for the handling, storage and management of all hazardous materials to be used in the work in compliance with the requirements of the AHJ at the Project site.
9. The Contractor's employees and subcontractor's staff shall have received training as applicable in the use of hazardous materials and shall govern their actions accordingly.

C. Quality Management Program

1. Designate a competent and experienced employee to provide BMS Project Management. The designated Project Manager shall be empowered to make technical, scheduling and related decisions on behalf of the BMS Contractor. At minimum, the Project Manager shall:

- a. Manage the scheduling of the work to ensure that adequate materials, labor and other resources are available as needed.
- b. Manage the financial aspects of the BMS Contract.
- c. Coordinate as necessary with other trades.
- d. Be responsible for the work and actions of the BMS workforce on site

1.5 REFERENCES

A. All work shall conform to the following Codes and Standards, as applicable:

- 1. National Fire Protection Association (NFPA) Standards.
- 2. National Electric Code (NEC) and applicable local Electric Code.
- 3. Underwriters Laboratories (UL) listing and labels.
- 4. UL 864 UUKL Smoke Control
- 5. UL 268 Smoke Detectors.
- 6. UL 916 Energy Management
- 7. NFPA 70 - National Electrical Code.
- 8. NFPA 90A - Standard For The Installation Of Air Conditioning And Ventilating Systems.
- 9. NFPA 92A and 92B Smoke Purge/Control Equipment.
- 10. Factory Mutual (FM).
- 11. American National Standards Institute (ANSI).
- 12. National Electric Manufacturer’s Association (NEMA).
- 13. American Society of Mechanical Engineers (ASME).
- 14. American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE)
- 15. Air Movement and Control Association (AMCA).
- 16. Institute of Electrical and Electronic Engineers (IEEE).
- 17. American Standard Code for Information Interchange (ASCII).
- 18. Electronics Industries Association (EIA).
- 19. Occupational Safety and Health Administration (OSHA).
- 20. American Society for Testing and Materials (ASTM).
- 21. Federal Communications Commission (FCC) including Part 15, Radio Frequency Devices.
- 22. Americans Disability Act (ADA)
- 23. ANSI/ASHRAE Standard 195-2008 (BACnet)
- 24. In the case of conflicts or discrepancies, the more stringent regulation shall apply.
- 25. All work shall meet the approval of the Authorities Having Jurisdiction at the project site.

1.6 WORK BY OTHERS

A. The demarcation of work and responsibilities between the BMS Contractor and other related trades shall be as outlined in the BMS RESPONSIBILITY MATRIX.

BMS RESPONSIBILITY MATRIX				
WORK	FURNISH	INSTALL	LOW VOLT. WIRING / CONDUIT (*1)	LINE POWER (*1)
BMS low voltage and communication	BMS	BMS	BMS	N/A

wiring (note 1)				
VAV box controller (note 2)	BMS	23 (*2)	BMS	26
VAV boxes	23	23	N/A	N/A
BMS conduits and raceway	BMS	BMS	BMS	BMS
Automatic control dampers	BMS	23	N/A	N/A
Automatic control damper actuators	BMS	BMS	BMS	26
Air Flow Stations	BMS	23	BMS	N/A
Manual valves and dampers	23	23	N/A	N/A
Automatic control valves	BMS	23	BMS	N/A
Automatic control valve actuators	BMS	BMS	BMS	N/A
Pipe insertion devices and taps including thermowells, flow and pressure stations.	BMS	23	BMS	BMS
BMS Current Switches.	BMS	BMS	BMS	N/A
BMS Control Relays	BMS	BMS	BMS	N/A
Concrete equipment pads and bracing	23	23	N/A	N/A
All BMS Nodes, equipment, housings, enclosures and panels.	BMS	BMS	BMS	BMS
Smoke Detectors	28	28	28	28
Fire/Smoke Dampers	23	23	28	28
Fire Dampers	23	23	N/A	N/A
VFDs	23	26	BMS	26
BMS interface with Boiler plant control system	BMS	BMS	BMS	BMS
Boiler plant control system and interface with BMS	23	23	BMS	26
BMS interface with Chiller controls	BMS	BMS	BMS	BMS
Chiller controls and interface with BMS	23	23	23	26
BMS interface with CRAC units	BMS	BMS	BMS	26
CRAC unit controls and interface with BMS	23	23	23	26
Fan Coil Unit controls	BMS	BMS	BMS	26
Exhaust fan controls	BMS	BMS	BMS	26
Cabinet/Unit Heater controls (note 4)	BMS/23	26/BMS	BMS	26
VRF factory-mounted controls	23	23	BMS	26
VRF space-mounted controls	23	BMS	BMS	26
VRF field-mounted controls	BMS	BMS	BMS	26
Air Handling unit field-mounted controls	BMS	BMS	BMS	26
Air Handling unit factory-mounted controls	23	23	BMS	26
Firing Range DDC System	Carey's	Carey's	BMS	26
Automatic Transfer Switches	26	26	BMS (*3)	26
Surge Protective Devices	26	26	BMS (*3)	26
Medium Voltage Switchgear	26	26	BMS (*3)	26
Unit Substations	26	26	BMS (*3)	26
Low Voltage Switchgear	26	26	BMS (*3)	26

Low Voltage Switchboards	26	26	BMS (*3)	26
Distribution Panelboards	26	26	BMS (*3)	26
Electric Vehicle Charging Station	26	26	BMS (*3)	26
Starters, HOA switches	26	26	N/A	26
Interior & Exterior Cameras	28	28	BMS (*3)	26
Fire Alarm System	28	28	BMS (*3)	26
Elevator Sump System	22	22	BMS (*3)	26
Natural Gas Meter	22	22	BMS (*3)	26
Potable Water Meter	22	22	BMS (*3)	26
Irrigation Water Meter	22	22	BMS (*3)	26

Footnotes:

- *1: BMS controls contractor must hire the electrical contractor for the project to route and install all conduit.
- *2: VAV box controller factory install would normally be by Division 23 Mechanical who furnishes the VAV boxes; could be by BMS for field installation where applicable
- *3: BMS controls contractor is only responsible for the low voltage wiring and conduit associated with connecting the system into BMS system. All other low voltage wiring and conduit is the responsibility of the contractor furnishing and installing the system.
- *4: Cabinet/Unit Heater Controls – for line voltage stand-alone controls: furnished by Division 23 Mechanical Contractor who furnishes the Cabinet/Unit Heaters; line voltage stand-alone controls installed and connected by Division 26 Electrical Contractor. Alternately, controls may be furnished and installed by BMS Contractors for projects requiring Cabinet/Unit Heater controls to be integrated into BMS.

1.7 SUBMITTALS.

A. Shop Drawings, Product Data, and Samples.

1. The BMS contractor shall submit a list of all shop drawings with submittals dates within 30 days of contract award.
2. Submittals shall be in defined packages. Each package shall be complete and shall only reference itself and previously submitted packages. The packages shall be as approved by the Architect and Engineer for Contract compliance.
3. Allow 15 working days for the review of each package by the Architect and Engineer in the scheduling of the total BMS work.
4. Equipment and systems requiring approval of local authorities must comply with such regulations and be approved. Filing shall be at the expense of the BMS Contractor where filing is necessary. Provide a copy of all related correspondence and permits to the Design-Builder.
5. Prepare an index of all submittals and shop drawings for the installation. Index shall include a shop drawing identification number, Contract Documents reference and item description.
6. The BMS Contractor shall correct any errors or omissions noted in the first review.
7. At a minimum, submit the following:

- a. BMS network architecture diagrams including all nodes and interconnections.
- b. Systems schematics, sequences, and flow diagrams.
- c. Points schedule for each point in the BMS, including: Point Type, Object Name, Expanded ID, Display Units, Controller type, and Address.
- d. Samples of Graphic Display screen types and associated menus.
- e. Detailed Bill of Material list for each system or application, identifying quantities, part numbers, descriptions, and optional features.
- f. Control Damper Schedule including a separate line for each damper provided under this section and a column for each of the damper attributes, including: Code Number, Fail Position, Damper Type, Damper Operator, Duct Size, Damper Size, Mounting, and Actuator Type.
- g. Room Schedule including a separate line for each VAV box and/or terminal unit indicating location and address
- h. Control Valve Schedules including a separate line for each valve provided under this section and a column for each of the valve attributes: Code Number, Configuration, Fail Position, Pipe Size, Valve Size, Body Configuration, Close off Pressure, Capacity, Valve CV, Design Pressure, and Actuator Type.
- i. Details of all BMS interfaces and connections to the work of other trades.
- j. Product data sheets or marked catalog pages including part number, photo and description for all products including software.

1.8 RECORD DOCUMENTATION

A. Operation and Maintenance Manuals

1. Three (3) copies of the Operation and Maintenance Manuals shall be provided to the Design-Builder upon completion of the project. The entire Operation and Maintenance Manual shall be furnished on Compact Disc media, and include the following for the BMS provided:
 - a. Table of contents.
 - b. As-built system record drawings. Computer Aided Drawings (CAD) record drawings shall represent the as-built condition of the system and incorporate all information supplied with the approved submittal.
 - c. Manufacturer's product data sheets or catalog pages for all products including software.
 - d. System Operator's manuals.
 - e. Archive copy of all site-specific databases and sequences.
 - f. BMS network diagrams.
 - g. Interfaces to all third-party products and work by other trades.
2. The Operation and Maintenance Manual CD shall be self-contained, and include all necessary software required to access the product data sheets. A logically organized table of contents shall provide dynamic links to view and print all product data sheets. Viewer software shall provide the ability to display, zoom, and search all documents.

- B. On-Line documentation: After completion of all tests and adjustments the contractor shall provide a copy of all as-built information and product data to be installed on a customer designated computer workstation or server.

1.9 Warranty

A. Standard Material and Labor Warranty:

1. Provide a three-year labor and material warranty on the BMS.
2. If within twelve months from the date of acceptance of product, upon written notice from the Design-Builder, it is found to be defective in operation, workmanship or materials, it shall be replaced, repaired or adjusted at the option of the BMS Contractor at the cost of the BMS Contractor
3. Maintain an adequate supply of materials within 100 miles of the Project site such that replacement of key parts and labor support, including programming. Warranty work shall be done during BMS Contractor's normal business hours

PART 2 - PRODUCTS

2.1 GENERAL DESCRIPTION

- A. The Building Management System (BMS) shall use an open architecture and fully support a multi-vendor environment. To accomplish this effectively, the BMS shall support open communication protocol standards and integrate a wide variety of third-party devices and applications. The system shall be designed for use on the Internet, or intranets using off the shelf, industry standard technology compatible with other owner provided networks.
- B. The Building Management System shall consist of the following:
 1. Standalone Network Automation Engine(s)
 2. Field Equipment Controller(s)
 3. Input/Output Module(s)
 4. Local Display Device(s)
 5. Portable Operator's Terminal(s)
 6. Distributed User Interface(s)
 7. Network processing, data storage and communications equipment
 8. Other components required for a complete and working BMS
- C. The system shall be modular in nature and shall permit expansion of both capacity and functionality through the addition of sensors, actuators, controllers and operator devices, while re-using existing controls equipment.
- D. System architectural design shall eliminate dependence upon any single device for alarm reporting and control execution.
 1. The failure of any single component or network connection shall not interrupt the execution of control strategies at other operational devices.

2. The System shall maintain all settings and overrides through a system reboot.
3. Acceptable Manufacturers
 - a. Basis of Design: Johnson Controls, Inc., Facility Explorer by Local Branch Office
 - b. Siemens Building Systems, APOGEE

2.2 BMS ARCHITECTURE

- A. The existing Joint Public Safety Training Campus (JPSTC) is served by a JCI Facility Explorer system hardware with Tridium Niagara framework.
- B. Automation Network
 1. The automation network shall be based on a PC industry standard of Ethernet TCP/IP. Where used, LAN controller cards shall be standard “off the shelf” products available through normal PC vendor channels.
 2. The BMS shall network multiple user interface clients, automation engines, system controllers and application-specific controllers. Provide application and data server(s) as required for systems operation.
 3. All BMS devices on the automation network shall be capable of operating at a communication speed of 100 Mbps, with full peer-to-peer network communication.
 4. Network Automation Engines (NAE) shall reside on the automation network.
 5. The automation network will be compatible with other enterprise-wide networks. Where indicated, the automation network shall be connected to the enterprise network and share resources with it by way of standard networking devices and practices.
- C. Control Network
 1. Network Automation Engines (NAE) shall provide supervisory control over the control network and shall support the following communication protocols:
 - a. BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9
 - 1) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - 2) The NAE shall be tested and certified as a BACnet Building Controller (B-BC).
 2. Control networks shall provide either “Peer-to-Peer,” Master-Slave, or Supervised Token Passing communications, and shall operate at a minimum communication speed of 9600 baud.
 3. DDC Controllers shall reside on the control network.
 4. Control network communication protocol shall be BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135.
 5. A BACnet Protocol Implementation Conformance Statement (PICS) shall be provided for each controller device (master or slave) that will communicate on the BACnet MS/TP Bus.

D. Integration**1. Hardwired**

- a. Analog and digital signal values shall be passed from one system to another via hardwired connections.
- b. There will be one separate physical point on each system for each point to be integrated between the systems.

2. Direct Protocol (Integrator Panel)

- a. The BMS system shall include appropriate hardware equipment and software to allow bi-directional data communications between the BMS system and 3rd party manufacturers' control panels. The BMS shall receive, react to, and return information from multiple building systems, including but not limited to the chillers, boilers, variable frequency drives, power monitoring system, and medical gas.
- b. All data required by the application shall be mapped into the Automation Engine's database, and shall be transparent to the operator.
- c. Point inputs and outputs from the third-party controllers shall have real-time interoperability with BMS software features such as: Control Software, Energy Management, Custom Process Programming, Alarm Management, Historical Data and Trend Analysis, Totalization, and Local Area Network Communications.

3. BACnet Protocol Integration - BACnet

- a. The neutral protocol used between systems will be BACnet over Ethernet and comply with the ASHRAE BACnet standard 135-2008.
- b. A complete Protocol Implementation Conformance Statement (PICS) shall be provided for all BACnet system devices.
- c. The ability to command, share point object data, change of state (COS) data and schedules between the host and BACnet systems shall be provided.

2.3 USER INTERFACE**A. Dedicated Web Based User Interface**

1. Where indicated on plans (Engineering & CUP) the BMS Contractor shall provide and install a personal computer for command entry, information management, network alarm management, and database management functions. All real-time control functions, including scheduling, history collection and alarming, shall be resident in the BMS Network Automation Engines to facilitate greater fault tolerance and reliability.
2. Dedicated User Interface Architecture – The architecture of the computer shall be implemented to conform to industry standards, so that it can accommodate applications provided by the BMS Contractor and by other third party applications suppliers, including but not limited to Microsoft Office Applications. Specifically it must be implemented to conform to the following interface standards.

- a. Microsoft Internet Explorer for user interface functions
 - b. Microsoft Office Professional for creation, modification and maintenance of reports, sequences other necessary building management functions
 - c. Microsoft Outlook or other e-mail program for supplemental alarm functionality and communication of system events, and reports
 - d. Required network operating system for exchange of data and network functions such as printing of reports, trends and specific system summaries
3. PC Hardware – The two personal computer(s) shall be configured as follows:
- a. Memory – 16 GB (8 GB Minimum)
 - b. CPU– Pentium 4 processor. 3.2 GHz Clock Speed (2.0 GHz minimum)
 - c. Hard Drive – 500 GB free hard drive space (80GB minimum)
 - d. Hard drive backup system – CD/RW, DVD/RW or network backup software provided by IT department
 - e. CD ROM Drive – 32X performance
 - f. Ports – (2) USB 3.0, Ethernet, VGA, microphone/headset.
 - g. Keyboard – 101 Keyboard and 2 Button Mouse
 - h. CRT configuration – 1-2 CRTs as follows:
 - 1) Each Display – 24” Flat Panel Monitor 1920 x 1080 resolution minimum
 - 2) 16 bit or higher color resolution
 - 3) Display card with multiple monitor support
 - 4) LAN communications – Ethernet communications board; 3Comm or equal
4. Operating System Software
- a. Windows 10 or higher (64 bit)
 - b. Where user interface is not provided via browser, provide complete operator workstation software package, including any hardware or software keys. Include the original installation disks and licenses for all included software, device drivers, and peripherals.
 - c. Provide software registration cards to the Owner for all included software.
5. Peripheral Hardware
- a. Reports printer:
 - 1) Printer Make – Hewlett Packard DeskJet
 - 2) Print Speed – 600 DPI Black, 300 DPI Color
 - 3) Buffer – 64 K Input Print Buffer
 - 4) Color Printing – Include Color Kit

B. Distributed Web Based User Interface

- 1. All features and functions of the dedicated user interface previously defined in this document shall be available on any computer connected directly or via a wide area or virtual private network (WAN/VPN) to the automation network and conforming to the following specifications.

2. The software shall run on the Microsoft Internet Explorer (11.0 or higher) browser supporting the following functions:
 - a. Configuration
 - b. Commissioning
 - c. Data Archiving
 - d. Monitoring
 - e. Commanding
 - f. System Diagnostics

3. Minimum hardware requirements:
 - a. 8GB RAM
 - b. 3.0 GHz Clock Speed Pentium 4 Microprocessor
 - c. 100 GB Hard Drive.
 - d. 1 Keyboard with 83 keys (minimum).
 - e. SVGA 1024x768 resolution display with 64K colors and 16 bit color depth
 - f. Mouse or other pointing device

C. Site Management User Interface Application Components

1. Operator Interface
 - a. An integrated browser-based client application shall be used as the user operator interface program.
 - b. The System shall employ an event-driven rather than a device polling methodology to dynamically capture and present new data to the user.
 - c. All Inputs, Outputs, Setpoints, and all other parameters as defined within Part 3, shown on the design drawings, or required as part of the system software, shall be displayed for operator viewing and modification from the operator interface software.
 - d. The user interface software shall provide help menus and instructions for each operation and/or application.
 - e. The system shall support customization of the UI configuration and a home page display for each operator.
 - f. The system shall support user preferences in the following screen presentations:
 - 1) Alarm
 - 2) Trend
 - 3) Display
 - 4) Applications
 - g. All controller software operating parameters shall be displayed for the operator to view/modify from the user interface. These include: setpoints, alarm limits, time delays, PID tuning constants, run-times, point statistics, schedules, and so forth.
 - h. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:

- 1) User access for selective information retrieval and control command execution
- 2) Monitoring and reporting
- 3) Alarm, non-normal, and return to normal condition annunciation
- 4) Selective operator override and other control actions
- 5) Information archiving, manipulation, formatting, display and reporting
- 6) BMS internal performance supervision and diagnostics
- 7) On-line access to user HELP menus
- 8) On-line access to current BMS as-built records and documentation
- 9) Means for the controlled re-programming, re-configuration of BMS operation and for the manipulation of BMS database information in compliance with the prevailing codes, approvals and regulations for individual BMS applications

i. The system shall support a list of application programs configured by the users that are called up by the following means:

- 1) The Tools Menu
- 2) Hyperlinks within the graphics displays
- 3) Key sequences

j. The operation of the control system shall be independent of the user interface, which shall be used for operator communications only. Systems that rely on an operator workstation to provide supervisory control over controller execution of the sequences of operations or system communications shall not be acceptable.

2. Navigation Trees

- a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.
- b. Provide the ability for the operator to add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.
- c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar. A simple keystroke will reattach the navigation to the primary display of the user interface.

3. Alarms

- a. Alarms shall be routed directly from Network Automation Engines to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the user interface shall, at the minimum, provide the following functions:
 - 1) Log date and time of alarm occurrence.

- 2) Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
 - 3) Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
 - 4) Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
 - 5) Provide the ability to direct alarms to an e-mail address or alphanumeric pager. This must be provided in addition to the pop up window described above. Systems that use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
 - 6) Configuration of which NAE offline alarms are seen by each user
 - 7) Any attribute of any object in the system may be designated to report an alarm.
- b. The BMS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions.
 - c. The BMS shall allow a minimum of 4 categories of alarm sounds customizable through user defined wav.files.
 - d. The BMS shall annunciate application alarms at minimum, as required by Part 3.
4. Reports and Summaries
- a. Reports and Summaries shall be generated and directed to the user interface displays, with subsequent assignment to printers, or disk. As a minimum, the system shall provide the following reports:
 - 1) All points in the BMS
 - 2) All points in each BMS application
 - 3) All points in a specific controller
 - 4) All points in a user-defined group of points
 - 5) All points currently in alarm
 - 6) All points locked out
 - 7) All user defined and adjustable variables, schedules, interlocks and the like.
 - b. Summaries and Reports shall be accessible via standard UI functions and not dependent upon custom programming or user defined HTML pages.
 - c. Selection of a single menu item, tool bar item, or tool bar button shall print any displayed report or summary on the system printer for use as a building management and diagnostics tool.
 - d. Provide the capability to view, command and modify large quantities of similar data in tailored summaries created online without the use of a secondary application like a spreadsheet. Summary definition shall allow up to seven user defined columns describing attributes to be displayed including custom column labels. Up to 100 rows per summary shall be supported. Summary viewing shall be available over the network using a standard Web browser.

- e. Provide a focused set of reports that includes essential information required for effective management of energy resources within the facility. Energy reports shall be configurable from predefined, preconfigured templates. Required includes but shall not be limited to:
 - 1) Energy Overview
 - 2) Load Profile
 - 3) Simple Energy Cost
 - 4) Consumption
 - 5) Equipment Runtime
 - 6) Electrical Energy
 - 7) Energy Production
- f. Reports shall be selectable by date, time, area and device. Each report shall include a color visual summary of essential energy information.

5. Schedules

- a. A graphical display for time-of-day scheduling and override scheduling of building operations shall be provided. At a minimum, the following functions shall be provided:
 - 1) Weekly schedules
 - 2) Exception Schedules
 - 3) Monthly calendars
- b. Weekly schedules shall be provided for each group of equipment with a specific time use schedule.
- c. It shall be possible to define one or more exception schedules for each schedule including references to calendars
- d. Monthly calendars shall be provided that allow for simplified scheduling of holidays and special days for a minimum of five years in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the exception schedules.
- e. Changes to schedules made from the User Interface shall directly modify the Network Automation Engine schedule database.
- f. Schedules and Calendars shall comply with ASHRAE SP135/2008 BACnet Standard.
- g. The Calendar object supports an option to add a reference to another Calendar Object that is designated to be the master for the facility. Any Supervisory and BAC calendars can be configured to reference a single master Global Calendar. Changes to the master global calendar are automatically synced with all calendars that are referenced.
- h. Selection of a single menu item or tool bar button shall print any displayed schedule on the system printer for use as a building management and diagnostics tool.
- i. Software shall be provided to configure and implement optimal start and stop programming based on existing indoor and outdoor environmental conditions as well as equipment operating history

- j. The system Solar Clock shall support the scheduling and energy management functions. The Solar Clock will calculate the sunrise, sunset, and sun angle values for a specified latitude and longitude. A time offset can also be specified. An example would be to use the Solar Clock object as a master to an interlock to turn lights on 30 minutes after sunset and off 30 minutes before sunrise.
6. Security/Passwords
- a. Multiple-level passwords access protection shall be provided via roles and permissions. The feature will allow the system to base access on a user's job title or role and allow the user/manager access interface control, display, and database manipulation capabilities based on an assigned password.
 - b. Roles may be copied and altered to meet specific roles and permissions based on the particular policies.
 - c. Each user shall have the following: a user account name (with a maximum of 30 characters), a complex password or passphrase (with a min of 8 characters and a max of 50 characters), other user account policies (such as session timeout), timesheet access based on day of the week and time of day, and specific user view.
 - d. The system shall allow each user to change his or her password at will.
 - e. When entering or editing passwords, the system shall not echo the actual characters for display on the monitor.
 - f. A maximum of 150 categories may be used to determine or assign areas of responsibilities to each user account. A maximum of 13 (of the 150) named categories which are specifics such as "No Access, View, Advanced Review, Operate, Intervene, Diagnostic, Manage Item Events, Manage Every, and Configure Items".
 - g. A minimum of 100 unique passwords shall be supported.
 - h. Operators shall be able to perform only those commands available for their respective passwords. Display of menu selections shall be limited to only those items defined for the access level of the password used to log-on.
 - i. Operators shall be further limited to only access, command, and modify those buildings, systems, and subsystems for which they have responsibility. Provide a minimum of 100 categories of systems to which individual operators may be assigned.
 - j. The system shall automatically generate a report of log-on/log-off and system activity for each user. Any action that results in a change in the operation or configuration of the control system shall be recorded, including: modification of point values, schedules or history collection parameters, and all changes to the alarm management system, including the acknowledgment and deletion of alarms.
 - k. The system shall have the ability to provide a Department of Defense (DoD) specific warning banner for applicable sites that warns the user they are accessing a restricted site.
 - l. After successful login to the Site Management Portal (SMP) the last time and date that user name was previously logged in is shown on the screen.
 - m. Each login attempt is recorded in the system Audit Log with the option to record the IP address of the PC that made the login.

7. Screen Manager
 - a. The system will allow a customized image on the login screen (i.e. organization name, logo).
 - b. User View navigations can be displayed as either a set of tabs or a drop down list.
 - c. Allows user preference for assigning of a background color for when an object is Out of Service which will enable the operator to quickly distinguish points that have been commanded to this state.
 - d. The User Interface shall be provided with screen management capabilities that allow the user to activate, close, and simultaneously manipulate a minimum of 4 active display windows plus a network or user defined navigation tree.

8. Dynamic Color Graphics
 - a. The naming/numbering/tagging convention used must be a coordinated effort between the Mechanical Contractor, Controls Contractor, Owner, Design-Builder, and A/E and must be approved by all parties prior to implementation. The naming/numbering/tagging convention must be consistent and reflected through the building automation control system, charts, diagrams, tagging and O&M manuals.
 - b. Graphic layouts are to be approved by the Design-Builder prior to implementation.
 - c. The graphics application program shall be supplied as an integral part of the User Interface. Browser or Workstation applications that rely only upon HTML pages shall not be acceptable.
 - d. The graphics applications shall include a create/edit function and a runtime function. The system architecture shall support an unlimited number of graphics documents (graphic definition files) to be generated and executed. The graphics shall be able to display and provide animation based on real-time data that is acquired, derived, or entered.
 - e. Graphics runtime functions – A maximum of 16 graphic applications shall be able to execute at any one time on a user interface or workstation with 4 visible to the user. Each graphic application shall be capable of the following functions:
 - 1) All graphics shall be fully scalable
 - 2) The graphics shall support a maintained aspect ratio.
 - 3) Multiple fonts shall be supported.
 - 4) Unique background shall be assignable on a per graphic basis.
 - 5) The color of all animations and values on displays shall indicate the status of the object attribute.
 - 6) Graphics that represent buildings or systems shall allow natural links and transitions between related detailed tabular views of data that complement the graphic.
 - f. Operation from graphics – It shall be possible to change values (setpoints) and states in system controlled equipment directly from the graphic.
 - g. Floor Plan graphics – The user interface shall provide graphic applications that summarize conditions on a floor. Floor plan graphics shall indicate

thermal comfort using dynamic colors to represent zone temperature deviations from zone setpoint(s). Floor plan graphics shall display overall metrics for each zone in the floor.

- h. Aliasing – Many graphic displays representing part of a building and various building components are exact duplicates, with the exception that the various variables are bound to different field values. Consequently, it shall be possible to bind the value of a graphic display to aliases, as opposed to the physical field tags.
- i. Graphic editing tool – A graphic editing tool shall be provided that allows for the creation and editing of graphic files. The graphic editor shall be capable of performing/defining all animations, and defining all runtime binding.
 - 1) The graphic editing tool shall provide a library of standard HVAC equipment, floor plan, lighting, security and network symbols.
 - 2) The graphic editing tool shall provide for the creation and positioning of library symbols by dragging from tool bars or drop-downs and positioning where required.
 - 3) The graphics editing tool shall permit the importing of AutoCAD drawings for use in the system.
 - 4) The graphic editing tool shall be able to add additional content to any graphic by importing images in the SVG, PNG or JPG file formats.

9. Historical trending and data collection

- a. Each Automation Engine shall store trend and point history data for all analog and digital inputs and outputs, as follows:
 - 1) Any point, physical or calculated, may be designated for trending. Two methods of collection shall be allowed:
 - a) Defined time interval
 - b) Upon a change of value
 - 2) Each Automation Engine shall have the capability to store multiple samples for each physical point and software variable based upon available memory, including an individual sample time/date stamp. Points may be assigned to multiple history trends with different collection parameters.
- b. Trend and change of value data shall be stored within the engine and uploaded to a dedicated trend database or exported in a selectable data format via a provided data export utility. Uploads to a dedicated database shall occur based upon one of the following: user-defined interval, manual command, or when the trend buffers are full. Exports shall be as requested by the user or on a time scheduled basis.
- c. The system shall provide a configurable data storage subsystem for the collection of historical data. Data can be stored in SQL database format.
- d. The system shall provide data to enable optimization capabilities including fault detection and diagnostics, advanced analytics and central plant optimization without the need of a gateway or additional hardware.

10. Trend data viewing and analysis
 - a. Provide a trend viewing utility that shall have access to all database points.
 - b. It shall be possible to retrieve any historical database point for use in displays and reports by specifying the point name and associated trend name.
 - c. The trend viewing utility shall have the capability to define trend study displays to include multiple trends
 - d. Displays shall be able to be single or stacked graphs with on-line selectable display characteristics, such as ranging, color, and plot style.
 - e. Display magnitude and units shall both be selectable by the operator at any time without reconfiguring the processing or collection of data. This is a zoom capability.
 - f. Display magnitude shall automatically be scaled to show full graphic resolution of the data being displayed.
 - g. The Display shall support the user's ability to change colors, sample sizes, and types of markers.

11. Database Management
 - a. Where a separate SQL database is utilized for information storage the System shall provide a Database Manager that separates the database monitoring and managing functions by supporting two separate windows.
 - b. Database secure access shall be accomplished using standard SQL authentication including the ability to access data for use outside of the Building Automation application.
 - c. The database managing function shall include summarized information on trend, alarm, event, and audit for the following database management actions:
 - 1) Backup
 - 2) Purge
 - 3) Restore
 - d. The Database Manager shall support four tabs:
 - 1) Statistics – shall display Database Server information and Trend, Alarm (Event), and Audit information on the Databases.
 - 2) Maintenance – shall provide an easy method of purging records from the Server trend, alarm (event), and audit databases by supporting separate screens for creating a backup prior to purging, selecting the database, and allowing for the retention of a selected number of day's data.
 - 3) Backup – Shall provide the means to create a database backup file and select a storage location.
 - 4) Restore – shall provide a restricted means of restoring a database by requiring the user to log into an Expert Mode in order to view the Restore screen.

- e. The Status Bar shall appear at the bottom of all Database Manager Tabs and shall provide information on the current database activity. The following icons shall be provided:
 - 1) Ready
 - 2) Purging Record from a database
 - 3) Action Failed
 - 4) Refreshing Statistics
 - 5) Restoring database
 - 6) Shrinking a database
 - 7) Backing up a database
 - 8) Resetting internet information Services
 - 9) Starting the Device Manager
 - 10) Shutting down the Device Manager
 - 11) Action successful
- f. The Database Manager monitoring functions shall be accessed through the Monitoring Settings window and shall continuously read database information once the user has logged in.
- g. The System shall provide user notification via taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.
- h. The Monitoring Settings window shall have the following sections:
 - 1) General – Shall allow the user to set and review scan intervals and start times.
 - 2) Email – Shall allow the user to create and review e-mail and phone text messages to be delivered when a Warning or Alarm is generated.
 - 3) Warning – shall allow the user to define the Warning limit parameters, set the Reminder Frequency, and link the e-mail message.
 - 4) Alarm – shall allow the user to define the Alarm limit parameters, set the Reminder Frequency, and link the e-mail message.
 - 5) Database login – Shall protect the system from unauthorized database manipulation by creating a Read Access and a Write Access for each of the Trend, Alarm (Event) and Audit databases as well as an Expert Mode required to restore a database.
- i. The Monitoring Settings Taskbar shall provide the following informational icons:
 - 1) Normal – Indicates by color and size that all databases are within their limits.
 - 2) Warning - Indicates by color and size that one or more databases have exceeded their Warning limit.
 - 3) Alarm - Indicates by color and size that one or more databases have exceeded their Alarm limit.
- j. The System shall provide user notification via Taskbar icons and e-mail messages when a database value has exceeded a warning or alarm limit.

12. Portable Operator Terminal

- a. For systems that do not provide full access to systems configuration and definition via the Browser Based user interface the BMS Contractor shall provide a portable operator terminal for programming purposes. The terminal shall be configured as follows:
 - 1) Personal Laptop Computer Manufacturer – Dell, Compaq or HP
 - 2) 16 GB RAM (8 GB minimum) – Windows 10
 - 3) 2.0 GHz Clock Speed Pentium 4 Microprocessor or higher
 - 4) 80 GB Hard Drive (40 GB minimum)
 - 5) (1) CD-ROM Drive, 32x speed
 - 6) (1) Serial (1) Parallel (2) USB ports
 - 7) 1 Keyboard with 83 keys (minimum).
 - 8) Integral 2 button Track Point or Track Ball.
 - 9) 10" SVGA 1024x768 resolution color display
 - 10) Two PCMCIA Type II or one Type III card slot
 - 11) Complete operator workstation software package, including any hardware or software.
 - 12) Original printed manuals for all software and peripherals.
 - 13) Original installation disks or CD for all software, device drivers, and peripherals
 - 14) Software registration cards for all included software shall be provided to the Owner.
 - 15) Carrying case
 - 16) Spare battery.
 - 17) External power supply/battery charger

13. Proprietary Portable Terminal

- a. Manufacturers providing proprietary portable terminals shall submit technical data sheets for the terminal and all associated software and hardware.
- b. The proprietary terminal shall meet the same operator interface software requirements as specified above.

14. Software

- a. Portable operator terminals shall support all controllers within the system on a direct-connect communications basis.
- b. When used to access First or Second Tier controllers, the portable operator terminal shall utilize the standard operator workstation software, as previously defined.
- c. When used to access Application Specific Controllers, the portable operator terminal shall utilize either the standard operator workstation software, as previously defined, or controller-specific utility software.

2.4 NETWORK AUTOMATION ENGINES (NAE)**A. Network Automation Engine**

1. The Network Automation Engine (NAE) shall be a fully user-programmable, supervisory controller. The NAE shall monitor the network of distributed application-specific controllers, provide global strategy and direction, and communicate on a peer-to-peer basis with other Network Automation Engines.
2. Automation network – The NAE shall reside on the automation network and shall support a subnet of system controllers.
3. User Interface – Each NAE shall have the ability to deliver a web based User Interface (UI) as previously described. All computers connected physically or virtually to the automation network shall have access to the web based UI.
 - a. The web based UI software shall be imbedded in the NAE. Systems that require a local copy of the system database on the user's personal computer are not acceptable.
 - b. The NAE shall support up a minimum of four (4) concurrent users.
 - c. The web based user shall have the capability to access all system data through one NAE.
 - d. Remote users connected to the network through an Internet Service Provider (ISP) or telephone dial up shall also have total system access through one NAE.
 - e. Systems that require the user to address more than one NAE to access all system information are not acceptable.
 - f. The NAE shall have the capability of generating web based UI graphics. The graphics capability shall be imbedded in the NAE.
 - g. Systems that support UI Graphics from a central database or require the graphics to reside on the user's personal computer are not acceptable.
 - h. The web based UI shall support the following functions using a standard version of Microsoft Internet Explorer:
 - 1) Configuration
 - 2) Commissioning
 - 3) Data Archiving
 - 4) Monitoring
 - 5) Commanding
 - 6) System Diagnostics
 - i. Systems that require workstation software or modified web browsers are not acceptable.
 - j. The NAE shall allow temporary use of portable devices without interrupting the normal operation of permanently connected modems.
 - k. Processor – The NAE shall be microprocessor-based with a minimum word size of 32 bits. The NAE shall be a multi-tasking, multi-user, and real-time digital control processor. Standard operating systems shall be employed. NAE size and capability shall be sufficient to fully meet the requirements of this Specification.
 - l. Memory – Each NAE shall have sufficient memory to support its own operating system, databases, and control programs, and to provide supervisory control for all control level devices.
 - m. Hardware Real Time Clock – The NAE shall include an integrated, hardware-based, real-time clock.
 - n. The NAE shall include troubleshooting LED indicators to identify the following conditions:

- 1) Power – On/Off
 - 2) Ethernet Traffic – Ethernet Traffic/No Ethernet Traffic
 - 3) Ethernet Connection Speed – 10 Mbps/100 Mbps/1000 Mbps
 - 4) FC Bus A – Normal Communications/No Field Communications
 - 5) FC Bus B – Normal Communications/No Field Communications
 - 6) Peer Communication – Data Traffic between NAE Devices
 - 7) Run – NAE Running/NAE in Startup/NAE Shutting Down/Software Not Running
 - 8) Bat Fault – Battery Defective, Data Protection Battery Not Installed
 - 9) 24 VAC – 24 VAC Present/Loss Of 24VAC
 - 10) Fault – General Fault
 - 11) Modem RX – NAE Modem Receiving Data
 - 12) Modem TX – NAE Modem Transmitting Data
- o. Communications Ports – The NAE shall provide the following ports for operation of operator Input/Output (I/O) devices, such as industry-standard computers, modems, and portable operator’s terminals.
- 1) Two (2) USB port
 - 2) Two (2) URS-232 serial data communication port
 - 3) Two (2) RS-485 port
 - 4) One (1) Ethernet port
- p. Diagnostics – The NAE shall continuously perform self-diagnostics, communication diagnosis, and diagnosis of all panel components. The Network Automation Engine shall provide both local and remote annunciation of any detected component failures, low battery conditions, or repeated failures to establish communication.
- q. Power Failure – In the event of the loss of normal power, The NAE shall continue to operate for a user adjustable period of up to 10 minutes after which there shall be an orderly shutdown of all programs to prevent the loss of database or operating system software.
- 1) During a loss of normal power, the control sequences shall go to the normal system shutdown conditions. All critical configuration data shall be saved into Flash memory.
 - 2) Upon restoration of normal power and after a minimum off-time delay, the controller shall automatically resume full operation without manual intervention through a normal soft-start sequence.
- r. Certification – The NAE shall be listed by Underwriters Laboratories (UL).
- s. Controller network – The NAE shall support the following communication protocols on the controller network:
- t. The NAE shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
- 1) The NAE shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - 2) The NAE shall be tested and certified as a BACnet Building Controller (B-BC) using BACnet Protocol Revision 12 or higher.

- 3) A BACnet Protocol Implementation Conformance Statement shall be provided for the NAE.
- 4) The Conformance Statements shall be submitted 10 days prior to bidding.
 - (i) The NAE shall support a minimum of 100 control devices.

B. DDC System Controllers**1. Advanced Application Field Equipment Controller**

- a. The Field Equipment Controller (FEC) shall be a fully user-programmable, digital controller that communicates via BACnet MS/TP protocol or optionally via N2Open.
- b. The FAC shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - 1) The FAC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - 2) The FAC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - 3) A BACnet Protocol Implementation Conformance Statement shall be provided for the FAC.
 - 4) The Conformance Statement shall be submitted 10 days prior to bidding.
- c. The FAC shall employ a finite state control engine to eliminate unnecessary conflicts between control functions at crossover points in their operational sequences. Suppliers using non-state based DDC shall provide separate control strategy diagrams for all controlled functions in their submittals.
- d. Controllers shall be factory programmed with a continuous adaptive tuning algorithm that senses changes in the physical environment and continually adjusts loop tuning parameters appropriately. Controllers that require manual tuning of loops or perform automatic tuning on command only shall not be acceptable. The FAC shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
- e. The FAC shall include an integral real-time clock and support time-based tasks which enables these field controllers to monitor and control:
 - 1) Schedules
 - 2) Calendars
 - 3) Alarms
 - 4) Trends
- f. The FAC can continue time-based monitoring when offline for extended periods of time from a system network.
- g. The FAC can operate as a stand-alone controller in applications that do not require a networked supervisory device or for network applications where it is preferred to have the scheduling, alarming, and/or trending performed locally in the field controllers.

- h. The FAC shall include troubleshooting LED indicators to identify the following conditions:
 - 1) Power On
 - 2) Power Off
 - 3) Download or Startup in progress, not ready for normal operation
 - 4) No Faults
 - 5) Device Fault
 - 6) Field Controller Bus - Normal Data Transmission
 - 7) Field Controller Bus - No Data Transmission
 - 8) Field Controller Bus - No Communication
 - 9) Sensor-Actuator Bus - Normal Data Transmission
 - 10) Sensor-Actuator Bus - No Data Transmission
 - 11) Sensor-Actuator Bus - No Communication
- i. The FAC shall accommodate the direct wiring of analog and binary I/O field points.
- j. The FAC shall support the following types of inputs and outputs:
 - 1) Universal Inputs - shall be configured to monitor any of the following:
 - a) Analog Input, Voltage Mode
 - b) Analog Input, Current Mode
 - c) Analog Input, Resistive Mode
 - d) Binary Input, Dry Contact Maintained Mode
 - e) Binary Input, Pulse Counter Mode
 - 2) Binary Inputs - shall be configured to monitor either of the following:
 - a) Dry Contact Maintained Mode
 - b) Pulse Counter Mode
 - 3) Analog Outputs - shall be configured to output either of the following:
 - a) Analog Output, Voltage Mode
 - b) Analog Output, Current Mode
 - 4) Binary Outputs - shall output the following:
 - a) Line-voltage relay outputs
 - b) 24 VAC Triac
 - 5) Configurable Outputs - shall be capable of the following:
 - a) Analog Output, Voltage Mode
 - b) Binary Output Mode
- k. The FAC shall have the ability to reside on a Field Controller Bus (FC Bus).
- l. The FC Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard protocol SSPC-135, Clause 9.

- m. The FC Bus shall support communications between the FACs and the NAE.
 - n. The FC Bus shall also support Input/Output Module (IOM) communications with the FAC and with the NAE.
 - o. The FC Bus shall support a minimum of 100 IOMs and FACs in any combination.
 - p. The FC Bus shall operate at a maximum distance of 15,000 Ft. between the FAC and the furthest connected device.
 - q. The FAC shall have the ability to monitor and control a network of sensors and actuators over a Sensor-Actuator Bus (SA Bus).
 - 1) The SA Bus shall be a Master-Slave/Token-Passing (MS/TP) Bus supporting BACnet Standard Protocol SSPC-135, Clause 9.
 - 2) The SA Bus shall support a minimum of 10 devices per trunk.
 - 3) The SA Bus shall operate at a maximum distance of 1,200 Ft. between the FAC and the furthest connected device.
 - r. The FAC shall have the capability to execute complex control sequences involving direct wired I/O points as well as input and output devices communicating over the FC Bus or the SA Bus.
 - s. The FAC shall support, but not be limited to, the following applications:
 - t. Chilled water/central plant optimization applications including but not limited to:
 - 1) Selection and sequencing of up to eight chillers of different sizes
 - 2) Selection and sequencing of up to eight (each) primary and secondary chilled water pumps of varying pumping capacities
 - 3) Selection and sequencing of up to four heat exchangers, of different capacities
 - 4) A proven and documented central cooling plant optimization program that incorporates custom equipment efficiency profiles, without rewriting software code, in order to meet the building load using the least amount of energy as calculated.
 - 5) The use of advanced control algorithms that apply equipment specific parameters, including operational limits and efficiency profiles, in order to determine equipment start and runtime preferences
 - 6) Identification of the most efficient equipment combination and automatic control of state and speed of all necessary equipment to balance runtime, optimize timing and sequencing and ensure the efficiency and stability of the central cooling plant
 - 7) Control definition for the chiller plant in a single FAC, FEC, or NCE, as supported by available memory and point Input/Output (I/O), or capable of being split across multiple FACs, FECs, or NCEs
 - a) Heating central plant applications
 - b) Built-up air handling units for special applications
 - c) Terminal & package units
 - d) Special programs as required for systems control
2. The FAC shall support a Local Controller Display (DIS-1710) either as an integral part of the FAC or as a remote device communicating over the SA Bus.

- a. The Display shall use a BACnet Standard SSPC-135, clause 9 Master-Slave/Token-Passing protocol.
- b. The Display shall allow the user to view monitored points without logging into the system.
- c. The Display shall allow the user to view and change setpoints, modes of operation, and parameters.
- d. The Display shall provide password protection with user adjustable password timeout.
- e. The Display shall be menu driven with separate paths for:
 - 1) Input/Output
 - 2) Parameter/Setpoint
 - 3) Overrides
- f. The Display shall use easy-to-read English text messages.
- g. The Display shall allow the user to select the points to be shown and in what order.
- h. The Display shall support a back lit Liquid Crystal Display (LCD) with adjustable contrast and brightens and automatic backlight brightening during user interaction.
- i. The display shall be a minimum of 4 lines and a minimum of 20 characters per line
- j. The Display shall have a keypad with no more than 6 keys.
- k. The Display shall be panel mountable.

2.5 FIELD DEVICES

A. Input/Output Module

- 1. The Input/Output Module (IOM) provides additional inputs and outputs for use in the FEC.
- 2. The IOM shall communicate with the FEC over the FC Bus or the SA Bus.
- 3. The IOM shall support BACnet Standard MS/TP Bus Protocol ASHRAE SSPC-135, Clause 9 on the controller network.
 - a. The IOM shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - b. The IOM shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - c. A BACnet Protocol Implementation Conformance Statement shall be provided for the FEC.
 - d. The Conformance Statement shall be submitted 10 days prior to bidding.
 - 1) The IOM shall be assembled in a plenum-rated plastic housing with flammability rated to UL94-5VB.
 - 2) The IOM shall have a minimum of 4 points to a maximum of 17 points.
 - 3) The IOM shall support the following types of inputs and outputs:
 - e. Universal Inputs - shall be configured to monitor any of the following:

- 1) Analog Input, Voltage Mode
 - 2) Analog Input, Current Mode
 - 3) Analog Input, Resistive Mode
 - 4) Binary Input, Dry Contact Maintained Mode
 - 5) Binary Input, Pulse Counter Mode
- f. Binary Inputs - shall be configured to monitor either of the following:
- 1) Dry Contact Maintained Mode
 - 2) Pulse Counter Mode
- g. Analog Outputs - shall be configured to output either of the following
- 1) Analog Output, Voltage Mode
 - 2) Analog Output, current Mode
- h. Binary Outputs - shall output the following:
- 1) 24 VAC Triac
- i. Configurable Outputs - shall be capable of the following:
- 1) Analog Output, Voltage Mode
 - 2) Binary Output Mode
4. The IOM shall include troubleshooting LED indicators to identify the following conditions:
- a. Power On
 - b. Power Off
 - c. Download or Startup in progress, not ready for normal operation
 - d. No Faults
 - e. Device Fault
 - f. Normal Data Transmission
 - g. No Data Transmission
 - h. No Communication
5. Network Thermostat
- a. The network thermostat shall be capable of controlling two- or four-pipe fan coils, cabinet unit heaters, a pressure dependent Variable Air Volume System, zoning type systems employing reheat including local hydronic reheat valves, or other similar equipment.
 - b. The Networked Thermostat shall communicate over the FC Bus using BACnet Standard protocol SSPC-135.
 - 1) Communications shall be selectable locally at thermostat through the display
 - c. The TEC shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.

- 1) The TEC shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - 2) A BACnet Protocol Implementation Conformance Statement shall be provided for the TEC.
 - 3) The Conformance Statement shall be submitted 10 days prior to bidding.
- d. The network thermostat shall include a 4.2 inch LED backlit touch screen with the following configurable icons.
- e. Home screen configurable icons include
- 1) On/Off icon
 - 2) Fan override icon
 - 3) Zone temperature icon
 - 4) Hold temperature icon
 - 5) Zone humidity (on applicable models) icon
 - 6) Occupancy status (on applicable models) icon
 - 7) Temperature setpoint icon
 - 8) Alarm icon
 - 9) Unit status icon
 - 10) Date/Time icon
 - 11) Fan override icon
- f. Home screen non-configurable icon includes
- 1) Menu icon
6. The network thermostat shall provide the flexibility to support any one of the following inputs:
- a. Integral indoor air temperature sensor
 - b. Analog input for remote air temperature sensing that supports the following sensor types
 - 1) Nickel
 - 2) Platinum
 - 3) A99B PENN
 - 4) 2.25k ohm NTC
 - 5) 10k ohm NTC
 - 6) 10k ohm NTC Type 3
 - c. Universal input that supports the following configurations
 - 1) Analog sensor
 - 2) Cooling when switch is closed
 - 3) Heating when switch is closed
 - d. Remote indoor air temperature sensor
 - e. Two configurable binary inputs with the following configurations
 - 1) Disabled

- 2) Occupancy
 - 3) Override
 - 4) Remote PIR
 - 5) Dirty filter
 - 6) Service
 - 7) Fan Lock
 - 8) Open door
 - 9) Open window
- f. The network thermostat shall provide the flexibility to support any one of the following fan outputs:
- 1) Three speed fan control
 - 2) Proportional speed fan control configurable from 0 to 10V
- g. The network thermostat shall provide the flexibility to support any one of the following valve outputs:
- 1) Two on/off
 - 2) Two floating
- h. The network thermostat shall provide 4 digit passcode security
- i. The network thermostat shall provide the flexibility to adjust the following control parameters:
- 1) Adjustable maximum setpoint offset from 0 to 20°F
 - 2) Adjustable fan on delay from 0 to 120 seconds
 - 3) Adjustable fan off delay from 0 to 120 seconds
 - 4) Adjustable minimum cooling on time from 0 to 360 seconds
 - 5) Adjustable minimum cooling off time from 0 to 360 seconds
 - 6) Adjustable minimum heating on time from 0 to 360 seconds
 - 7) Adjustable minimum heating off time from 0 to 360 seconds
 - 8) Adjustable minimum reheat on time from 0 to 360 seconds
 - 9) Adjustable minimum reheat off time from 0 to 360 seconds
 - 10) Adjustable stroke time from 5 to 300 seconds
 - 11) Adjustable supply fan minimum command from 0 to 100%
 - 12) Adjustable supply fan Medium command from 0 to 100%
 - 13) Adjustable supply fan high command from 0 to 100%
 - 14) Adjustable reheat minimum damper position from 0 to 100%
- j. Where required by application and indicated on plans or room schedules provide the network thermostat with an integral Passive Infra-Red (PIR) occupancy sensor models.
- k. Where required by application and indicated on plans or room schedules provide the network thermostat with an integral relative humidity sensor model.
- l. The network thermostat shall employ nonvolatile electrically erasable programmable read-only memory (EEPROM) for all adjustable parameters.
- m. The network thermostat shall have a temperature accuracy of $\pm 0.9\text{F}^\circ/\pm 0.5\text{C}^\circ$ at 70.0°F/21.0°C typical calibrated

- n. The network thermostat shall have a humidity accuracy of $\pm 5\%$ RH from 20 to 80% RH at 50 to 90°F (10 to 32°C)
- o. The network thermostat shall provide user equipment visibility from a mobile device through the Mobil Access Portal (MAP) release 4.0 or later.

B. VAV Modular Assembly

- 1. The VAV Modular Assembly shall provide both standalone and networked direct digital control of pressure-independent, variable air volume terminal units. It shall address both single and dual duct applications.
- 2. The VMA shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - a. The VMA shall be tested and certified as a BACnet Application Specific Controller (B-ASC).
 - b. A BACnet Protocol Implementation Conformance Statement shall be provided for the VMA.
- 3. The VAV Modular Assembly shall communicate over the Field Controller Bus (FC Bus) using BACnet Standard protocol SSPC-135, Clause 9.
- 4. The VAV Modular Assembly shall have internal electrical isolation for AC power, DC inputs, and MS/TP communications. An externally mounted isolation transformer shall not be acceptable.
- 5. The VAV Modular Assembly shall be a configurable digital controller with integral differential pressure transducer and damper actuator. All components shall be connected and mounted as a single assembly that can be removed as one piece.
- 6. Inputs:
 - a. Analog inputs with user defined ranges shall monitor the following analog signals, without the addition of equipment outside the terminal controller cabinet:
 - 1) 0-10 VDC Sensors
 - 2) 1000ohm RTDs
 - 3) NTC Thermistors
 - b. Binary inputs shall monitor dry contact closures. Input shall provide filtering to eliminate false signals resulting from input "bouncing."
 - c. For noise immunity, the inputs shall be internally isolated from power, communications, and output circuits.
 - d. Provide side loop application for humidity control.
- 7. Outputs
 - a. Analog outputs shall provide the following control outputs:
 - 1) 0-10 VDC
 - b. Binary outputs shall provide a SPST Triac output rated for 500mA at 24 VAC.
 - c. For noise immunity, the outputs shall be internally isolated from power, communications, and other output circuits.

d. Application Configuration

- 1) The VAV Modular Assembly shall be configured with a software tool that provides a simple Question/Answer format for developing applications and downloading.

e. Sensor Support

- 1) The VAV Modular Assembly shall communicate over the Sensor-Actuator Bus (SA Bus) with a Network Sensor.
- 2) The VMA shall support an LCD display room sensor.
- 3) The VMA shall also support standard room sensors as defined by analog input requirements.
- 4) The VMA shall support humidity sensors defined by the AI side loop.

C. Network Sensors

1. The Network Sensors (NS) shall have the ability to monitor the following variables as required by the systems sequence of operations:
 - a. Zone Temperature
 - b. Zone Humidity
 - c. Zone Setpoint
 - d. Discharge Air Temperature
 - e. Zone CO2
2. The NS shall transmit the information back to the controller on the Sensor-Actuator Bus (SA Bus) using BACnet Standard protocol SSPC-135, Clause 9.
3. The NS shall be BACnet Testing Labs (BTL) certified and carry the BTL Label.
 - a. The NS shall be tested and certified as a BACnet Smart Sensors (B-SS).
 - b. A BACnet Protocol Implementation Conformance Statement shall be provided for the NS.
 - c. The Conformance Statement shall be submitted 10 days prior to bidding.
4. The Network Zone Temperature Sensors shall include the following items:
 - a. A backlit Liquid Crystal Display (LCD) to indicate the Temperature, Humidity and Setpoint
 - b. An LED to indicate the status of the Override feature
 - c. A button to toggle the temperature display between Fahrenheit and Celsius
 - d. A button to program the display for temperature or humidity
 - e. A button to initiate a timed override command
 - f. Available in either surface mount, wall mount, or flush mount
 - g. Available with either screw terminals or phone jack
5. The Network Discharge Air Sensors shall include the following:
 - a. 4 inch or 8 inch duct insertion probe
 - b. 10 foot pigtail lead
 - c. Dip Switches for programmable address selection

- d. Ability to provide an averaging temperature from multiple locations
 - e. Ability to provide a selectable temperature from multiple locations
6. The Network CO2 Zone Sensors shall include the following:
- a. Available in either surface mount or wall mount
 - b. Available with screw terminals or phone jack
7. Many-To-One Wireless Room Temperature Sensor System

2.6 SYSTEM TOOLS

A. System Configuration Tool (SCT)

- 1. The Configuration Tool shall be a software package enabling a computer platform to be used as a stand-alone engineering configuration tool for a Network Automation Engine (NAE) or a Network Integration Engine (NIE).
- 2. The configuration tool shall provide an archive database for the configuration and application data.
- 3. The configuration tool shall have the same look-and-feel at the User Interface (UI) regardless of whether the configuration is being done online or offline.
- 4. The configuration tool shall include the following features:
 - a. Basic system navigation tree for connected networks
 - b. Integration of BACnet enabled devices
 - c. Customized user navigation trees
 - d. Point naming operating parameter setting
 - e. Graphic diagram configuration
 - f. Alarm and event message routing
 - g. Graphical logic connector tool for custom programming
 - h. Downloading, uploading, and archiving databases
- 5. The configuration tool shall have the capability to automatically discover field devices on connected buses and networks. Automatic discovery shall be available for the following field devices:
 - a. BACnet Devices
- 6. The configuration tool shall be capable of programming the Field Equipment Controllers.
 - a. The configuration tool shall provide the capability to configure, simulate, and commission the Field Equipment Controllers.
 - b. The configuration tool shall allow the FECs to be run in Simulation Mode to verify the applications.
 - c. The configuration tool shall contain a library of standard applications to be used for configuration.
- 7. The configuration tool shall be capable of programming the field devices.

- a. The configuration tool shall provide the capability to configure, simulate, and commission the field devices.
 - b. The configuration tool shall allow the field devices to be run in Simulation Mode to verify the applications.
 - c. The configuration tool shall contain a library of standard applications to be used for configuration
8. A wireless access point shall allow a wireless enabled portable PC to make a temporary Ethernet connection to the automation network.
- a. The wireless connection shall allow the PC to access configuration tool through the web browser using the User Interface (UI).
 - b. The wireless use of configuration tool shall be the same as a wired connection in every respect.
 - c. The wireless connection shall use the Bluetooth Wireless Technology.
- B. Handheld VAV Balancing Sensor (ATV7003)
1. The sensor shall be a light weight portable device of dimensions not more than 3.2 x 3.2 x 1.0 inches.
 2. The sensor shall be capable of displaying data and setting balancing parameters for VAV control applications.
 3. The sensor shall be powered through a connection to either the Sensor-Actuator (SA) or the Field Controller (FC) Bus.
 4. The sensor shall be a menu driven device that shall modify itself automatically depending upon what type of application resides in the controller.
 5. The sensor shall contain a dial and two buttons to navigate through the menu and to set balancing parameters.
 6. The sensor shall provide an adjustable time-out parameter that will return the controller to normal operation if the balancing operation is aborted or abandoned.
 7. The sensor shall include the following
 - a. 5 foot retractable cable
 - b. Laminated user guide
 - c. Nylon carrying case
 8. The sensor shall be Underwriters Laboratory UL 916 listed and CSA certified C22.2 N. 205, CFR47.

2.7 INPUT DEVICES

A. General Requirements

1. Installation, testing, and calibration of all sensors, transmitters, and other input devices shall be provided to meet the system requirements.

B. Temperature Sensors

1. General Requirements:

- a. Sensors and transmitters shall be provided, as outlined in the input/output summary and sequence of operations.
- b. The temperature sensor shall be of the resistance type, and shall be either two-wire 1000 ohm nickel RTD, or two-wire 1000 ohm platinum RTD.
- c. The following point types (and the accuracy of each) are required, and their associated accuracy values include errors associated with the sensor, lead wire, and A to D conversion:

Point Type	Accuracy
Chilled Water	$\pm .5^{\circ}\text{F.}$
Room Temp	$\pm .5^{\circ}\text{F.}$
Duct Temperature	$\pm .5^{\circ}\text{F.}$
All Others	$\pm .75^{\circ}\text{F.}$

C. Room Temperature Sensors

- 1. Room sensors shall be constructed for either surface or wall box mounting.
- 2. Room sensors shall have the following options when specified:
 - a. Setpoint warmer/cooler dial or reset slide switch providing a +3 degree (adjustable) range.
 - b. Individual heating/cooling setpoint slide switches.
 - c. A momentary override request push button for activation of after-hours operation.
 - d. Analog thermometer.

D. Room Temperature Sensors with Integral Display

- 1. Room sensors shall be constructed for either surface or wall box mounting.
- 2. Room sensors shall have an integral LCD display and either a setpoint adjustment dial or setpoint adjustment push buttons, and the following capabilities when specified:
 - a. Display room air temperatures.
 - b. Display and adjust room comfort setpoint.
 - c. Display and adjust fan operation status via push button.
 - d. Override request via Occupancy Override push button with LED status for activation of after-hours operation.
 - e. Override request via setpoint adjustment dial or setpoint adjustment push buttons for activation of after-hours operation.
 - f. Occupancy sensor
 - g. F/C toggle pushbutton to toggle between F and C.
 - h. RH%/Temperature toggle push button to temporarily display RH%

E. Thermo Wells

- 1. Thermowell manufacturer shall have models available in stainless steel, brass body, and copper bulb.

2. When thermo wells are required, the sensor and well shall be supplied as a complete assembly, including wellhead and sensor.
3. Thermo wells shall be pressure rated and constructed in accordance with the system working pressure.
4. Thermo wells and sensors shall be mounted in a direct mount (no adapter) offering faster installation or 1/2" NPT saddle and allow easy access to the sensor for repair or replacement.
5. Thermo wells constructed of 316 stainless steel shall comply with Canadian Registration Number (CRN) pressure vessel rating.

F. Outside Air Sensors

1. Outside air sensors shall be designed to withstand the environmental conditions to which they will be exposed. They shall also be provided with a solar shield.
2. Sensors exposed to wind velocity pressures shall be shielded by a perforated plate that surrounds the sensor element.
3. Temperature transmitters shall be of NEMA 3R (IP54) or NEMA 4 (IP65) construction and rated for ambient temperatures.
4. The outdoor sensor can be easily mounted on a roof, pole or side of a building utilizing its already assembled mounting bracket.
5. Outside Relative Humidity sensors 0-100% full range of accurate measurement. Operating temperature -4 to 140F (-20 to 60C).
6. Outside temperature sensors operating temperature range is -40 to 140F, +/- .55F (+/- .3C).

G. Duct Mount Sensors

1. Duct mount sensors shall mount in an electrical box through a hole in the duct, and be positioned so as to be easily accessible for repair or replacement.
2. Duct sensors shall be insertion type and constructed as a complete assembly, including lock nut and mounting plate.
3. For outdoor air duct applications, a weatherproof mounting box with weatherproof cover and gasket shall be used.

H. Averaging Sensors

1. For ductwork greater in any dimension that 48 inches and/or where air temperature stratification exists, an averaging sensor with multiple sensing points shall be used.
2. For plenum applications, such as mixed air temperature measurements, a continuous averaging sensor or a string of sensors mounted across the plenum shall be used to account for stratification and/or air turbulence. The averaging string shall have a minimum of 4 sensing points per 12-foot long segment.
3. Capillary supports at the sides of the duct shall be provided to support the sensing string.

I. Acceptable Manufacturers: Johnson Controls, Minco.

1. Note: Include others, as appropriate.

J. Humidity Sensors

1. The sensor shall be a solid-state type, relative humidity sensor of the Thin Film Capacitance or Bulk Polymer Design. The sensor element shall resist service contamination.
2. The humidity transmitter shall be equipped with non-interactive span and zero adjustments, a 2-wire isolated loop powered, 4-20 mA, 0-100% linear proportional output.
3. The humidity transmitter shall meet the following overall accuracy, including lead loss and Analog to Digital conversion. 3% between 20% and 80% RH @ 77 Deg F unless specified elsewhere.
4. Outside air relative humidity sensors shall be installed with a rain proof, perforated cover. The transmitter shall be installed in a NEMA 3R (IP54) or NEMA 4 (IP65) enclosure with sealtite fittings.
5. A single point humidity calibrator shall be provided, if required, for field calibration. Transmitters shall be shipped factory pre-calibrated.
6. Duct type sensing probes shall be constructed of 304 stainless steel, and shall be equipped with a neoprene grommet, bushings, and a mounting bracket.
7. Acceptable Manufacturers: Johnson Controls and Vaisala.

K. CO2 Sensors

1. Where shown on the drawings, CO2 sensors shall have the following features:
 - a. Jumper selectable: 0-20mA, 4-20mA & 0-10VDC output
 - b. Liquid Crystal Display
2. The CO2 sensors shall have the ability to monitor and output the following variables as required by the systems sequence of operations:
 - a. Zone carbon-dioxide
3. The CO2 shall transmit the information back to the controller via jumper selectable 0-20mA, 4-20mA & 0-10VDC output signals.
 - a. The CO2 sensors shall provide a maximum output current of 25mA; Maximum output voltage of 12.5V.
 - b. The CO2 sensors shall be FCC compliant to CFR47 Part 15 subpart B Class A.
4. The CO2 Sensors shall be available with
 - a. CO2 reponse time (0-63%) of 1 minute
 - b. Less than 0.083% of full scale/F° temperature dependence of CO2 output
 - c. Long term CO2 stability $\pm 5\%$ of full scale for 5 years
 - d. CO2 measurement accuracy of $\pm(40\text{ppm} + 2.0\%$ of reading)
 - e. CO2 non-linearity of less than 1.0% of full scale
5. The CO2 Sensors may include the following items :
 - a. Relay output module
 - b. Liquid Crystal Display module
 - c. Analog temperature module with linear 0-10VDC output for 32-122F

L. Differential Pressure Transmitters**1. General Air and Water Pressure Transmitter Requirements:**

- a. Pressure transmitters shall be constructed to withstand 100% pressure over-range without damage, and to hold calibrated accuracy when subject to a momentary 40% over-range input.
- b. Pressure transmitters shall transmit a 0 to 5 VDC, 0 to 10 VDC, or 4 to 20 mA output signal.
- c. Differential pressure transmitters used for flow measurement shall be sized to the flow sensing device, and shall be supplied with Tee fittings and shut-off valves in the high and low sensing pick-up lines to allow the balancing Contractor and Owner permanent, easy-to-use connection.
- d. A minimum of a NEMA 1 housing shall be provided for the transmitter. Transmitters shall be located in accessible local control panels wherever possible.

2. Low Differential Water Pressure Applications (0" - 20" w.c.)

- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of flow meter differential pressure or water pressure sensing points.
- b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - c. .01-20" w.c. input differential pressure range.
 - d. 4-20 mA output.
 - e. Maintain accuracy up to 20 to 1 ratio turndown.
 - f. Reference Accuracy: +0.2% of full span.
 - g. Acceptable Manufacturers: Setra and Mamac.

3. Medium to High Differential Water Pressure Applications (Over 21" w.c.)

- a. The differential pressure transmitter shall meet the low pressure transmitter specifications with the following exceptions:
 - 1) Differential pressure range 10" w.c. to 300 PSI.
 - 2) Reference Accuracy: +1% of full span (includes non-linearity, hysteresis, and repeatability).
- b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
- c. Acceptable Manufacturers: Setra and Mamac.

4. Building Differential Air Pressure Applications (-1" to +1" w.c.)

- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - 1) -1.00 to +1.00 w.c. input differential pressure ranges. (Select range appropriate for system application)
 - 2) 4-20 mA output.
 - 3) Maintain accuracy up to 20 to 1 ratio turndown.
 - 4) Reference Accuracy: +0.2% of full span.
 - 5) Acceptable Manufacturers: Johnson Controls
5. Low Differential Air Pressure Applications (0" to 2.5" w.c.)
- a. The differential pressure transmitter shall be of industrial quality and transmit a linear, 4 to 20 mA output in response to variation of differential pressure or air pressure sensing points.
 - b. The differential pressure transmitter shall have non-interactive zero and span adjustments that are adjustable from the outside cover and meet the following performance specifications:
 - 1) (0.00 - 1.00" to 5.00") w.c. input differential pressure ranges. (Select range appropriate for system application.)
 - 2) 4-20 mA, 0-5 VDC, 0-10 VDC, output.
 - 3) Maintain accuracy up to 20 to 1 ratio turndown.
 - 4) Reference Accuracy: +0.25%, or 0.5% of full span.
 - c. Acceptable Manufacturers: Johnson Controls and Ruskin.
6. Medium Differential Air Pressure Applications (5" to 21" w.c.)
- a. The pressure transmitter shall be similar to the Low Air Pressure Transmitter, except that the performance specifications are not as severe. Differential pressure transmitters shall be provided that meet the following performance requirements:
 - 1) Zero & span: (c/o F.S./Deg. F): .04% including linearity, hysteresis and repeatability.
 - 2) Accuracy: 1% F.S. (best straight line) Static Pressure Effect: 0.5% F.S. (to 100 PSIG.
 - 3) Thermal Effects: <+.033 F.S./Deg. F. over 40°F. to 100°F. (calibrated at 70°F.).
 - b. Standalone pressure transmitters shall be mounted in a bypass valve assembly panel. The panel shall be constructed to NEMA 1 standards. The transmitter shall be installed in the panel with high and low connections piped and valved. Air bleed units, bypass valves, and compression fittings shall be provided.
 - c. Acceptable manufacturers: Johnson Controls and Ruskin.

M. Flow Monitoring

1. Air Flow Monitoring

a. Fan Inlet Air Flow Measuring Stations

- 1) At the inlet of each fan and near the exit of the inlet sound trap, airflow sensors shall be provided that shall continuously monitor the fan air volumes or velocity pressure.
- 2) Each sensor shall be surface mount type. Unit shall be capable of monitoring and reporting the airflow and temperature at each fan inlet location through two or four sensing circuits. If a static pressure manifold is used, it shall incorporate dual offset static tips on the opposing sides of the averaging manifold so as to be insensitive to flow-angle variations of as much as + 20° in the approaching air stream.
- 3) Devices creating fan performance degradation, resulting in additional energy consumption, caused from pressure drop associated with probes or mounting apparatus in the center of the fan inlet are not allowed. The device shall not induce a significant pressure drop, nor shall the sound level within the duct be amplified by its singular or multiple presence in the air stream. Sensor circuit casings shall be constructed of U.L. 94 flame rated, high impact ABS and include a stainless steel thermistor cap that maintains the precise calibrated flow over the heated and ambient measurement points. Each sensor circuit shall consist of two ceramic base, glass encapsulated, thermistors for measuring ambient temperature and velocity. Circuit shall be designed for operation in a wide range of environments, including high humidity (non-condensing) and rapid thermal cycling.
- 4) Acceptable manufacturers are: Johnson Controls or Ebtron Models GTC116P+ or GTC108-F

2. Single Probe Air Flow Measuring Sensor

- a. The single probe airflow-measuring sensor shall be duct mounted with an adjustable sensor insertion length of up to eight inches. The transmitter shall produce a 4-20 mA or 0-10 VDC signal linear to air velocity. The sensor shall be a thermal dispersion and utilize one temperature sensor and a heated thermistor. The sensor pair shall measure the air temperature and airflow velocity.

3. Duct Air Flow Measuring Stations

- a. Furnish and install, at locations shown on plans or as in accordance with schedules, an equalized air measuring probe system piped to a high performance pressure transducer or an electronic type airflow temperature measuring station.
- b. Each device shall be designed and built to comply with, and provide results in accordance with, accepted practice as defined for system testing in the ASHRAE Handbook of fundamentals, as well as in the Industrial Ventilation Handbook.

- c. Assembly shall be AMCA tested and capable of measuring a range from 70 to 5,000 FPM (22 to 1524 MPM).
- d. Equalized air measuring assembly shall measure to $\pm 3\%$ average and consist of 6063T5 extruded aluminum step sensing blade(s) with anodized finish, plenum-rated polyethylene pressure tubing, brass barbed fittings, mounting hardware and a glass-on-silicone capacitance sensor pressure transducer capable of measuring up to five field-selectable pressure ranges up to 2.5 in. w.c.
- e. The transducer shall be accurate to $\pm 0.5\%$, or 0.25% of full scale and be contained in a National Electrical Manufacturer's Association (NEMA) 4 (IP-65) enclosure. Transducer shall be factory mounted and piped to high and low pressure ports through fittings made of brass.
- f. All sensor tubing shall terminate in solid brass barbed fittings.
- g. Total and static pressure manifolds shall terminate with external ports for connection to control tubing. An identification label shall be placed on each unit casing, listing model number, size, area, and specified airflow capacity.
- h. Air straightener shall be provided for sizes over 17 square feet (1.6 sq meter).
- i. Airflow measuring station assemblies shall be fabricated of galvanized steel or aluminum casing of appropriate thickness for slip fits or with 90 Deg. connecting flanges in configuration and size equal to that of the duct into which it is mounted. Each station shall be complete with an air directionalizer and parallel cell profile suppressor (3/4" maximum cell) across the entering air stream and mechanically fastened to the casing in such a way to withstand velocities up to 5000 feet per minute. This air directionalizer and parallel cell honeycomb suppressor shall provide 98% free area, and eliminate turbulent and rotational flow from the air stream prior to the measuring point.
- j. Equalized air measuring probe assemblies shall be, in all respects, equivalent to Johnson Controls® AD-1250 or AD-1251 airflow measuring systems.
- k. Electronic air measuring station shall be capable of monitoring and reporting the airflow and temperature at each measuring location through one or more measuring probes containing multiple sensor points and a control transmitter that outputs a 4-20 mA linear signal.
- l. Probe(s) shall be constructed of an airfoil shaped aluminum extrusion containing the sensor circuit(s).
- m. Each sensor circuit shall consist of coated thermistors, for temperature and velocity, mounted to a Printed Circuit Board (PCB).
- n. Probe multiplexer circuit(s) shall include a microprocessor that collects data from each PCB and digitally communicates the average airflow and temperature of each probe to a microprocessor based control transmitter.
- o. Multiplexer board shall be encased to prevent moisture damage.
- p. Shielded CAT5e communications cable shall be Underwriters Laboratories Inc.® (UL) plenum-rated with RJ45 terminal connectors. Dust boot covers and gold-plated contacts shall link probes to electronic controller.
- q. Control transmitter shall be capable of processing independent sensing points and shall operate on a fused 24 VAC supply.
- r. Control transmitter shall feature a 16 x 2 character alphanumeric LCD screen, digital offset/gain adjustment, continuous performing sensor/transmitter diagnostics, and a visual alarm to detect malfunctions.

- s. All electronic components of the assembly shall be Restriction of Hazardous Substances (RoHS) Directive compliant.
- t. Equal to Johnson Controls AD-1252
- u. Installation Considerations
 - 1) The maximum allowable pressure loss through the Flow and Static Pressure elements shall not exceed .04" w.c. at 1000 feet per minute, or .11" w.c. at 2000 feet per minute. Each unit shall measure the airflow rate within an accuracy of plus 3-5% as determined by AMCA.
 - 2) Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct. Station flanges shall be 1.5 inches to facilitate matching connecting ductwork.
 - 3) Where control dampers are shown as part of the airflow measuring station, parallel blade precision controlled volume dampers integral to the station and complete with actuator, and linkage shall be provided.
 - 4) Stations shall be installed in strict accordance with the manufacturer's published requirements, and in accordance with ASME Guidelines affecting non-standard approach conditions.
 - a) All air measuring devices shall be tested according to AMCA Standard 610
 - b) Acceptable manufacturers: Johnson Controls, Air Monitor Corp., Tek-Air, Ruskin, and Dietrich Standard.

4. Static Pressure Traverse Probe

- a. Duct static traverse probes shall be provided where required to monitor duct static pressure. The probe shall contain multiple static pressure sensors located along exterior surface of the cylindrical probe.
- b. Acceptable manufacturers: Cleveland Controls

5. Shielded Static Air Probe

- a. A shielded static pressure probe shall be provided at each end of the building. The probe shall have multiple sensing ports, an impulse suppression chamber, and airflow shielding. A suitable probe for indoor and outdoor locations shall be provided.
- b. Water Flow Monitoring
 - 1) Water flow meters shall be electromagnetic type with integral microprocessor-Based electronics. The meter shall have an accuracy of 0.25%.
 - 2) Acceptable manufacturers: Onicon

N. Power Monitoring Devices

1. Current Measurement (Amps)

- a. Current measurement shall be by a combination current transformer and a current transducer. The current transformer shall be sized to reduce the full

amperage of the monitored circuit to a maximum 5 Amp signal, which will be converted to a 4-20 mA DDC compatible signal for use by the Facility Management System.

- b. Current Transformer – A split core current transformer shall be provided to monitor motor amps.
 - 1) Operating frequency – 50 - 400 Hz.
 - 2) Insulation – 0.6 Kv class 10Kv BIL.
 - 3) UL recognized.
 - 4) Five amp secondary.
 - 5) Select current ration as appropriate for application.
 - 6) Acceptable manufacturers: Setra

- c. Current Transducer – A current to voltage or current to mA transducer shall be provided. The current transducer shall include:
 - 1) 6X input over amp rating for AC inrushes of up to 120 amps.
 - 2) Manufactured to UL 1244.
 - 3) Accuracy: +.5%, Ripple +1%.
 - 4) Minimum load resistance 30kOhm.
 - 5) Input 0-20 Amps.
 - 6) Output 4-20 mA.
 - 7) Transducer shall be powered by a 24VDC regulated power supply (24 VDC +5%).
 - 8) Acceptable manufacturers: Setra

O. Smoke Detectors

- 1. Ionization type air duct detectors shall be furnished as specified elsewhere in Division 28 for installation under Division 23. All wiring for air duct detectors shall be provided under Division 28, Fire Alarm System.

P. Status and Safety Switches

- 1. General Requirements
 - a. Switches shall be provided to monitor equipment status, safety conditions, and generate alarms at the BMS when a failure or abnormal condition occurs. Safety switches shall be provided with two sets of contacts and shall be interlock wired to shut down respective equipment.

- 2. Current Sensing Switches
 - a. The current sensing switch shall be self-powered with solid-state circuitry and a dry contact output. It shall consist of a current transformer, a solid state current sensing circuit, adjustable trip point, solid state switch, SPDT relay, and an LED indicating the on or off status. A conductor of the load shall be passed through the window of the device. It shall accept over-current up to twice its trip point range.
 - b. Current sensing switches shall be used for run status for fans, pumps, and other miscellaneous motor loads.

- c. Current sensing switches shall be calibrated to show a positive run status only when the motor is operating under load. A motor running with a broken belt or coupling shall indicate a negative run status.
 - d. Acceptable manufacturers: Johnson Controls
- 3. Air Filter Status Switches
 - a. Differential pressure switches used to monitor air filter status shall be of the automatic reset type with SPDT contacts rated for 2 amps at 120VAC.
 - b. A complete installation kit shall be provided, including: static pressure tops, tubing, fittings, and air filters.
 - c. Provide appropriate scale range and differential adjustment for intended service.
 - d. Acceptable manufacturers: Johnson Controls, Cleveland Controls
- 4. Air Flow Switches
 - a. Differential pressure flow switches shall be bellows actuated mercury switches or snap acting micro-switches with appropriate scale range and differential adjustment for intended service.
 - b. Acceptable manufacturers: Johnson Controls, Cleveland Controls
- 5. Air Pressure Safety Switches
 - a. Air pressure safety switches shall be of the manual reset type with SPDT contacts rated for 2 amps at 120VAC.
 - b. Pressure range shall be adjustable with appropriate scale range and differential adjustment for intended service.
 - c. Acceptable manufacturers: Johnson Controls, Cleveland Controls
- 6. Water Flow Switches
 - a. Water flow switches shall be equal to the Johnson Controls P74.
- Q. Low Temperature Limit Switches
 - 1. The low temperature limit switch shall be of the manual reset type with Double Pole/Single Throw snap acting contacts rated for 16 amps at 120VAC.
 - 2. The sensing element shall be a minimum of 15 feet in length and shall react to the coldest 18-inch section. Element shall be mounted horizontally across duct in accordance with manufacturers recommended installation procedures.
 - 3. For large duct areas where the sensing element does not provide full coverage of the air stream, additional switches shall be provided as required to provide full protection of the air stream.
 - 4. The low temperature limit switch shall be equal to Johnson Controls A70.
- R. Control Relays
 - 1. Control Pilot Relays

- a. Control pilot relays shall be of a modular plug-in design with retaining springs or clips.
 - b. Mounting Bases shall be snap-mount.
 - c. DPDT, 3PDT, or 4PDT relays shall be provided, as appropriate for application.
 - d. Contacts shall be rated for 10 amps at 120VAC.
 - e. Relays shall have an integral indicator light and check button.
 - f. Acceptable manufacturers: Johnson Controls, Relay In Box (RIB)
2. Lighting Control Relays
- a. Lighting control relays shall be latching with integral status contacts.
 - b. Contacts shall be rated for 20 amps at 277 VAC.
 - c. The coil shall be a split low-voltage coil that moves the line voltage contact armature to the ON or OFF latched position.
 - d. Lighting control relays shall be controlled by:
 - 1) Pulsed Tri-state Output – Preferred method.
 - 2) Pulsed Paired Binary Outputs.
 - 3) A Binary Input to the Facility Management System shall monitor integral status contacts on the lighting control relay. Relay status contacts shall be of the “dry-contact” type.
 - e. The relay shall be designed so that power outages do not result in a change-of-state, and so that multiple same state commands will simply maintain the commanded state. Example: Multiple OFF command pulses shall simply keep the contacts in the OFF position.

S. Electronic Signal Isolation Transducers

1. A signal isolation transducer shall be provided whenever an analog output signal from the BMS is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input signal from a remote system.
2. The signal isolation transducer shall provide ground plane isolation between systems.
3. Signals shall provide optical isolation between systems.
4. Acceptable manufacturers: Advanced Control Technologies

T. Thermostats

1. Electric room thermostats of the heavy-duty type shall be provided for unit heaters, cabinet unit heaters, and ventilation fans, where required. All these items shall be provided with concealed adjustment. Finish of covers for all room-type instruments shall match and, unless otherwise indicated or specified, covers shall be manufacturer’s standard finish.

2.8 OUTPUT DEVICES

A. Actuators and Operators

1. General Requirements
 - a. Damper and valve actuators shall be electronic and/or pneumatic, as specified in the System Description section.
 - b. The manufacturer shall be ISO 9001 certified.

- B. Electronic Damper Actuators
 1. Spring Return Actuators:
 - a. Manufactured, brand labeled or distributed by Johnson Controls, Inc. or approved equivalent.
 - b. Regulatory Agency Listing: cULus ,CSA C22.2 No. 24-93, and CE marked
 - c. Direct-Coupled Design: Requires no crankarm or linkage for mounting to a shaft.
 - d. Coupling: toothed V-bolt clamp and nuts with toothed cradle.
 - e. Reversible Mounting: Provides either clockwise or counterclockwise operation.
 - f. Power Failure Operation: Mechanical spring return system drives load to the home position. Other forms of internal energy storage for power failure operation are not acceptable.
 - g. Motor Technology:
 - 1) Modulating Types: Microprocessor-controlled Brushless DC motor
 - 2) On/Off Types: DC brush motor.
 - h. Overload Protection: Electronic stall detection protects from overload at all angles of rotation without the use of end switches.
 - i. Enclosure Ratings: NEMA type 2 / IP54 mounted in any orientation.
 - j. Double-Insulated construction: Eliminate the need for electrical ground wires.
 - k. Wiring: Integral cables with colored and numbered conductors.
 - l. Sized for torque required to seal damper at load conditions
 - m. Parallel Operation: Actuators shall be available that are capable of being mechanically or electrically paralleled.
 - n. Proportional actuators shall be user configurable without the use of external computer software or programming tools. Calibration, input signal range selection, and control logic reversal shall be selectable with an external mode selection switch.
 - o. Operating Temperature Range:
 - 1) 70 lb·in. Torque and Below: -40°F to 140°F
 - 2) 71 lb·in. Torque and above: -40°F to 131°F
 - p. Power Requirements:
 - 1) Modulating Types:
 - a) 27 lb·in. Torque and Below: 5VA maximum
 - b) 70 lb·in. to 19 lb·in.Torque: 8VA maximum
 - c) 89 lb·in. to 71 lb·in.Torque: 10VA maximum

- d) 90 lb·in. to 177 lb·in.Torque: 16VA maximum
- 2) 2-Position Types:
 - a) 27 lb·in. Torque and Below: 5VA maximum
 - b) 70 lb·in. to 19 lb·in.Torque: 7VA maximum
 - c) 71 lb·in. to 177 lb·in.Torque: 25VA maximum
- 2. Non-Spring Return Actuators:
 - a. Manufactured, brand labeled or distributed by Johnson Controls, Inc. or approved equivalent.
 - b. Regulatory Agency: UL Listed ,CSA Certified, and CE marked
 - c. Direct-Coupled Design: Requires no crankarm or linkage for mounting to a shaft.
 - d. Coupling:
 - 1) Above 80 lb·in.: toothed V-bolt clamp and nuts with toothed cradled
 - 2) 80 lb·in.and below: single cup-point set screw and toothed cradle.
 - e. Overload Protection: Electronic stall detection or magnetic slip clutch protects from overload at all angles of rotation without the use of end switches.
 - f. Minimum Enclosure Ratings:
 - 1) Types with covered wiring terminals: NEMA type 2 / IP42 mounted in any orientation.
 - 2) Types without covered wiring terminals: NEMA type 1 / IP30 or IP40.
 - 3) Types with integrated cables: NEMA 2 / IP42 mounted in any orientation.
 - g. Sized for torque required to seal damper at load conditions
 - h. Parallel Operation: Actuators shall be available that are capable of being mechanically or electrically paralleled.
 - i. Proportional actuators shall be user configurable without the use of external computer software or programming tools.
 - j. Operating Temperature Range: -4°F to 122°F except for VAV and similar indoor applications in which case 32°F to 122°F is acceptable.
 - k. Power Requirements: 24 V with models available for both 24 VAC and 24 VDC operation, maximum
 - 1) Above 80 lb·in.: 7.5 VA at 24 VAC
 - 2) 80 lb·in.and below: 3.5 VA at 24VAC
 - l. The manufacturer shall provide 5-year limited warranty from the date of sale covering defects in material or workmanship.

2.9 CONTROL VALVES

- A. Pressure Independent Valves, 1/2 through 6 in.

1. Acceptable Manufacturers:
 - a. IMI Hydronics / TA (TA-Fusion P / TA-Compact P / TA Modulator)
2. The valve should be a control valve with adjustable, stepless, pre-settable balancing and built-in dp-controller. It shall be supplied and installed as shown on the drawings to ensure proper balancing and performs the control function for water flows.
3. The valve shall be pressure independent with integral spring and diaphragm arrangement for integral differential pressure control over built in control section.
4. The valve/actuator shall have retained EQM characteristic for all recommended pre-settings.
5. Test points shall be provided for measuring differential pressure and be integral with the body and incorporate means for positive leak tight shutoff when not in use.
6. True flow measurement must be possible with balancing instrument. Flow deviation max +/- 10%. Measurement of differential pressure with no valve coefficient will not suffice.
7. The valve shall have the capacity for manual, leak tight shutoff without the actuator attached for maintenance purposes and to allow measurement of available differential pressure for diagnostics.
8. It should be possible to perform a high speed flush with the valve installed in the system without causing damage to the product and without removing / replacing any parts.
9. The valve shall have a minimum valve authority rating of 0.75.
10. Material: Valve body with connection in sizes 1 1/2" to 2" shall be made of dezincification resistant alloy brass with a pressure rating of 235 psi. Sizes 2 1/2 - 6" shall consist of ductile iron housings and stainless steel valve plugs with a pressure rating of 365 psi. The minimum differential pressure shall be 5 psi.
11. Material: Valve body and insert with connection sizes 3/8" to 1 1/4" shall be of dezincification resistant alloy brass with stainless steel valve plug, spindle, and spring. EPDM membrane and o-rings with a pressure rating of 230 psi. The minimum differential pressure shall be 3 psi.
12. Threaded connections shall be NPT in accordance with ANSI/ASME B1.20.1-1983.
13. Valve actuators shall be full modulating, low voltage (24VAC) and of the same manufacturer as the control valve.

2.10 CONTROL DAMPERS

- A. The BMS Contractor shall furnish all automatic dampers. All automatic dampers shall be sized for the application by the BMS Contractor or as specifically indicated on the Drawings.
 1. All dampers used for throttling airflow shall be of the opposed blade type arranged for normally open or normally closed operation, as required. The damper is to be sized so that, when wide open, the pressure drop is a sufficient amount of its close-off pressure drop to shift the characteristic curve to near linear.

2. All dampers used for two-position, open/close control shall be parallel blade type arranged for normally open or closed operation, as required.
 3. Damper frames and blades shall be constructed of either galvanized steel or aluminum. Maximum blade length in any section shall be 60". Damper blades shall be 16-gauge minimum and shall not exceed eight (8) inches in width. Damper frames shall be 16-gauge minimum hat channel type with corner bracing. All damper bearings shall be made of reinforced nylon, stainless steel or oil-impregnated bronze. Dampers shall be tight closing, low leakage type, with synthetic elastomer seals on the blade edges and flexible stainless steel side seals. Dampers of 48"x48" size shall not leak in excess of 8.0 cfm per square foot when closed against 4" w.g. static pressure when tested in accordance with AMCA Std. 500.
 4. Airfoil blade dampers of double skin construction with linkage out of the air stream shall be used whenever the damper face velocity exceeds 1500 FPM or system pressure exceeds 2.5" w.g., but no more than 4000 FPM or 6" w.g.
 - a. Acceptable manufacturers are Johnson Controls VD-1250, VD1630, or VD-1330, Ruskin CD50 or CD60, and Vent Products 5650.
- B. One piece rolled blade dampers with exposed or concealed linkage may be used with face velocities of 1500 FPM or below.
1. Acceptable manufacturers are: Johnson Controls VD-1620, VD-1320, Ruskin CD36, and Vent Products 5800.
 2. Multiple section dampers may be jack-shafted to allow mounting of piston pneumatic actuators and direct connect electronic actuators. Each end of the jackshaft shall receive at least one actuator to reduce jackshaft twist.

2.11 MISCELLANEOUS DEVICES

A. Variable Frequency Motor Speed Control Drives

1. See specification section 23 0514 Variable Frequency Drives for requirements.
2. Local Control Panels
 - a. All control panels shall be factory constructed, incorporating the BMS manufacturer's standard designs and layouts. All control panels shall be UL inspected and listed as an assembly and carry a UL 508 label listing compliance. Control panels shall be fully enclosed, with perforated sub-panel, hinged door, and slotted flush
 - b. In general, the control panels shall consist of the DDC controller(s), display module as specified and indicated on the plans, and I/O devices—such as relays, transducers, and so forth—that are not required to be located external to the control panel due to function. Where specified the display module shall be flush mounted in the panel face unless otherwise noted.
 - c. All I/O connections on the DDC controller shall be provide via removable or fixed screw terminals.
 - d. Low and line voltage wiring shall be segregated. All provided terminal strips and wiring shall be UL listed, 300-volt service and provide adequate clearance for field wiring.

- e. All wiring shall be neatly installed in plastic trays or tie-wrapped.
- f. A 120 volt convenience outlet, fused on/off power switch, and required transformers shall be provided in each enclosure.

3. Power Supplies

- a. DC power supplies shall be sized for the connected device load. Total rated load shall not exceed 75% of the rated capacity of the power supply.
- b. Input: 120 VAC +10%, 60Hz.
- c. Output: 24 VDC.
- d. Line Regulation: +0.05% for 10% line change.
- e. Load Regulation: +0.05% for 50% load change.
- f. Ripple and Noise: 1 mV rms, 5 mV peak to peak.
- g. An appropriately sized fuse and fuse block shall be provided and located next to the power supply.
- h. A power disconnect switch shall be provided next to the power supply.

B. Gas Monitoring System

1. General:

- a. Contractor will furnish, install and place in operating condition a hazardous gas monitoring system suitable for detecting combustible gas and various toxic gases. The system shall be installed in accordance with the drawings and as specified herein complete with all accessories necessary for proper operation.
- b. The system shall be designed to minimize the risk to personnel and facilities of exposure to dangerously high concentrations of gases. Also, inherent in the system design will be internal, continuous self-diagnostics to ensure the system is operating properly.
- c. Products used in the work of this Section shall be produced by manufacturers regularly engaged in the manufacture of similar items and with a history of satisfactory production acceptable to the Engineer. The manufacturer shall have an ISO 9001:2008 Registered Quality Control System in place and approved.
- d. The controller shall be FM Approved. Combustible gas sensor modules shall also be FM approved (hazardous location and performance) and SIL-2 Certified. The combustible gas sensor shall have FM hazardous locations approval per FM Specification 3600, and FM Performance approval per FM Specification 6320.
- e. The Contractor shall be responsible to ensure that all equipment items and accessories supplied as part of the gas monitoring system are compatible and will operate as a complete working system. The controller shall be capable of accepting a signal from any combination of combustible gas, or toxic gas sensors utilizing SentryBus, Modbus RTU, 4-20 mA or digital output.
- f. The equipment shall be manufactured by Sierra Monitor Corporation, 1991 Tarob Court, Milpitas, CA 95035 USA, Phone (408) 262-6611, Fax (408) 262-9042, or approved equivalent.

2. Operation (Controller)

- a. The controller shall be capable of:
 - 1) Accepting input from devices utilizing 4-20 mA (2, 3 or 4-wire per ISA specifications), RS-485 Modbus RTU, SentryBus and binary (supervised or digital).
 - 2) Large 5.7" color, backlit touch-screen interface with appropriate bar charts, text data screens necessary for display of operation and configuration/set-up.
 - 3) Interface up to 32 module addresses
 - 4) Capable of 4-20 mA (2 or 3-wire) output, SPDT relays, digital output
 - 5) Multiple protocol communication
 - 6) Capable of remote operation via WebServer or remote terminal
 - 7) Configuration of the controller system shall be easy and meet user defined needs in terms of input, output, power and signal
 - 8) There shall be a Warning and Alarm (Low and High) level alarm for each sensor and a trouble alarm for each controller. The type of alarm shall be annunciated on the controller display panel with an alarm LED.
3. Operation (Sensors)
 - a. The sensor/transmitters shall have a minimum of 180 day calibration interval for the toxic gas sensor and 365 days for combustible gas sensor module.
 - b. The gas sensor module must be able to be calibrated without opening the enclosure (non-intrusive calibration) using a magnetic wand to activate four keys.
 - c. Utilizing an integral display and magnetic wand activated keys, the sensor module must have a menu-driven procedure for calibration, set-up, maintenance and alarm reset.
 - d. Sensor module will have user selectable ranges.
 - e. Operating temperature for toxic gas sensor modules shall be 4 degree F to plus 122 degree F.
 - f. Operating temperature for toxic gas sensors shall be -4 degree F to 140 degree F.
 - g. Operating ranges shall be up to 1200 PPM (User adjustable) for Carbon Monoxide gas sensor modules
 - h. Operating ranges shall be 0 to 100% LEL for the combustible gas sensors.
 - i. There shall be a high and a low level alarm for each sensor and a trouble alarm for each controller. The type of alarm shall be annunciated on the controller display panel with an alarm LED.
 - j. The 5 amp alarm Relays for Alarm, Warning, and ¼ amp Trouble relay will be integral to the sensor module and will activate circuitry for remote alarm indication.
 - k. HART communication for set up and diagnostics.
4. Interconnectivity
 - a. Sensor module shall include multiple interface/connectivity capabilities, including:

- 1) 4-20 mA output (selectable as Type 3 3-wire circuit or Type 4 4-wire circuit). 4-20 mA output will have:
 - a) User-selectable values for output during calibration and trouble conditions
 - b) Interface testing during set-up confirming 4mA and 20 mA matching between the module and the interface device
 - b. RS-485 digital interface utilizing Modbus RTU protocol with baud rate user-adjustable between 2400 and 38400 baud. Manufacturer will supply a complete Modbus memory map that shall include addresses for:
 - 1) Concentration
 - 2) High Alarm Value
 - 3) Low Alarm Value
 - 4) High Alarm Relay status
 - 5) Low Alarm Relay status
 - 6) Range
 - 7) Units
 - 8) Module number
 - c. SentryBus digital interface to enable interconnectivity to Sentry controllers.
 - d. Integral High and Low alarm relays (SPDT type):
 - e. A minimum of 5 Amps to enable interface to control devices.
 - f. Shall be integral to the sensor module and field-selectable through non-intrusive means, without use of an external remote control unit. Selectable features include:
 - 1) Alarm level
 - 2) Latching/Non-Latching
 - 3) Sentry control or Module control
5. Sensor Enclosure
- a. Sensor and transmitter housing for all gas sensor modules shall be FM or ATEX approved explosion proof for use in Class 1, Division I, Groups B, C and D areas.
 - b. Enclosures shall have a NEMA 4 rating and available in either epoxy-coated, die-cast copper-free aluminum or 316 Stainless Steel.
6. Sensor Calibration
- a. Calibration shall be single-person, auto-adjusting without any manual adjustments required and without exposing circuit electronics to the atmosphere. Global calibration procedure controls all calibration functions at IT Controller.
 - b. A calibration system shall be available consisting of cylinders of calibration gas plus pressure and flow regulator for delivery of the calibration gas to the sensor.
7. Approvals

- a. Combustibles and primary toxic gas sensor modules shall be SIL-2 Certified.
- b. The combustible gas sensor module and controller shall have FM Performance approval.
- c. The combustible gas sensor shall have FM hazardous locations approval per FM Specification 3600, and FM Performance approval per FM Specification 6320.
- d. Manufacturer must be ISO9001:2008 certified.

PART 3 - PERFORMANCE/EXECUTION

3.1 BMS SPECIFIC REQUIREMENTS

A. Existing BMS

1. Coordinate the provision installation of all materials, UI and IoT componentry to be compatible with existing JPSTC front end system architecture.

B. Graphic Displays

1. The naming/numbering/tagging convention used must be a coordinated effort between the Mechanical Contractor, Controls Contractor, Owner, Design-Builder, and A/E and must be approved by all parties prior to implementation. The naming/numbering/tagging convention must be consistent and reflected through the building automation control system, charts, diagrams, tagging and O&M manuals.
2. Provide a color graphic system flow diagram display for each system with all points as indicated on the point list. All terminal unit graphic displays shall be from a standard design library. Utilize existing main building graphic icons and symbology.
3. User shall access the various system schematics via a graphical penetration scheme and/or menu selection.
4. Custom Reports:
 - a. Provide custom reports as required for this project
5. Actuation / Control Type
6. Primary Equipment
 - a. Controls shall be provided by equipment manufacturer as specified herein.
 - b. All damper and valve actuation shall be electric.
7. Air Handling Equipment
 - a. All air handlers shall be controlled with a HVAC-DDC Controller
 - b. All damper and valve actuation shall be electric.
8. Terminal Equipment:

- a. Terminal Units (VAV, UV, etc.) shall have electric damper and valve actuation.
- b. All Terminal Units shall be controlled with HVAC-DDC Controller)

3.2 INSTALLATION PRACTICES

A. BMS Wiring

1. All conduit, wiring, accessories and wiring connections required for the installation of the Building Management System, as herein specified, shall be provided by the BMS Contractor unless specifically shown on the Electrical Drawings under Division 26 Electrical. All wiring shall comply with the requirements of applicable portions of Division 26 and all local and national electric codes, unless specified otherwise in this section.
2. All BMS wiring materials and installation methods shall comply with BMS manufacturer recommendations.
3. The sizing, type and provision of cable, conduit, cable trays, and raceways shall be the design responsibility of the BMS Contractor. If complications arise, however, due to the incorrect selection of cable, cable trays, raceways and/or conduit by the BMS Contractor, the Contractor shall be responsible for all costs incurred in replacing the selected components.

a. Class 2 Wiring

- 1) All Class 2 (24VAC or less) wiring shall be installed in conduit unless otherwise specified.
- 2) Conduit is not required for Class 2 wiring in concealed accessible locations. Class 2 wiring not installed in conduit shall be supported every 5' from the building structure utilizing metal hangers designed for this application. Wiring shall be installed parallel to the building structural lines. All wiring shall be installed in accordance with local code requirements.
4. Class 2 signal wiring and 24VAC power can be run in the same conduit. Power wiring 120VAC and greater cannot share the same conduit with Class 2 signal wiring.
5. Provide for complete grounding of all applicable signal and communications cables, panels and equipment so as to ensure system integrity of operation. Ground cabling and conduit at the panel terminations. Avoid grounding loops.

B. BMS Line Voltage Power Source

1. 120-volt AC circuits used for the Building Management System shall be taken from panel boards and circuit breakers provided by Division 26.
2. Circuits used for the BMS shall be dedicated to the BMS and shall not be used for any other purposes.
3. DDC terminal unit controllers may use AC power from motor power circuits.

C. BMS Raceway

1. All wiring shall be installed in conduit or raceway except as noted elsewhere in this specification. Minimum control wiring conduit size 1/2".
2. Where it is not possible to conceal raceways in finished locations, surface raceway (Wiremold) may be used as approved by the Architect.
3. All conduits and raceways shall be installed level, plumb, at right angles to the building lines and shall follow the contours of the surface to which they are attached.
4. Flexible Metal Conduit shall be used for vibration isolation and shall be limited to 3 feet in length when terminating to vibrating equipment. Flexible Metal Conduit may be used within partition walls. Flexible Metal Conduit shall be UL listed.

D. Penetrations

1. Provide fire stopping for all penetrations used by dedicated BMS conduits and raceways.
2. All openings in fire proofed or fire stopped components shall be closed by using approved fire resistive sealant.
3. All wiring passing through penetrations, including walls shall be in conduit or enclosed raceway.
4. Penetrations of floor slabs shall be by core drilling. All penetrations shall be plumb, true, and square.

E. BMS Identification Standards

1. Node Identification. All nodes shall be identified by a permanent label fastened to the enclosure. Labels shall be suitable for the node location.
2. Cable types specified in Item A shall be color coded for easy identification and troubleshooting.

F. BMS Panel Installation

1. The BMS panels and cabinets shall be located as indicated at an elevation of not less than 2 feet from the bottom edge of the panel to the finished floor. Each cabinet shall be anchored per the manufacturer's recommendations.
2. The BMS contractor shall be responsible for coordinating panel locations with other trades and electrical and mechanical contractors.

G. Input Devices

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.

H. HVAC Input Devices – General

1. All Input devices shall be installed per the manufacturer recommendation
2. Locate components of the BMS in accessible local control panels wherever possible.
3. The mechanical contractor shall install all in-line devices such as temperature wells, pressure taps, airflow stations, etc.

4. Input Flow Measuring Devices shall be installed in strict compliance with ASME guidelines affecting non-standard approach conditions.
5. Outside Air Sensors
 - a. Sensors shall be mounted on the North wall to minimize solar radiant heat impact or located in a continuous intake flow adequate to monitor outside air conditions accurately.
 - b. Sensors shall be installed with a rain proof, perforated cover.
6. Water Differential Pressure Sensors
 - a. Differential pressure transmitters used for flow measurement shall be sized to the flow-sensing device.
 - b. Differential pressure transmitters shall be supplied with tee fittings and shut-off valves in the high and low sensing pick-up lines.
 - c. The transmitters shall be installed in an accessible location wherever possible.
7. Medium to High Differential Water Pressure Applications (Over 21" w.c.):
 - a. Air bleed units, bypass valves and compression fittings shall be provided.
8. Building Differential Air Pressure Applications (-1" to +1" w.c.):
 - a. Transmitters exterior sensing tip shall be installed with a shielded static air probe to reduce pressure fluctuations caused by wind.
 - b. The interior tip shall be inconspicuous and located as shown on the drawings.
9. Air Flow Measuring Stations:
 - a. Where the stations are installed in insulated ducts, the airflow passage of the station shall be the same size as the inside airflow dimension of the duct.
 - b. Station flanges shall be two inch to three inch to facilitate matching connecting ductwork.
10. Duct Temperature Sensors:
 - a. Duct mount sensors shall mount in an electrical box through a hole in the duct and be positioned so as to be easily accessible for repair or replacement.
 - b. The sensors shall be insertion type and constructed as a complete assembly including lock nut and mounting plate.
 - c. For ductwork greater in any dimension than 48 inches or where air temperature stratification exists such as a mixed air plenum, utilize an averaging sensor.
 - d. The sensor shall be mounted to suitable supports using factory approved element holders.
11. Space Sensors:

- a. Shall be mounted per ADA requirements.
 - b. Provide lockable tamper-proof covers in public areas and/or where indicated on the plans.
12. Low Temperature Limit Switches:
- a. Install on the discharge side of the first water coil in the air stream.
 - b. Mount element horizontally across duct in a serpentine pattern insuring each square foot of coil is protected by 1 foot of sensor.
 - c. For large duct areas where the sensing element does not provide full coverage of the air stream, provide additional switches as required to provide full protection of the air stream.
13. Air Differential Pressure Status Switches:
- a. Install with static pressure tips, tubing, fittings, and air filter.
14. Water Differential Pressure Status Switches:
- a. Install with shut off valves for isolation.
 - 1) HVAC Output Devices
 - 2) All output devices shall be installed per the manufacturers recommendation. The mechanical contractor shall install all in-line devices such as control valves, dampers, airflow stations, pressure wells, etc.
 - 3) Actuators: All control actuators shall be sized capable of closing against the maximum system shut-off pressure. The actuator shall modulate in a smooth fashion through the entire stroke. When any pneumatic actuator is sequenced with another device, pilot positioners shall be installed to allow for proper sequencing.
 - 4) Control Dampers: Shall be opposed blade for modulating control of airflow. Parallel blade dampers shall be installed for two position applications.
 - 5) Control Valves: Shall be sized for proper flow control with equal percentage valve plugs. The maximum pressure drop for water applications shall be 5 PSI.
 - 6) Electronic Signal Isolation Transducers: Whenever an analog output signal from the Building Management System is to be connected to an external control system as an input (such as a chiller control panel), or is to receive as an input a signal from a remote system, provide a signal isolation transducer. Signal isolation transducer shall provide ground plane isolation between systems. Signals shall provide optical isolation between systems

3.3 TRAINING

- A. The BMS contractor shall provide the following training services:

1. Provide 40 hours, broke down into 4 hour sessions, covering a minimum of 2 staff shifts, of on-site orientation by a system technician who is fully knowledgeable of the specific installation details of the project. This orientation shall, at a minimum, consist of a review of the project as-built drawings, the BMS software layout and naming conventions, and a walk through of the facility to identify panel and device locations.
2. Provide 1 week of factory training for two people.
3. Provide 20 additional hours of on-site training after one year of facility operation.

3.4 COMMISSIONING

A. Fully commission all aspects of the Building Management System work.

1. Acceptance Check Sheet
 - a. Prepare a check sheet that includes all points for all functions of the BMS as indicated on the point list included in this specification.
 - b. Submit the check sheet to the Engineer for approval
 - c. The Engineer will use the check sheet as the basis for acceptance with the BMS Contractor.
2. VAV box performance verification and documentation:
 - a. The BMS Contractor shall test each VAV box for operation and correct flow. At each step, after a settling time, box air flows and damper positions will be sampled. Following the tests, a pass/fail report indicating results shall be produced. Possible results are Pass, No change in flow between full open and full close, Reverse operation or Maximum flow not achieved. The report shall be submitted as documentation of the installation.
 - b. The BMS Contractor shall issue a report based on a sampling of the VAV calculated loop performance metrics. The report shall indicate performance criteria, include the count of conforming and non-conforming boxes, list the non-conforming boxes along with their performance data, and shall also include graphical representations of performance.
3. Promptly rectify all listed deficiencies and submit to the Engineer that this has been done.

END OF SECTION 23 09 00

SECTION 23 21 13 – HYDRONIC PIPING**PART 1 - GENERAL****SUMMARY**

This Section includes pipe and fitting materials, and joining methods, for the following systems:

1. Heating Water piping.
2. Chilled Water piping.
3. Makeup Water piping.
4. Cooling Coil Condensate Drain piping.

SUBMITTALS

Provide coordination drawings per Division 23 Section "General Mechanical Requirements".

QUALITY ASSURANCE

Steel Support Welding: Qualify processes and operators according to AWS D1.1, "Structural Welding Code - Steel."

Welding: Qualify processes and operators according to ASME Boiler and Pressure Vessel Code: Section IX.

5. Comply with provisions in ASME B31 Series, "Code for Pressure Piping."
6. Certify that each welder has passed AWS qualification tests for welding processes involved and that certification is current.

ASME Compliance: Comply with ASME B31.9, "Building Services Piping," for materials, products, and installation. Safety valves and pressure vessels shall bear the appropriate ASME label. Fabricate and stamp air separators and expansion tanks to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 01.

Grooved mechanical piping systems shall be installed according to grooved manufacturer's installation instructions. All grooved piping products shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as grooved components.

PART 2 - PRODUCTS**PIPING**

For piping 4 inches and smaller: Schedule 40 black steel pipe, furnace-butt welded, continuous welded (ASTM A53, Type F) or Drawn-Temper Copper Tubing (ASTM B 88, Type L).

For piping 5 inches and larger: Schedule 40 black steel pipe, electric-resistance welded (ASTM A53, Type E, Grade B).

PIPE FITTINGS

For Piping 2 Inches and Smaller

1. Steel Pipe:
 - a. Welded Wrought-Steel Fittings (ASTM A234).
 - b. Cast-Iron Threaded Fittings, Class 125 (ASME B16.4).
 - c. Malleable-Iron Threaded Fittings, Class 150 (ASME B16.3).
2. Copper: Welded or Soldered Wrought-Copper (ASME B16.22)

For Piping Larger Than 2 Inches

3. Steel Pipe:
4. Welded Wrought-Steel Fittings (ASTM A234)
5. Wrought Cast- and Forged-Steel Flanges and Flanged Fittings, minimum Class 150 rating (ASME B16.5)
6. Copper: Soldered Wrought-Copper (ASME B16.22)

Grooved Mechanical-Joint Fittings and Couplings

7. Contractors with minimum of 5 installed grooved mechanical-joint systems may use grooved mechanical joint fittings and couplings on roll grooved standard weight Schedule 40 piping 2 inches to 60 inches.
8. Basis-of-Design Product: Subject to compliance with requirements, provide Victaulic grooved mechanical-joint fittings and couplings. If another manufacturer is used with a manufacturer's torque requirement, the contractor shall create a log of the measured torque at every mechanical joint.
9. Grooved End Fittings: Standard fittings shall be cast of ductile iron conforming to ASTM A-536, Grade 65-45-12, forged steel conforming to ASTM A-234, Grade WPB 0.375" wall, or fabricated from Std Wt Carbon Steel pipe conforming to ASTM A-53, Type F, E or S, Grade B. Fittings provided with an alkyd enamel finish or hot dip galvanized to ASTM A-153. Zinc electroplated fittings and couplings conform to ASTM B633. (Fittings 14" and larger shall be supplied with Victaulic factory AGS grooved ends).
10. Couplings 2" through 12": Manufactured in two segments of cast ductile iron, conforming to ASTM A-536, Grade 65-45-12. Gaskets shall be pressure responsive synthetic rubber, grade to suit the intended service, conforming to ASTM D-2000.

- a. Rigid Type: Coupling housings with offsetting, angle-pattern bolt pads shall be used to provide system rigidity and support and hanging in accordance with ANSI B31.1, B31.9 and NFPA 13.
 - 1) Victaulic Style 107N QuickVic®. Installation ready rigid coupling for direct stab installation, without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 Deg F to +250 Deg F.
 - b. Flexible Type: Use in locations where vibration attenuation and stress relief are required. Flexible couplings may be used in lieu of flexible connectors at equipment connections. Three couplings, for each connector, shall be placed in close proximity to the vibration source.
 - 1) Victaulic Style 177 QuickVic®. Installation ready flexible coupling for direct stab installation, without field disassembly. Gasket shall be Grade "EHP" EPDM compound with red color code designed for operating temperatures from -30 Deg F to +250 Deg F.
11. Couplings 14" through 60": Couplings shall consist of two ASTM A-536 ductile iron housing segments with wedge shaped AGS key profile and lead in chamfer.
- a. Rigid Type: Victaulic Style AGS W07. Coupling key designed to fill wedge shaped AGS groove. Gasket shall be Grade "E" EPDM with green color code designed for operating temperatures from -30 Deg F to +230 Deg F.
 - b. Flexible Type: Victaulic Style AGS W77. Coupling key designed to fill wedge shaped AGS groove and allow for linear and angular movement, vibration attenuation, and stress relief. Gasket shall be Grade "E" EPDM with green color code designed for operating temperatures from -30 Deg F to +230 Deg F.
12. Grooved Joints: Assemble joints with coupling and gasket, lubricant, and bolts. Cut or roll grooves in ends of pipe based on pipe and coupling manufacturer's written instructions for pipe wall thickness.
13. Victaulic prefabricated pump drop assemblies, which include check valves, butterfly valves, strainers, suction diffusers, flexible couplings (style 177 or W77), and grooved pipe, may be used in lieu of individual components. Victaulic Series 380, 381, 382.
14. Vic-Headers: Victaulic prefabricated factory-fabricated grooved end header [manifold] all-in-one assembly for fluid distribution. Header shall consist of an ASTM A53, Grade B, standard weight pipe spool with required outlet connections. Grooved ends roll grooved to Victaulic [OGS] [AGS] dimensions, with enamel coating or galvanized to project requirements.

JOINING MATERIALS

Pipe-Flange Gasket Materials: Suitable for chemical and thermal conditions of piping system contents.

15. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
 - a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
 - b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

Gasket Material: Thickness, material, and type suitable for fluid to be handled and working temperatures and pressures.

Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

Solder Filler Metals (Pipes 2 inches and less): ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

Brazing Filler Metals (Pipes greater than 2 inches): AWS A5.8, BCuP Series, copper-phosphorus alloys for joining copper with copper; or BAg-1, silver alloy for joining copper with bronze or steel.

Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for wall thickness and chemical analysis of steel pipe being welded.

PART 3 - EXECUTION

PIPING INSTALLATIONS

Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Install piping as indicated without major deviations. Major deviations shall be approved by the Design-Builder on Coordination Drawings prior to installation.

Coordinate the exact location of this work, with the work of other trades prior to fabrication or installation and verify all dimensions and elevations. Provide additional offsets and sections of piping as may be required to meet the applicable job conditions. Coordinate with and review all related drawings of all trades prior to start of work.

Refer to specification section 23 05 00 "General Mechanical Requirements" for HVAC expansion loop fittings.

Main piping shall be run horizontal with no slope. Branch piping shall pitch down back to main piping, uniformly a minimum of one inch in 60 feet.

Provide trapped cooling coil condensation piping from outlets of drain pans of all cooling coils. Pitch all cooling coil condensation piping down a minimum of 1 inch in 30 feet in the direction of flow. Install insect screen at outdoor terminations.

Minimum pipe size shall be 3/4 inch unless noted otherwise.

Provide eccentric fittings and/or eccentric reducing couplings in all cases where air or water pockets would otherwise occur in the main due to reduction in pipe size. Eccentric fittings shall keep the pipes flush on top for water piping and flush on the bottom for condensate or drain piping.

Do not run piping over or within 3 feet of electrical switchgear, panels, or similar equipment.

No piping shall pass through walls at an angle of other than 90 degrees.

No pipe, piping fittings, or coverings shall in any way extend partly into any plastered wall or ceiling.

Install piping concealed in walls, ceilings, webs of columns, or furring where possible, unless otherwise approved by the Design-Builder and except in equipment rooms and service areas.

Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

No piping shall be installed in a manner that will interfere with doorways, door and window operation, ventilation equipment, ductwork, lighting and outlets or other equipment, nor prevent proper vibration isolation or service of equipment or components.

Install all piping in locations and elevations such that coils, tubes, and filters can be removed and replaced without major piping removal.

Install piping to permit valve servicing.

Install piping to allow application of insulation.

Install groups of pipes parallel to each other (where applicable).

If a hole is required after the structure is cast, its location and size shall be approved by the Design-Builder and structural engineer. Core-drill the hole. Maintain the fire integrity of the structure.

All fittings shall be far enough away from plastered surfaces to allow space for installation of escutcheons. Escutcheons must not extend over any irregular parts of the walls, with all voids between piping materials and construction being properly filled in an approved manner. Provide nickel-plated steel escutcheons on all exposed pipes passing through walls, ceiling, floors, and partitions.

Provide unions or flanges of suitable temperature and pressure rating between all dissimilar metals including where copper tubing or components are connected to steel or cast iron piping or components. Unions on copper tubing shall be solder-type, copper-to-copper, up to and including 2-inch pipe size, and flanged 150-pound brass companion flanges for 2-1/2-inch pipe size and above.

Install unions in pipes 2 inch and smaller, adjacent to each valve, at final connections to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

Install flange or grooved coupling in piping, 2-1/2 inch and larger, at final connections to valves, apparatus, and equipment and elsewhere as indicated.

Install flexible connectors at inlet and discharge connections to pumps (except in-line pumps) and other vibration producing equipment.

Install branch connections to mains using tee fittings in main pipe, with the branch connected to the top of the main pipe. The use of nipples welded directly into piping for branch take-offs will not be permitted.

Install expansion loops, expansion joints, anchors, and pipe alignment guides as indicated on drawings.

Install drains, consisting of a tee fitting, 3/4-inch ball valve, and short 3/4-inch threaded nipple with cap, at low points in piping system mains and elsewhere as required for system drainage.

Install manual air vents at high points in piping, at heat-transfer coils, and elsewhere as required for system air venting. Install automatic air vents at high points of system piping in mechanical equipment rooms only.

PIPE JOINT CONSTRUCTION

Join pipe and fittings according to the following requirements.

Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

Soldered Joints: Construct joints according to ASTM B 828 or CDA's "Copper Tube Handbook".

Brazed Joints: Construct joints according to AWS's "Brazing Handbook," "Pipe and Tube" Chapter.

Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:

1. Align threads at point of assembly.
2. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.
3. Assemble joint wrench tight. Wrench on valve shall be on the valve end into which the pipe is being threaded.

4. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

Welded Joints: Construct joints according to AWS D10.12, using qualified processes and welding operators according to Part 1 "Quality Assurance" Article.

Flanged Joints: Select appropriate gasket material, size, type, and thickness for service application. Align flanges surfaces parallel with gasket concentrically positioned. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly using torque wrench.

Grooved Joints: Pipe ends shall be clean and free from indentations, projections and roll marks in the area from pipe end to groove for proper gasket sealing. Install piping in accordance with latest installation instructions. Verify gasket is suitable for intended service. Factory trained representative (direct employee of grooved manufacturer) shall provide on-site training for contractor's field personnel.

SLEEVES

Provide sleeves wherever pipes pass through building construction. Anchor all sleeves to building construction. Size sleeves to permit passage of insulation where insulation is required. Maintain the fire integrity of walls, floors, ceilings, and partitions.

Where pipes pass through foundation walls or footings, provide cast iron sleeve and caulk the space between sleeve and pipe with lead wool, watertight.

Install sleeves in floors perfectly plumb and sleeves in walls level. Center the pipe in the sleeve. Pack sleeves with fire rated materials, per shop drawings, approved submittals, and caulk in tight.

Set sleeves in walls, floor, and foundations during the construction.

Fire Barrier Penetrations: Where pipes pass through fire-rated walls, partitions, ceilings and floors, maintain the fire-rated integrity.

FIELD QUALITY CONTROL

Prepare hydronic piping according to ASME B31.9 and as follows:

5. Leave joints, including welds, uninsulated and exposed for examination during test.
6. Provide temporary restraints for expansion joints that cannot sustain reactions due to test pressure. If temporary restraints are impractical, isolate expansion joints from testing.
7. Flush hydronic piping systems with clean water; then remove and clean or replace strainer screens.

8. Isolate equipment from piping. If a valve is used to isolate equipment, its closure shall be capable of sealing against test pressure without damage to valve. Install blinds in flanged joints to isolate equipment.
9. Install safety valve, set at a pressure no more than one-third higher than test pressure, to protect against damage by expanding liquid or other source of overpressure during test.

Perform the following tests on hydronic piping:

10. Use ambient temperature water as a testing medium unless there is risk of damage due to freezing. Another liquid that is safe for workers and compatible with piping may be used.
11. While filling system, use vents installed at high points of system to release air. Use drains installed at low points for complete draining of test liquid.
12. Isolate expansion tanks and determine that hydronic system is full of water.
13. Subject piping system to hydrostatic test pressure that is not less than 125 psi for a length of 6 hours. No pressure drop shall occur over this duration. Test pressure shall not exceed maximum pressure for any vessel, pump, valve, or other component in system under test. Verify that stress due to pressure at bottom of vertical runs does not exceed 90 percent of specified minimum yield strength or 1.7 times "SE" value in Appendix A in ASME B31.9, "Building Services Piping."
14. After hydrostatic test pressure has been applied, examine piping, joints, and connections for leakage. Eliminate leaks by tightening, repairing, or replacing components, and repeat hydrostatic test until there are no leaks.
15. Prepare written report of testing.

Perform the following before operating the hydronic system:

16. Open manual valves fully.
17. Inspect pumps for proper rotation.
18. Set makeup pressure-reducing valves for required system pressure.
19. Inspect air vents at high points of system and determine if all are installed and operating freely (automatic type), or bleed air completely (manual type).
20. Set temperature controls so all coils are calling for full flow.
21. Inspect and set operating temperatures of hydronic equipment, such as boilers, chillers, cooling towers, to specified values.
22. Verify lubrication of motors and bearings.

CLEANING

At completion of project, thoroughly flush each of the various HVAC hydronic circulating systems with a cleaning solution as recommended by the chemical supplier so as to remove any oil, rust, dirt, scale, or grease that may be present.

Utilize water treatment provider's instructions to clean system. Drain and rinse systems completely with clean water, and clean all screens and strainers.

After cleaning is complete, drain system and rinse with fresh water. The chemical supplier shall test and check drain water for pH level and condition.

Submit report to the Engineer on condition and finalized method of chemical treatment recommended by the chemical supplier and utilized for this project.

If drain water indicates an acid level, neutralize the system with an alkaline-type material as recommended by the chemical supplier and reflush entire system.

END OF SECTION 23 21 13

SECTION 23 21 23 - HYDRONIC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Close-coupled, in-line centrifugal pumps.
2. Separately coupled, vertically mounted, in-line centrifugal pumps.
3. Automatic condensate pump units.

1.2 DEFINITIONS

- A. ECM: Electronically commutated motor.
- B. EPDM: Ethylene propylene diene monomer.
- C. FKM: Fluoroelastomer polymer.
- D. HI: Hydraulic Institute.
- E. NBR: Nitrile rubber or Buna-N.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of pump.
- B. Shop Drawings: For each pump.
- C. Delegated Design Submittals: For each pump.
 1. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans, or BIM model, drawn to scale, showing the items described in this Section, and coordinated with all building trades.
- B. Field quality-control reports.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 CLOSE-COUPLED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Armstrong Fluid Technology.
 - 2. Bell & Gossett; a Xylem brand.
 - 3. Taco Comfort Solutions.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, close-coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted horizontally or vertically.
- C. Pump Construction:
 - 1. Casing: Radially split, cast iron, with threaded gauge tappings at inlet and outlet and threaded companion-flangeconnections.
 - 2. Impeller: ASTM B584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For constant-speed pumps, trim impeller to match specified performance.
 - 3. Pump Shaft Sleeve: Type 304 stainless steel.
 - 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and NBR rubber bellows and gasket. Include water slinger on shaft between motor and seal.
 - 5. Seal Flushing: Flush, cool, and lubricate pump seal by directing pump discharge water to flow over the seal.
- D. Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "General Mechanical Requirements."
 - 1. Enclosure : Totally enclosed, fan cooled.
 - 2. NEMA Premium Efficient motors as defined in NEMA MG 1.
 - 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
5. Variable-speed motor.
6. Provide integral pump motor variable-speed controller.

2.3 SEPARATELY COUPLED, VERTICALLY MOUNTED, IN-LINE CENTRIFUGAL PUMPS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Armstrong Fluid Technology.
 2. Bell & Gossett; a Xylem brand.
 3. Taco Comfort Solutions.
- B. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically.
- C. Pump Construction:
 1. Casing: Radially split, cast iron, with threaded gauge tappings at inlet and outlet and threaded companion-flange connections.
 2. Impeller: ASTM B584, cast bronze; statically and dynamically balanced, keyed to shaft, and secured with a locking cap screw. For pumps that are not frequency-drive controlled, trim impeller to match specified performance.
 3. Pump Shaft: Type 316 stainless steel.
 4. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless steel spring, and NBR bellows and gasket.
- D. Shaft Coupling: Molded-rubber insert with interlocking spider capable of absorbing vibration.
- E. Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "General Mechanical Requirements."
 1. Enclosure: Totally enclosed, fan cooled.
 2. NEMA Premium Efficient motors as defined in NEMA MG 1.
 3. Motor Sizes: Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.
 4. Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 5. Variable-speed motor.
 6. Provide integral pump motor variable-speed controller.

2.4 AUTOMATIC CONDENSATE PUMP UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Refco Manufacturing (US) Inc.
 2. Bell & Gossett; a Xylem brand.
 3. GRUNDFOS CBS Inc.
 4. Little Giant; a brand of Franklin Electric Co., Inc.
- B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Collects and removes condensate from fan coil units, air handling units, condensing boilers, and similar components. Include factory- or field-installed check valve and 72-inch-minimum, electrical power cord with plug.

2.5 PUMP SPECIALTY FITTINGS

- A. Suction Diffuser:
1. Angle pattern.
 2. 175-psig pressure rating, ductile-iron body and end cap, pump-inlet fitting.
 3. Bronze 16-mesh wire startup and Type 304 stainless steel permanent strainers with 3/16-inch.
 4. Type 304 stainless steel straightening vanes.
 5. Drain plug.
 6. Factory-fabricated support.
- B. Triple-Duty Valve:
1. Angle or straight pattern.
 2. 175-psig pressure rating, ductile-iron body, pump-discharge fitting.
 3. Valve with multi-turn stem and memory stop to allow valve to be returned to its original position after shutoff.
 4. Brass valve disc with EPDM rubber seat.
 5. Type 304 stainless steel valve stem.
 6. Drain plug and bronze-fitted shutoff, balancing, and check valve features.
 7. Brass gauge ports with integral check valve and orifice for flow measurement.

PART 3 - EXECUTION

3.1 PUMP INSTALLATION

- A. Comply with HI 1.4.
- B. Install pumps to provide access for periodic maintenance including removing motors, impellers, couplings, and accessories.

- C. Independently support pumps and piping so weight of piping is not supported by pumps and weight of pumps is not supported by piping.
- D. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.
- E. Equipment Mounting:
 - 1. Install base-mounted pumps on cast-in-place concrete equipment bases. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - 2. Comply with requirements for vibration isolation and seismic-control devices specified in Section 230548 "Vibration Control for HVAC Piping and Equipment."

3.2 ALIGNMENT

- A. Engage a factory-authorized service representative to perform alignment service.
- B. Comply with requirements in HI standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.
- C. Comply with pump and coupling manufacturers' written instructions.
- D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

3.3 PIPING CONNECTIONS

- A. Comply with requirements for piping specified in Section 23 21 13 "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to pump, allow space for service and maintenance.
- C. Connect piping to pumps. Install valves that are same size as piping connected to pumps.
- D. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.
- E. Install triple-duty valve on discharge side of pumps.
- F. Install suction diffuser and shutoff valve on suction side of pumps.
 - 1. Use startup strainer for initial system startup. Install permanent strainer element before turnover of system to Owner.
- G. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

- H. Install pressure gauges on pump suction and discharge or at integral pressure-gauge tapping, or install single gauge with multiple-input selector valve.
- I. Install check valve on each condensate pump unit discharge unless unit has a factory-installed check valve.

3.4 ELECTRICAL CONNECTIONS

- A. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- B. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- C. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- D. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.5 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."

3.6 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 - 2. Check piping connections for tightness.
 - 3. Clean strainers on suction piping. Use startup strainer for initial startup.
 - 4. Perform the following startup checks for each pump before starting:
 - a. Verify bearing lubrication.
 - b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
 - c. Verify that pump is rotating in correct direction.
 - 5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
 - 6. Start motor.

7. Open discharge valve slowly.

3.7 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Hydronic pumps will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps.

END OF SECTION 23 21 23

SECTION 23 23 00 – REFRIGERANT PIPING

PART 1 - GENERAL

REFERENCE

All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

DESCRIPTION

Work Included

1. Furnish all labor, materials, tools, equipment, and services for the refrigeration piping system as indicated, in accordance with provisions of the Contract Documents.
2. Completely coordinate with work of all other trades.
3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

Refrigeration Piping System

4. Refrigeration piping.
5. Refrigeration valves.
6. Refrigeration specialties.

QUALITY ASSURANCE

Qualify brazing processes and brazing operators in accordance with ASME, "Boiler and Pressure Vessel Code," Section IX, "Welding & Brazing Qualifications."

Regulatory Requirements: Comply with provisions of the following codes:

7. ANSI B31.5: ASME Code for Pressure Piping -- Refrigerant Piping.
8. ANSI/ASHRAE Standard 15: Safety Code for Mechanical Refrigeration.
9. International Mechanical Code.

SUBMITTALS

Shop Drawings: Drawings showing layout of refrigerant piping, specialties and fittings, including, but not limited to, pipe and tube sizes, valve arrangements and locations, slopes of horizontal runs, wall and floor penetrations, and equipment connection details. Before any site work begins, selection data must be submitted to the Engineer showing the refrigerant line loss with the actual condensing unit and coil at condition

shown on the schedule sheet of the bid set for all conditions listed on the schedule sheet as well as the manufacturer's recommended DX piping diagram and specialties. Note areas where underground piping enters and leaves underslab conduit.

Product Data: Refrigerant pipe "type".

Samples: Not required for review.

Project Information: Not required for review.

Contract Close-Out Information

10. Brazers' certificates signed by Contractor certifying that Brazers comply with requirements specified under "Quality Assurance" above.
11. Test result reports.
12. Maintenance data for refrigerant valves and piping specialties, for inclusion in Operating & Maintenance Manuals.

PART 2 - PRODUCTS

MANUFACTURERS

Subject to compliance with requirements, provide products of one of the following:

1. Refrigerant Valves and Specialties
 - a. Emerson Climate Technologies.
 - b. Danfoss.
 - c. Henry Technologies.
 - d. Parker-Hannifin Corp.
 - e. Sporlan Valve Co.

PIPE AND FITTINGS

Refrigerant Piping: Copper, dehydrated, with high-temperature soldered joints and wrought copper (400 psig) fittings.

2. For Underground Use: Type K without joints.
3. For Above-Ground Use: Type L, or type ACR with wrought copper fittings and brazed joints. Mechanical fittings (crimp or flare) are not permitted.
4. If other than Type ACR tubing is used, clean and protect inside of tubing as specified in "Cleaning" section.

For field assembled units, size refrigeration lines according to manufacturer's published tables using pressure or temperature drops as follows:

5. Suction Lines: 2 deg F.
6. Liquid Lines: 1 deg F or 2 psi.
7. Hot Gas Lines: 1deg F or 3.6 psi.

8. Size discharge and hot gas risers for positive oil return to compressors.

Hangers: As specified in Division 23 Section "Hangers and Supports for HVAC Piping and Supports".

9. Install hangers over outside of insulation.
10. Use copper or cadmium-plated hangers when in direct contact with copper lines.

SPECIALTIES

Moisture Indicator: Show presence of moisture in system by change of color.

11. Install adjacent to filter.
12. In bypass line use Sporlan SA-12S.

Strainers: Design to permit removing screen without removing strainer from piping system.

13. Provide with screens of not larger than 80 mesh.
14. Provide strainers on liquid line serving each thermostatic expansion valve and in suction line serving each refrigerant compressor not equipped with integral strainer.

Oil Traps: Provide in lines as required.

VALVES

All Valves: All bronze.

15. In Lines 2 Inches and Less: Solder ends.
16. In Lines 3 Inches and Over: Four bolt union ends.

Shut Off Valves: Packed type with gas-tight cap seal and hard metal seats and shoulders which permit packing stuffing boxes wide open under pressure, or sealed diaphragm type.

17. Wheel, globe, angle or "T" handle.

Check Valves

18. In Liquid Lines 5/8 inch and Less: Lift check type.
19. In Lines 3/4 inch-2 inch: Swing check type.
20. In Lines 3 inches and Over: Wafer-type swing check with bronze disc.

Expansion Valves: Sized by manufacturer for refrigerant used.

21. Provide one in each circuit with liquid distribution connection immediately.

Vent and Test Valves: Angle cap type with seal and outlet caps.

Install pressure regulating and relief valves as required by ASHRAE Standard 15.

PART 3 - EXECUTION

CLEANING

Before installation of copper tubing other than Type ACR tubing, clean the tubing and fitting using following cleaning procedure:

1. Remove coarse particles of dirt and dust by drawing a clean, lintless cloth through the tubing by means of a wire or an electrician's tape.
2. Draw a clean, lintless cloth saturated with trichloroethylene through the tube or pipe. Continue this procedure until cloth is not discolored by dirt.
3. Draw a clean, lintless cloth saturated with compressor oil, squeezed dry, through the tube or pipe to remove remaining lint. Inspect tube or pipe visually for remaining dirt and lint.
4. Finally, draw a clean, dry lintless cloth through the tube or pipe.

PIPING INSTALLATION

General: Install refrigerant piping in accordance with ASHRAE Standard 15 -- "The Safety Code for Mechanical Refrigeration."

Install piping for minimum number of joints using as few elbows and other fitting as possible.

Arrange piping to allow normal inspection and servicing of compressor and other equipment. Install valves and specialties in accessible locations to allow for servicing and inspection.

Provide adequate clearance between pipe and adjacent walls and hanger, or between pipes for insulation installation. Use sleeves through floors, walls, or ceilings, sized to permit installation of full thickness insulation.

Insulate suction lines. Liquid lines are not required to be insulated, except where they are installed adjacent and clamped to suction lines, where both liquid and suction lines shall be insulated as a unit.

5. Do not install insulation until system testing has been completed and all leaks have been eliminated.

Install branch tie-in lines to parallel compressors equal length, and pipe identically and symmetrically.

Install seamless soft copper tubing in straight length in underground conduit as shown.

6. Install traps and double risers as required to entrain oil in vertical runs.
7. Liquid lines may be installed level.

Use fittings for all changes in direction and all branch connections.

Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

Conceal all pipe installations in walls, pipe chases, utility spaces, above ceilings, below grade or floors, unless indicated to be exposed to view.

Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1 inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

Locate groups of pipe parallel to each other, spaced to permit applying insulation and servicing of valves.

Exterior Wall Penetrations: Seal pipe penetrations through exterior walls using sleeves and mechanical sleeve seals. Pipe sleeves smaller than 6" shall be steel; pipe sleeves 6 inches and larger shall be sheet metal.

Fire Barrier Penetrations: Where pipes pass through fire-rated walls, partitions, ceilings, and floors, maintain the fire-rated integrity.

Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

Install strainers immediately ahead of each expansion valve, solenoid valve, hot gas bypass valve, compressor suction valve, and as required to protect refrigerant piping system components.

Install moisture/liquid indicators in liquid lines between filter/driers and thermostatic expansion valves and in liquid line to receiver.

8. Install moisture/liquid indicators in lines larger than 2-1/8-inch OD, using a bypass line.

Install unions to allow removal of solenoid valves, pressure regulating valves, expansion valves, and at connections to compressors and evaporators.

Install flexible connectors at the inlet and discharge connection of compressors.

PIPE JOINT CONSTRUCTION

Brazed Joints: Comply with the procedures contained in the AWS "Brazing Manual."

9. **WARNING:** Some filler metals contain compounds which produce highly toxic fumes when heated. Avoid breathing fumes. Provide adequate ventilation.
10. **CAUTION:** When solenoid valves are being installed, remove the coil to prevent damage. When sight glasses are being installed, remove the glass. Remove stems, seats, and packing of valves, and accessible internal parts of refrigerant

specialties before brazing. Do not apply heat near the bulb of the expansion valve.

During brazing fill the pipe and fittings with an inert gas (i.e., nitrogen or carbon dioxide) to prevent formation of scale.

Heat joints using oxy-acetylene torch. Heat to proper and uniform brazing temperature.

EQUIPMENT CONNECTIONS

The Drawings indicate the general arrangement of piping, fittings, and specialties.

Install piping adjacent to machine to allow servicing and maintenance.

All suction piping not completely concealed underslab or in ceiling cavities shall be rigidly mounted, insulated and covered with PVC jackets.

TESTING

Inspect, test, and perform corrective action for refrigerant piping in accordance with ASME Code B31.5, Chapter VI.

Preparation for Testing: Prepare piping in accordance with ASME B31.9 and as follows:

11. Leave joints, including welds, un-insulated and exposed for examination during the test.
12. Provide temporary restraints for expansion joints which cannot sustain the reactions due to test pressure. If temporary restraints are not practical, isolate expansion joints from testing.
13. Isolate equipment that is not to be subjected to the test pressure of the piping. If a valve is used to isolate the equipment, its closure shall be capable of sealing against the test pressure without damage to the valve. Flanged joints at which blinds are inserted to isolate equipment need not be tested.
14. Install relief valve set at a pressure to protect against damage by expansion of liquid or other source of overpressure during the test.

Testing Procedure

15. Use ambient temperature water as the testing medium, except where there is a risk of damage due to freezing. Another liquid may be used, if it is safe for workmen and compatible with the piping system components.
16. Use vents installed at high points in the system to release trapped air while filling the system. Use drains installed at low points for complete removal of that liquid.
17. Examine system to see that equipment and parts that cannot withstand test pressures are properly isolated. Examine test equipment to ensure that it is tight and that low pressure filling lines are disconnected.
18. All hydrostatic pressure shall be held for a minimum of 6 hours without a loss of pressure.

- 19. All gravity test shall be held long enough to visually inspect each joint with no visible loss of water for 15 minutes.
- 20. Air test will be held for a minimum of 2 hours without loss of pressure.
- 21. Any visible leakage or appreciable pressure drop during the test will be cause for rejection of the test. Additional tests will be required after corrective measures have been taken until satisfactory results are obtained.

Testing Requirements

Pipe Leak Testing		
Type of Pipe	Pressure Requirement	Minimum Test Duration
Refrigerant - High side	275 psig dry nitrogen	24 hours
Refrigerant - Low side	150 psig dry nitrogen	24 hours
All other piping test method determined by Superintendent		
* All sewers and drains shall not have more than 100 gallons per inch of nominal diameter per mile of length of either infiltration or exfiltration or as required by USEPA construction requirements under the clean water act.		

Testing Records

- 22. A signed and dated affidavit of testing shall be provided to the Superintendent within 72 hours of completion of testing.
- 23. Each affidavit shall contain, at a minimum, the testing date, testing start and end time (duration of testing), system or subsystem tested, test medium and pressure, test results, name and signature of individual performing test, name and signature of test witness and whether the portion of pipe tested meets state and local regulations and Purdue requirements for leaking.
- 24. Copies of all affidavits shall be included in the Operation and Maintenance Manuals.

ADJUSTING AND CLEANING

Verify actual evaporator applications and operating conditions, and adjust thermostatic expansion valve to obtain proper evaporator superheat requirements.

Clean and inspect refrigerant piping systems as recommended by equipment manufacturer.

Adjust controls and safeties. Replace damaged or malfunctioning controls and equipment with new materials and products.

COMMISSIONING

Charge system using the following procedure:

- 25. Install core in filter dryer after leak test but before evacuation.

26. Evacuate refrigerant system with vacuum pumps; until temperature of 35 deg F is indicated on vacuum dehydration indicator.
27. During evacuation, apply heat to pockets, elbows, and low spots in piping.
28. Maintain vacuum on system for minimum of 5 hours after closing valve between vacuum pump and system.
29. Break vacuum with refrigerant gas, and allow pressure to build up to 2 psi.
30. Complete charging of system, using new filter dryer core in charging line. Provide full operating charge.

Train Owner's maintenance personnel on procedures and schedules related to start-up and shut-down, troubleshooting, servicing, and preventative maintenance of refrigerant piping valves and refrigerant piping specialties.

Review data in Operating and Maintenance Manuals. Refer to Division 01 Section "Project Closeout".

Schedule training with Owner through the Design-Builder, with at least 7 days' advance notice.

END OF SECTION 23 23 00

SECTION 23 25 00 – HVAC WATER TREATMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. This Section includes the following HVAC water-treatment systems:
 - 1. HVAC water-treatment chemicals.

1.3 DEFINITIONS

- A. EEPROM: Electrically erasable, programmable read-only memory.
- B. Low Voltage: As defined in NFPA 70 for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.

1.4 PERFORMANCE REQUIREMENTS

- A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or the environment.
- B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.
- C. Closed hydronic systems, including chilled water cooling and heating hot water, shall have the following water qualities:
 - 1. pH: Maintain a value within 9.0 to 10.5.
 - 2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
 - 3. Boron: Maintain a value within 100 to 200 ppm.
 - 4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
 - 5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
 - 6. TDS: Maintain a maximum value of 10 ppm.
 - 7. Ammonia: Maintain a maximum value of 20 ppm.
 - 8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
 - 9. Microbiological Limits:

- a. Total Aerobic Plate Count: Maintain a maximum value of 1000 organisms/ml.
- b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
- c. Nitrate Reducers: Maintain a maximum value of 100 organisms/ml.
- d. Sulfate Reducers: Maintain a maximum value of 0 organisms/ml.
- e. Iron Bacteria: Maintain a maximum value of 0 organisms/ml.

1.5 ACTION SUBMITTALS

- A. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for the following products:
 1. Chemical material safety data sheets.
- B. Shop Drawings: Pretreatment and chemical treatment plan

1.6 INFORMATIONAL SUBMITTALS

- A. Field quality-control test reports.
- B. Other Informational Submittals:
 1. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in the "Performance Requirements" Article above.
 2. Water Analysis: Illustrate water quality available at Project site.

1.7 QUALITY ASSURANCE

- A. HVAC Water-Treatment Service Provider Qualifications: An experienced HVAC water-treatment service provider capable of analyzing water qualities, installing water-treatment equipment, and applying water treatment as specified in this Section.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1.8 MAINTENANCE SERVICE

- A. Scope of Maintenance Service: Provide chemicals and service program to maintain water conditions required above to inhibit corrosion, scale formation, and biological growth for cooling, chilled-water piping, heating hot water piping and equipment. Services and chemicals shall be provided for a period of one year from date of Substantial Completion, and shall include the following:
 1. Initial water analysis and HVAC water-treatment recommendations.

2. Startup assistance for Contractor to flush the systems, clean with detergents, and initially fill systems with required chemical treatment prior to operation.
3. Periodic field service and consultation.
4. Customer report charts and log sheets.
5. Laboratory technical analysis.
6. Analyses and reports of all chemical items concerning safety and compliance with government regulations.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. US Water Services
 2. Barclay Chemical Co.; Water Management, Inc.
 3. GE Betz.
 4. GE Osmonics.
 5. H-O-H Chemicals, Inc.
 6. Watcon, Inc.

2.2 CHEMICALS

- A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment, and that can attain water quality specified in Part 1 "Performance Requirements" Article.

PART 3 - EXECUTION

3.1 WATER ANALYSIS

- A. Perform an analysis of supply water to determine quality of water available at Project site.

3.2 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.

- B. At eight-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Design-Builder of changes necessary to adhere to Part 1 "Performance Requirements" Article.
- C. Comply with ASTM D 3370 and with the following standards:
 - 1. Silica: ASTM D 859.
 - 2. Steam System: ASTM D 1066.
 - 3. Acidity and Alkalinity: ASTM D 1067.
 - 4. Iron: ASTM D 1068.
 - 5. Water Hardness: ASTM D 1126.

3.3 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain HVAC water-treatment systems and equipment. Refer to Division 01 Section "Demonstration and Training."
- B. Training: Provide a "how-to-use" self-contained breathing apparatus video that details exact operating procedures of equipment.

END OF SECTION 23 25 00

SECTION 23 30 00 – DUCTWORK AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION

A. Description of Systems

1. Ductwork, fittings, and accessories.
2. Access doors.
3. Dampers.
4. Combination fire/smoke dampers.
5. Diffusers, registers and grilles.
6. Pressure relief doors.
7. Louver blank-off panels.
8. Acoustical pipe lagging.
9. Duct elbow silencers.
10. Duct leakage testing.

B. Work Installed But Not Furnished

1. Automatic dampers and operators. See Division 23 Section "Controls and Instrumentation".
2. Duct-mounted smoke detectors. See Division 26.

C. Definitions

1. Gage
2. Steel sheet and wire: U.S. Standard gage
 - a. Aluminum sheet: Browne & Sharpe Gage
 - b. Steel wire: Washburn and Moen Gage
3. Concealed Insulated Surfaces: Piping, ductwork and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed alleyways, and above suspended ceilings.
4. Exposed Insulated Surfaces: Piping, ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.

D. Drawings show tentative arrangement of partitions, diffusers and lights.

1. Owner reserves right to rearrange rooms, lights, and diffusers prior to actual installation to suit his needs.

2. Final location of diffusers, registers and grilles shall be from architectural reflected ceiling plans.

1.3 QUALITY ASSURANCE

A. Design and Installation Standards

1. ASHRAE Hand Book – HVAC Systems and Equipment, current chapter on duct construction.
2. ADC Standard 1062: GRD-84, Test Code for Grilles, Registers and Diffusers.
3. ADC Test Code FD 72-R1, Flexible Air Duct Test Code.
4. AMCA Standard 210, Test Code.
5. ASHRAE Standard 70, Method of Testing for Rating Fans for rating performance of Outlets and Inlets.
6. SMACNA HVAC Duct Construction Standard - Metal and Flexible, Third Edition, 2009. [NO EXCEPTIONS]
7. NFPA 90-A, Standard for the Installation of Air Conditioning and Ventilating Systems.
8. International Mechanical Code.
9. ASTM C1071: Microbial growth resistant coatings.

B. Fire and Smoke Rating Test Standards

1. ASTM E84, NFPA 255, and UL 723.

1.4 SUBMITTALS

A. Shop Drawings

1. Ductwork layout at 1/4-inch to 1-foot scale.
2. Indicate dimensions, elevations, clearances, etc.
3. Indicate all equipment, transitions, and fittings to scale.
4. Provide equipment connection details and ductwork support details.
5. Drawings shall be fully coordinated with the work of all other Trades.
6. Any interference that cannot be resolved between the various Trades shall be clearly identified on the Drawings.
7. Contractor shall not fabricate or install ductwork or equipment without approved Shop Drawings.

B. Product Data

1. All product items specified.
2. Manufacturer's literature and performance data.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Closeout Information

1. Operating and maintenance data.
2. Test, Adjust and balance reports.
3. “As-Built” drawings.
4. Warranties.

1.5 JOB CONDITIONS

- A. Coordinate the exact location of this work with the work of other trades prior to fabrication and installation. Verify all dimensions and elevations. Provide additional offsets and section of ductwork as required to meet job conditions. Coordinate with and review all related Drawings of all trades prior to start of work.
- B. See requirements of Division 23 Section “General Mechanical Requirements”.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Ductwork: McGill Airflow LLC; Semco, Sheet Metal Products Co.; Tangent Air; Monroe Metal Manufacturing Co.; Spiral-Air; Regional Sheetmetal Manufacturing, LLC and Lindab USA.
- B. Duct Sealer: Durkee-Atwood; Hardcast Inc.; McGill Airseal LLC; Foster Products Division; HB Fuller; and Ductmate.
- C. Duct Sealing Tape: Durkee-Atwood; Hardcast Inc.; and McGill Airseal LLC.
- D. Turning Vanes: Aero-Dyne; Airsan; Hart & Cooley; Titus; Vent Products Co.; and Ductmate.
- E. Duct fittings: Buckley, Flexmaster USA, Ins, McGill Air Flow LLC, ACME Mfg.
- F. Flexible Fan Connections: Base: Duro-Dyne; Elgin; Ventfabrics; and Ductmate.
- G. Flexible Duct: Acme Manufacturing Co.; Flexmaster USA, Inc.; Clevepak Corp.; Clevaflex Division; General Flex Corp.; Flexible Technologies, Automation Industries, Inc.; Flexible Systems Group.
- H. Fabric Ductwork (and Accessories): Duct Sox; Fabricair; Q-Sox; approved equivalent.
- I. Access Doors: Advanced Air, Inc.; Air Balance Inc.; Air Dynamics, Inc.; Greenheck; Prefco Products, Inc.; Ruskin; McGill Airflow LLC; Ventfabrics; Zurn Industries, Inc.; and Ductmate.
- J. Manual Dampers: Air Balance, Inc.; Greenheck; Krueger; Pottorff; Prefco Products Inc.; Ruskin Manufacturing Co.; McGill Airflow LLC and Safe-Air Inc.
- K. Backdraft Dampers: Air Balance, Inc.; Greenheck; Cesco; Pottorff; Prefco Products Inc.; Ruskin Manufacturing Co.; and Safe-Air Inc.

- L. Fire and Combination Fire/Smoke Dampers: Pottorff; Greenheck; Air Balance, Inc.; Ruskin Manufacturing Co.; Arrow United Industries, Inc.; Prefco Products; Safe-Air Inc.
- M. Diffusers, Registers, and Grilles: Anemostat; Krueger; Titus; and Price.
- N. Pressure Relief Doors: Ruskin, Green Heck, Pottorff, KEES, AJ Manufacturing, Inc.

2.2 MATERIALS—GENERAL

A. Sheet Metal

- 1. Galvanized Steel: ASTM A93, A924, A653, F.S. QQ-I-716

B. Duct Sealer

- 1. NFPA rating of "Non-Combustible."
- 2. Flame Spread Rating: 25 or lower, in dry condition.
- 3. Smoke Developed Rating: 50 or lower, in dry condition.
- 4. Resistant to water and water vapors.
- 5. Pressure Rupture Rating: 16-in. water gauge, minimum.
- 6. Durkee-Atwood, Permatite Class I; Hardcast 601; or United McGill, Uni-Grip Duct Sealer.

C. Flexible Ducts

- 1. UL 181, 191
- 2. NFPA 90A and 90B

D. Solder: ASTM B23, Grade 50B or F.S. QQ-S-571, Composition Sn50.

E. Duct Sealing Tape

- 1. NFPA rating of "Non-Combustible."
- 2. Flame Spread Rating: 25 or lower, in dry condition.
- 3. Smoke Developed Rating: 50 or lower, in dry condition.
- 4. Adhesive: Specifically compounded for adhesion to galvanize and stainless steel.
- 5. Tape to be UL listed.

F. RTV Foam: UL-listed room temperature vulcanized silicone rubber foam.

G. Acoustical Duct Liner (Transfer air only)

- 1. Knauf, Certain Teed Corp., Owens-Corning, Manville or Manson.

2.3 DUCTWORK, FITTINGS, AND ACCESSORIES

A. Ductwork - General

- 1. Constructed of galvanized steel sheet.

- a. Maintain full areas and suitable shapes at all points.
 - b. Shapes may be changed to fit unusual space conditions.
 - c. Provide all necessary transitions and offsets to complete systems.
 2. Each duct system shall be constructed for the specific external static pressures shown on the Contract Drawings.
- B. Ductwork, under 4 in wg (water gauge), Sheet Metal
 1. Ductwork includes but is not limited to:
 - a. All ductwork on outlet side of air terminal units and air pressure reducing valves.
 - b. Parts of return, exhaust and relief air ductwork as indicated.
 2. Construct in accord with SMACNA HVAC Duct Construction Standard as follows:
 - a. Rectangular duct: Table 2-5 or 2-19, positive or negative.
 - b. Round duct: 10 in wg static pressure Table 3-5, positive or Table 3-13 negative.
 - c. Round ducts shall be spiral seam.
 3. For all ducts with longest side 24 inches and over: Construct using the Ductmate, Nexus, Quicduc, SMACNA T-24 flange, or Pyramid-Lok duct connection systems.
 - a. Seal flanged ends with pressure-sensitive, high-density, closed-cell neoprene or polyurethane tape gasket, "Tremco 440", or butyl gasket.
 - b. For smaller duct sizes (longest side 23 inches or less): Above systems are optional.
 4. Seal all ducts based on external static pressures. For external static pressures below 1.5 in wg seal to meet SMACNA Seal Class B for 2 in wg as a minimum. For external static pressures below 4 in wg seal to meet SMACNA Seal Class A for 10 in wg as a minimum.
 5. Runouts to Diffusers, Register and Grilles: May use flexible ducts.
 - a. Exception: Flexible ducts may not pass through smoke or fire-rated walls, floors, or ceilings.
 - b. Maximum flexible duct length: 5 ft.
 - c. Minimum turning radius: As recommended by manufacturer.
- C. Ductwork, 4-inch wg and Over
 1. Ductwork includes:
 - a. All supply ductwork from air handling unit discharge to connection with air terminal units and air pressure reducing valves.
 - b. Rectangular supply, return, and exhaust duct operating in (positive or negative) pressure.

2. Construct in accordance with SMACNA HVAC Duct Construction Standard as follows:
 - a. Rectangular duct: Table 2-7 or 2-21, 10 in wg static pressure, positive or negative.
 - b. Round duct: Table 3-5 10 in wg positive static pressure. Table 3-13, 10 in wg negative static pressure.
 - c. Flat oval duct: Table 3-15, 10 in wg static pressure.
 - d. Round and flat oval ducts to be spiral lockseam constructed.
3. Runouts to Air Terminal Units: Rigid or flexible ductwork.
 - a. Exception: Flexible ducts may not pass through smoke or fire-rated walls, floors, or ceilings.
 - b. Maximum flexible duct length: 3 feet.
 - c. Minimum turning radius: As recommended by manufacturer.
4. Seal all ducts to seal Class A requirements.

D. Aluminum Ductwork

1. Use aluminum ductwork for systems as noted on drawings.
2. Construct in accordance with SMACNA HVAC Duct Construction Standard as follows:
 - a. Type 3003-H14, conforming to ASTM B-209.
 - b. Use Table 2-50 to convert galvanized steel gauges required in paragraphs above, to comparable aluminum thicknesses.
 - c. Use Table 2-51 and Table 2-52 and notes for how to adapt the steel duct reinforcement required in paragraphs above, to comparable aluminum reinforcement.
3. Duct joints shall be all-soldered construction.
4. Provide only fasteners, hangers, turning vanes, access doors, taps, fittings, dampers, insulation, supports, reinforcing, and accessories that are fully compatible with aluminum.

E. Duct Hangers and Supports

1. In accordance with the following:
 - a. Ductwork (Sheet Metal): SMACNA HVAC Duct Construction Standard, Chapter 5.

F. Duct Fitting and Joints under 4-Inch wg

1. Radius Elbows Without Vanes: Radius ratio (R/W) of 1.5 and greater.
 - a. Radius ratio (R/W) less than 1.5 are not allowed.

2. Where square throat elbows are indicated or required, provide with turning vanes.
3. Connections to Diffusers, Grilles and Registers: Fitted securely to necks or collars provided behind diffuser, grille, or register face area.
4. Branch Connections
 - a. Round: Factory-built bellmouth-type with locking quadrant damper.
 - b. Rectangular: 45-degree entry type or radius elbow.
5. Provide all necessary transition pieces and duct collars to make connections to ductwork from neck sizes scheduled or shown on Drawings.
6. Where building walls, floor and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted to building structure.

G. Duct Fittings and Joints on Systems 4 in-Inch wg and Over

1. Elbows 3- through 12-Inch Diameter: Die-stamped, for minimum air friction loss, with continuous corrosion-resistant welds.
2. Elbows over 12 Inch Diameter: Welded segment-type or standing seam, not less than 5 pieces for 90-degree elbows, and not less than 3 pieces for 45-degree elbows, using corrosion-resistant welds.
3. Tees: "Low loss, short cone-type," unless specifically detailed otherwise for space limitations.
4. "Y"s 45-degree type; 60-degree type may be used if space conditions dictate.
5. Install "Y"s where indicated.
6. Where tees are indicated, "Y"s may be substituted if space is available.
7. "Y"s: Straight-sided-type (no cone).
8. Take-Offs from Air Handling Unit Plenums: Bellmouth fittings.
9. "Y" take-offs from horizontal ceiling mounted ducts to serve boxes: May be straight-sided, shop-fabricated-type by accurately cutting and welding "Y"s into spiral ducts without use of fittings.

H. Turning Vanes

1. For square-throat elbows.
2. Velocities up to 2500 fpm: Single-vane, runner Type 2, with 3/4-inch trailing edge, 2-inch vane radius, and 1-1/2-inch vane spacing, minimum 24-ga.
 - a. For widths over 36 inches install vanes in 2 or more sections or use tie rods to limit unbraced vane length.
3. Where inlet and outlet dimensions of elbows are not equal, set 2 or more sections at 45-degree angle to give optimum turning as detailed on sheet metal drawings.

I. Partitions and Blank-Off Plates

1. Where used as part of an air handling unit, construct of 14-ga sheet metal with 1-1/2-inch standing seams.

2. Partitions 8 feet long or less: Use 1-1/2 x 1/4-inch angles spaced 2 feet on centers for additional bracing.
3. Partitions over 8 feet long: Use 2 x 1/4-inch angles.

J. Flexible Fan Connections

1. Material: Minimum 30 ounce Neoprene double-coated closely woven glass fabric flexible connections.
2. Fasten fabric to sheet metal duct work and to fan collar extension with 3/16-inch rivets spaced not more than 5 inch on center.
3. Locate in inlet and outlet of all fans, as close to fan as possible.
4. Provide at all ducts crossing building expansion joints and where indicated on drawings.
5. Connections shall not be under tension.
6. Isolate duct system from all equipment by at least 1 inch.

K. Flexible Ducts, Preinsulated

1. Under 4 inch wg Construction
 - a. Spiral wire or band, reinforced fabric liner or flexible aluminum or galvanized steel duct.
 - b. Nominal 1 inch x 3/4 lb/cf fiberglass insulation covered with vinyl, polyethylene or reinforced metallized vapor barrier.
2. 4 inch wg and Over Construction
 - a. Spiral wire or band, reinforced fabric liner or 2-ply flexible aluminum or hot-dip galvanized duct.
 - b. Nominal 1 inch x 3/4 lb/cf fiberglass insulation covered with vinyl, polyethylene or reinforced metallized vapor barrier.
3. Rated Working Pressure
 - a. Under 4 in wg duct: 5 inches positive or negative.
 - b. 4 inch wg and over duct: 10 inches positive.
4. Fire-resistant, self-extinguishing, UL Standard 181, Class 1, with flame spread of 25 or less and smoke development not to exceed 50.
5. R value – 6.0 unconditioned spaces, 4.2 conditioned spaces.
6. Under 4 inch wg Connections
 - a. Secure non-metallic duct to collar or sleeve with nylon draw band.
 - b. Secure metallic duct (under 12 inches in diameter) to collar with minimum three #8 sheet metal screws equally spaced around the duct's circumference. For ducts 12 inches in diameter and over use minimum five #8 sheet metal screws.
7. 4 inch wg and over Connections

- a. Secure duct to collar or sleeve with duct sealer and 1/2-inch aluminum or galvanized steel bands or clamps.
 - b. Secure insulation jacket with 2 wraps of duct tape.
8. Insulation and vapor barrier on factory-fabricated ducts shall be fitted over the core connection and shall also be secured with a draw band.
 9. Duct Sealer: E Moore Co., Tuff-Bond No. 12; Benjamin Foster No. 30-02, or McGill Airseal.
 10. Turn Radius: Not less than R/D equal to 1.0.
 11. Provide flexible duct supports in accord with Figure 3-10 and 3-11, SMACNA HVAC Duct Construction Standards.
 12. FLEXIBLE DUCTS SHALL NOT BE USED FOR RETURN OR EXHAUST.
- L. Access Doors
1. Provide at all fire, smoke, or duct-mounted dampers and where indicated.
 2. Doors shall close with air pressure, and shall have latches and hinges.
 3. Provide doors with 2-inch extension necks to clear insulation where applicable.
 4. Install all doors to permit easy visual inspection of fire or smoke dampers.
 5. Hardware: Ventlok, or equal, as follows:
 - a. Doors up to 12-inch maximum, in any direction: One No. 100.
 - b. Doors up to 18 inch long: Two No. 140 or No. 205.
 - c. Doors up to 24 inch long: Two No. 260.
 - d. Doors over 24 inch long: Two or more No. 310.
 - e. Door handles: Ventlok 220
 6. Provide gasket seal on all access doors.
- M. Fabric Ductwork
1. General
 - a. Description of Work
 - 1) Extent of non-metal ductwork is indicated on drawings and by requirements of this section.
 - 2) Types of non-metal ductwork required for this project include the following:
 - a) Textile Air Dispersion products.
 - b. Quality Assurance
 - 1) Building Codes and Standards
 - a) Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread/smoke developed requirements of NFPA 90-A and UL 2518.
 - b) All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.

- 2) Design & Quality Control
 - a) Manufacturer must have documented design support information including duct sizing; vent, orifice, and/or nozzle location; vent, orifice, and/or nozzle sizing; length; and suspension. Parameters for design, including maximum air temperature, velocity, pressure, and textile permeability, shall be considered and documented.
 - c. Submittals
 - 1) Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
 - 2) Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and UL 2518.
 - 3) Provide detailed drawings confirming configuration of Textile Dispersion System (diameter, lengths, airflow, pressure, and textile permeability).
 - 4) Provide detailed installation instructions for components to be installed.
 - 5) Provide warranty and maintenance documentation.
 - d. Warranty
 - 1) Manufacturer must provide a 20-Year Product Warranty for products supplied for the fabric portion of this system, as well as a Design and Performance Warranty.
 - e. Delivery, Storage, and Handling
 - 1) Protect textile air dispersion system and hanger components from damage during shipping, storage, and handling.
 - 2) Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.
2. Products
- a. Textile Air Dispersion System:
 - 1) SkeleCore FTS (Fabric Tensioning System): Air diffusers shall be constructed with internal tensioning frame.
 - a) System shall cylindrically tension textile along the entire length of textile duct, including all fittings (crosses, elbows, reducers and tees).
 - b) Tensioning system shall include full 360-degree tensioning and intermediate rings with quick connection spacer tubes concealed inside the fabric system.

- c) Interior structure to include multiple mechanically adjustable tension devices. To provide proper textile tensioning, structural and textile system shall be configured in segments of no more than 45 feet.
 - d) Textile components supported solely by metal cylindrical rings.
 - e) Each cylindrical ring shall require a vertical metal to metal cable safety attachment.
 - f) Vertical supports are Galvanized steel with available lengths of 5'(standard), 10', 15', & 30'.
- b. Textile
- 1) Sedona-Xm
 - a) Textile Construction: Filament/filament twill polyester treated with a machine washable anti-microbial agent by the fabric manufacturer, fire retardant in accordance with UL 2518.
 - b) Air Permeability: 2 (+2/-1) CFM/ft² per ASTM D737, Frazier
 - c) Weight: 6.8 oz. /yd² per ASTM D3776
 - d) Warranty: 20 years with standard inlet velocity.
 - 2) Textile Color
 - a) Standard: blue, white, tan, red, green, silver, black. Color by Design-Builder.
- c. Textile System Fabrication Requirements:
- 1) Textile system to be constructed in modular lengths (zippered) with proper radial securing clips (inlets, endcaps and mid-sections) and top access zippers for vertical cable safety attachment.
 - 2) Integrated air dispersion shall be specified and approved by manufacturer.
 - a) Linear Vents
 - i. Air dispersion accomplished by linear vent and permeable fabric. Linear vents must be sized in 1 CFM per linear foot increments (based on .5" SP), starting a 1 CFM through 90 CFM per linear foot. Linear vent is to consist of an array of open orifices rather than a mesh style vent to reduce maintenance requirements of mesh style vents. Linear vents should also be designed to minimize dusting on fabric surface.
 - ii. Size of vent openings and location of linear vents to be specified and approved by manufacturer.
 - 3) Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener – supplied by contractor.
 - 4) Inlet connection includes zipper for easy removal / maintenance.

- 5) Lengths to include required intermediate zippers as specified by manufacturer.
- 6) System to include Adjustable Flow Devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
- 7) End cap includes zipper for easy maintenance.
- 8) Each section of the textile shall include identification labels documenting order number, section diameter, section length, piece number, code certifications and other pertinent information.

d. Design Parameters:

- 1) Textile air diffusers shall be designed from 0.25" water gage minimum to 3.1" maximum, with 0.5" as the standard.
- 2) Textile air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F.
- 3) System overall design; diameter, length, airflow, operating static pressure and dispersion shall be designed or approved by the manufacturer.
- 4) Do not use textile diffusers in concealed locations.
- 5) Use textile air dispersion systems only for positive pressure air distribution components of the mechanical ventilation system.

3. Installation

a. Installation of Textile Air Dispersion System

- 1) Install chosen suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

b. Cleaning and Protection

- 1) Clean air handling unit and ductwork prior to the DuctSox system unit-by-unit as it is installed. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
- 2) Temporary Closure: At ends of ducts that are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering, which will keep the system clean until installation is completed.
- 3) If DuctSox systems become soiled during installation, they should be removed and cleaned following the manufacturer's standard terms of laundry.

2.4 DAMPERS

A. Dampers - General

1. Sizes and Types: As indicated.

2. Locate where indicated.
3. Factory-built and -assembled dampers.

B. Dampers, Automatic-Control-Type

1. Furnished in Division 23 Section "Controls and Instrumentation".
2. Install as specified in this Section.

C. Dampers, Manual (Rectangular and Square)

1. Opposed-blade-type, fitted with shank bolts, marked for direction (open/closed).
2. Provide for double-socket wrenches to fit square shank and locking hex nut.
3. Construction: Heavy minimum 12-gauge galvanized steel frames, flat or angle iron, with blades of 16-ga galvanized steel, equipped with brass pin running on stainless steel pivot for vertical axis.

D. Damper, Manual (Round)

1. Butterfly-type with circular blade mounted to shaft.
2. Frame: Minimum 14-ga galvanized steel channel.
3. Blade: Minimum 16-ga galvanized steel.
4. Axle: 1/2-inch diameter.
5. Bearings: Self-lubricating nylon or stainless steel sleeve.

E. Dampers, Backdraft, under 4 inch wg

1. Counterbalanced, gravity-operated.
2. Fabricate of aluminum.
3. Blades: Provided with common linkage rod and felt seals.

2.5 COMBINATION FIRE/SMOKE DAMPERS

- A. Parallel blade type with all blades hinged together for operation in unison and bearings arranged for automatic operation.
- B. May be used in lieu of separate dampers in low pressure systems for normally closed operation.
- C. Static Pressure Loss: Not over 0.25 inch WG at 2000 fpm and 24 inches x 24 inches.
- D. Use oversized dampers where necessary.
- E. Fire Rating: UL labeled for 1-1/2 hour.
- F. UL 555S Leakage Class: I (8 cfm/ft² at 4 inch WG).
- G. Firestat: UL listed.
 1. Lock damper in closed position at 212 deg F duct temperature.
 2. Provide override function to operate damper in a smoke control operation.

3. Provide two damper position indicator switches to provide remote indicating damper position

H. Operator: Electric motor mounted on exterior of damper sleeve.

2.6 FIRE DAMPERS

A. Fire Dampers - General

1. UL-labeled, 1-1/2-hr.-rated for penetrations through barriers with fire resistance ratings less than 3 hours.
2. UL-labeled, 3-hr.-rated for penetrations through barriers with fire resistance ratings of 3 hours or more.
3. Provide where indicated and where required by NFPA and local regulations.
4. Provide with mounting angles and minimum 18 -gauge sleeves.
5. Fusible link temperature rating to be per NFPA 90A (approximately 50 deg F above operating temperature but not less than 212 deg F and not to exceed 286 deg F).
6. All dampers to be dynamic rated.

B. Fire Dampers in Ducts under 4 inch wg

1. Multi-blade for openings over 12 x 12 inches, single-blade for openings 12 x 12 inch and less.
2. Multi-blade dampers: All blades must be out of airstream.
3. In small ducts, 8 inch and less: 1 inch larger in each dimension to give total loss through damper of 0.10 inch WG or less.
4. 1-1/2-hr.-rated: Air Balance, Inc. Model D19; Ruskin Model DIBD2; Greenheck DFD150.
5. 3-hr.-rated: Air Balance, Inc. Model D39; Ruskin Model DIBD23; Greenheck DFD350.

C. Fire Dampers in Ducts 4in wg and over

1. With sleeve and adapter fittings on each side of sleeve.
2. 1-1/2-hr.-rated: Air Balance, Inc. Model MD19; Ruskin Model DFD60; Greenheck DFDAF-310.
3. 3-hr.-rated: Air Balance, Inc. Model MD39; Ruskin Model DFD60-3; Greenheck DFDAF-330.

2.7 DIFFUSERS, REGISTERS, AND GRILLES

A. Diffusers, Ceiling

1. Square-type or slot-type as indicated.
2. Size, Type, and Manufacturer: As scheduled.
3. Finish: Factory-applied, baked or electrocoated enamel; color as selected by Design-Builder or as indicated.
4. Sponge rubber gasketed for ceiling diffusers and supply registers.

5. Provide all necessary screws, duct collars, transitions and air pattern deflectors.
6. Paint interior of perforated supply and return diffusers flat black. Exterior surfaces to match ceiling color, of factory enamel finish.
7. Use nominal 24-x 24-inch panel style diffusers in areas with lay in ceilings.
8. For hard ceilings, use 12- x 12-inch face diffusers with overlap style mounting for 6-inch diameter neck sizes; and 24- x 24-inch face for neck sizes 8 inches and larger.
9. Use circular diffusers in areas where ductwork is exposed only where indicated.
10. For all Supply Air devices, provide with molded insulation blanket/insulated backpan unless noted otherwise.
11. Provide opposed-blade dampers where scheduled on the Drawings.
12. Provide easily removed inner core with a positive lock.

B. Air Grilles and Registers

1. Size, Type, and Manufacturer: As scheduled.
2. Finish: Factory-applied, baked or electrocoated enamel; color as selected by Design-Builder or as indicated.
3. Sponge rubber gasketed for ceiling and wall supply units.
4. Provide all necessary screws, duct collars, and transitions.
5. Provide opposed blade dampers with supply air grilles and registers where scheduled on the Drawings.

C. Diffusers and Grilles, Linear

1. Size, Type, and Manufacturer: As scheduled
2. Adjustable pattern, extruded aluminum or steel.
3. Fixed pattern, extruded aluminum, airline grille with 0-degree deflection, and damper.
4. Fixed pattern, extruded aluminum, airline grille with 15-degree deflection, and damper.

D. High Capacity Drum Louver

1. Furnish and install high capacity drum louver supply outlets of sizes and mounting types indicated on the plans and air distribution schedule.
2. The outlets shall have aluminum frame construction, and extruded aluminum drum and vanes.
3. The outlets shall consist of individually adjustable spread control vanes housed within a rotatable drum.
4. The drum pivot mechanism shall incorporate a positive positioning detent device to hold field adjusted drum angles of up to thirty degrees off-center. Adjustable vanes shall pivot and maintain blade setting.
5. The outlet mounting frame shall be constructed of formed steel with welded, reinforced corners for added strength.
6. The mounting frame shall be supplied with countersunk screw holes for aesthetic appeal.
7. All components shall have a baked-on powder coat finish.
8. Opposed Blade Damper: The heavy duty, opposed blade balancing damper shall be constructed of a minimum 18 gauge coated, cold rolled steel. The damper frame corners shall overlap and be of welded construction for added

strength. The damper shall be operable from the register face. The damper shall be supplied fitted with a face accessible screw-type blade locking mechanism.

9. The outlet shall be suitable for spiral duct mounting where applicable. The spiral duct frame shall be aluminum construction.

2.8 PRESSURE RELIEF DOORS

- A. Provide pressure relief doors to relieve pressure and prevent structural damage to ductwork or plenums in the event excessive pressure within the air distribution systems should occur. Provide in the supply and return air paths of air handling units.
- B. Doors to open at 8 inches wg static on supply systems and -4 inches wg on return systems.
- C. Doors to automatically close and reset when the static pressure is reduced to less than 4 inches wg on supply systems and -2 inches wg on return systems
- D. Doors to be installed to open outwardly to relieve positive pressure build-up or to open inwardly to prevent damage due to negative pressure.
- E. Construction
 1. 12-ga galvanized steel frame and door.
 2. Polyurethane foam seal around door perimeter.
 3. Negator springs for door closure upon loss of over-pressurization.
 4. 18 x 18 inch size.
- F. Ruskin PRD18 pressure relief door.
- G. Install vertically and level for proper operation.

2.9 LOUVER BLANK-OFF PANELS

- A. Provide blank-off panels behind inactive louver sections.
 1. Double-wall construction with minimum 22-ga galvanized sheet metal and 2-inch-thick rigid insulation.
 2. Paint side facing louver flat black.

2.10 ACOUSTICAL PIPE LAGGING

- A. Acoustical pipe lagging shall be a 1 lb. psf mass loaded vinyl noise barrier with a reinforced-foil face. Nominal thickness of 0.125 inches.
- B. Class A flammability rated; Flame Spread Index less than 15; Smoke Density less than 20.

- C. Accessories for securely mounting acoustical pipe lagging: Foil lag tape, stick pins, welding pins, banding.
- D. Acoustical Performance:

1. Sound Transmission Loss: Per ASTM E 90

Product	Sound Transmission Loss (db) Frequency (Hz)						STC
	125	250	500	1000	2000	4000	
B-10 LAG	15	18	22	27	32	37	27

- E. Products: Sound Seal Model B-10 LAG, or equal.
- F. Install per manufacturer’s recommendations.

2.11 DUCT ELBOW SILENCERS

A. General Requirements:

1. Silencers shall be of the size, configuration, capacity and acoustic performance as scheduled on the drawings. All silencers shall be factory fabricated and supplied by the same manufacturer.
2. Transitions on inlet and outlet will not be accepted. Silencers shall fit the ducting system they are installed in without requiring duct fittings/transitions. Silencer inlet and outlet must match duct dimensions. See contract documents for silencer configuration. Non-basis of design suppliers must submit details of internal geometry of silencers to be supplied.
3. Silencers shall be constructed in accordance with ASHRAE and SMACNA standards for the pressure and velocity classification specified for the air distribution system in which it is installed. Material gauges noted in other sections are minimums. Material gauges shall be increased as required for the system pressure and velocity classification. The silencers shall not fail structurally when subjected to a differential air pressure of 8 inches water gauge.
4. All casing seams and joints shall be lock-formed and sealed or stitch welded and sealed to provide leakage-resistant construction. Airtight construction shall be achieved by use of a duct-sealing compound supplied and installed by the contractor at the jobsite.
5. All perforated steel shall be adequately stiffened to insure flatness and form.
6. Fire-Performance Characteristics: Silencer assemblies, sealants, and acoustical spacer, shall have flame-spread index not exceeding 25 and smoke-developed index not exceeding 50 when tested according to ASTM E 84, NFPA 255 or UL 723.
7. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1-2007.

- B. Rectangular Silencers: Outer casing shall be ASTM A 653/A 653M, G90 galvanized sheet steel. Gauge 22 and Gauge 18 respectively. Inner perforated metal liner: ASTM A 653/A 653M, G90 galvanized sheet steel, Gauge 26 and Gauge 22

C. Principal Sound-Absorbing Mechanism:

1. Dissipative silencers:
 - a. Type with acoustic media. Media shall be of acoustic quality, shot-free glass fiber insulation with long, resilient fibers bonded with a thermosetting resin. Glass fiber density and compression shall be as required to insure conformance with laboratory test data. Glass fiber shall be packed with a minimum of 15% compression during silencer assembly. Media shall be resilient such that it will not crumble or break, and conform to irregular surfaces. Media shall not cause or accelerate corrosion of aluminum or steel. Mineral wool will not be permitted as a substitute for glass fiber.
- D. HTL Casings: Where indicated on the silencer schedule, silencers shall have high transmission loss (HTL) walls externally applied and completely sealed to the silencer casing by the silencer manufacturer to assure quality controlled transmission loss. The HTL walls shall consist of media, airspace, mass and outer protective metal skin, as required, to obtain the specified room noise criteria. Standard acoustical panels will not be accepted as HTL walls. If requested by the Engineer, break-out noise calculations for each air handling and fan system shall be provided with the silencer submittal to insure compliance with the room noise criteria. Break-out noise calculations shall be based on the sound power levels of the specified equipment.
- E. Products: Vibro-Acoustics model RD, RED, or equal.
- F. Install per manufacturer's recommendations.

2.12 DUCT LEAKAGE TESTING

- A. For ducts constructed for 4-incg wg and above:
- B. Use procedures listed in the "HVAC Air Duct Leakage Test Manual".
- C. Provide a report to the Design-Builder of the findings of the duct leakage test.
- D. Coordinate testing with the Commissioning Agent and Construction Manager.

PART 3 - EXECUTION

3.1 GENERAL

- A. Form and erect ductwork to avoid pipes, lighting fixtures, joists, beams, etc., and to maintain head room and clearances required for the project, or as noted. Coordinate locations with work of all Trade Contractors. Verify all dimensions and elevations. Special attention is again directed to the pre-construction layout drawing and coordination requirements of this section.
- B. Provide all offsets and modifications to the duct systems required because of interferences encountered. It is this Contractor's responsibility to avoid this as much as possible by coordinating his work with the work of the other Contractors. If

modifications are necessary, this Contractor shall perform all such modifications and offsets in an approved manner as required for this work, at no additional cost.

- C. Volume dampers or splitter dampers shall operate without rubbing side of ducts or binding. Blades shall be tight on shaft. If dampers are loose and noisy, system will be rejected and damper shall be replaced.
- D. Only one damper regulator will be allowed per multi-blade damper. All multi-blade dampers shall be provided with Vent Fabrics, Inc. parallel blade and opposed blade hardware. Dampers shall be set in a 3/8-inch x 2-inch steel frame.
- E. If, because of obstructions, damper regulation is not possible with the above hardware, regulation shall be accomplished with right angle gear assemblies. Dampers in concealed ductwork shall be operable at concealed regulators.
- F. Provide concealed regulators for volume dampers in concealed ductwork.
- G. Paint inside surface of ductwork for a distance of two feet directly behind air devices, with flat black where sheet metal is visible.

3.2 INSTALLATION OF DUCTWORK

- A. Install ductwork in accordance with arrangements and sizes indicated on the Drawings; construct of the best grade of galvanized steel unless otherwise specified. Include all necessary elbows or square turns with turning vanes of the double-wall galvanized steel air-foil-type, deflectors, dampers, damper quadrants, hangers, etc., and erect in a thorough and workmanlike manner. Rectangular ducts of 14-inch size dimensions and under, and round and oval ducts, shall have radius turns, with inside radius equal to or greater than the dimension of duct in direction of turn, in lieu of turning vanes.
- B. Conceal all ductwork in finished spaces unless indicated otherwise.
- C. All ductwork exposed to view shall be supplied and installed with paint grip galvanizing with final painting of same by the painting Trade Contractor. Painting shall not be a part of this Contractor's work. Do not paint ceiling-hung ductwork in electrical equipment rooms or sensitive production areas and switchrooms.
- D. Form radius elbows with a 1-1/2 ratio of centerline radius of duct dimension in the direction of the turn wherever possible.
- E. Do not install ductwork in or allow to enter or pass through electrical rooms, elevator machine rooms, or spaces housing switchboards, panelboards or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms, or spaces.
- F. Exercise special care to provide tight-fitting well-fabricated, well-braced ductwork systems.
- G. Field assembly rectangular, round or flat oval ductwork as follows:
 - 1. Use caulking-grade joint sealer applied slip joints, or:

2. Use slip joints, couplings, etc., sealed with "shrink-fit" plastic bands, with thermal setting adhesives pre-applied to plastic bands, or:
 3. Use slip joints, couplings, etc., sealed with pressure-sensitive tape.
 4. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets, and gaskets and washers for bolts.
- H. In ducts 4-inch wg and over ductwork, do not use 2-piece mitered 90-degree elbows with or without vanes unless approved by Design-Builder.
- I. Make all duct connections from hoods, openings, fans, and other devices.

3.3 INSTALLATION COMBINATION FIRE/SMOKE DAMPERS

- A. Install in accordance with manufacturer's instructions as well as all applicable codes.
- B. Seal all dampers at wall openings and between damper and sleeve or duct around one side of damper's downstream face.
- C. 24 volt AC power supply by Electrical Contractor.

3.4 CLEANING

- A. At completion of work and prior to final acceptance, clean all work installed under this Section.

3.5 EQUIPMENT DEMONSTRATION

- A. Prior to final acceptance, inspect, test, and operate satisfactorily, in presence of Design-Builder and representative of the Owner, operation of each piece of equipment and its accessories.
- B. If inspection or test shows defects, replace defective work or material.
- C. Repeat inspections and tests until defects are eliminated.

END OF SECTION 23 30 00

SECTION 23 34 00 – EXHAUST AND VENTILATING FANS

PART 1 - GENERAL

1.1 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section including, but not limited to, Division 01 General Requirements.

1.2 DESCRIPTION

A. DESCRIPTION OF SYSTEMS

- 1. Roof/Wall centrifugal exhaust fans: Greenheck models: G / GB / CUE / CUBE
- 2. In-line centrifugal fans: Greenheck models: SQ / BSQ

B. ABBREVIATIONS

- 1. AMCA: Air Moving and Conditioning Association.
- 2. ADC: Air Diffusion Council.
- 3. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.

1.3 QUALITY ASSURANCE STANDARDS

- A. ADC Standard 1062R2, Air Diffusing Equipment Test Code.
- B. AMCA Standard 210, Test Code for Air Moving Devices.
- C. ASHRAE Standard 70, Method of Testing and Rating the Air Flow Performance of Outlets and Inlets.
- D. NFPA 90-A, Standard for the Installation of Air Conditioning and Ventilating Systems.
- E. UL listed as “Power Ventilator for Smoke Control Systems” (where applicable).

1.4 SUBMITTALS

- A. All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Division 01 Section “Submittals”.
- B. Shop Drawings: All equipment items specified, including fan curves.
- C. Product Data
 - 1. Dimensional Drawing.

2. Performance data.
3. Fan curves for specific operation, with flow, static pressure, and horsepower.
4. Sound data
5. Dryer venting comprehensive set of interfaced drawings and duct design calculations.

D. Contract Close-Out Information

1. Operating and maintenance data.
2. Owner instruction report.

E. ACCEPTABLE MANUFACTURES

1. Greenheck Fan Corp., Acme, Penn, Loren Cook.

PART 2 - PRODUCTS

2.1 GENERAL

A. Fans - General

1. Performance ratings: Based on laboratory tests conducted in accordance with latest edition of the ASHRAE/AMCA Standard Test Codes. All fans to be AMCA labeled.
2. Ratings: As indicated.
3. Arrangement and drive: As indicated.
4. Provide removable belt guard.
5. Drive sheaves
 - a. Cast iron, split tapered bushings dynamically balanced at factory.
 - b. Provide wide-range variable-speed adjustable sheaves to be used for balancing systems.
 - c. Provide final fixed pitch drive sheaves for proper RPM determined during balancing process.
6. Fans 15 HP and less: Provide with adjustable sheaves.
7. Finish: Applied or as indicated on Drawings.
8. For fans suspended from ceilings, belt-tightening device may be pivoted-type.

2.2 ROOF-MOUNTED / WALL-MOUNTED CENTRIFUGAL EXHAUST FANS

A. Roof Exhaust Fans

1. Centrifugal, direct or belt-driven, curb-mounted-type.
2. Capacity: As scheduled.
3. Fan wheel: Backward-curved, dynamically and statically balanced.
4. AC Induction Motors
 - a. Motor enclosures: Open drip-proof as scheduled

- b. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase
 - c. Mounted on vibration isolators, out of the airstream
 - d. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants
 - e. Accessible for maintenance
5. Electronically Commutated Motor
- a. Motor enclosures: Open type
 - b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - c. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor
 - e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal
6. Shafts and Bearings:
- a. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating
 - b. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed
 - c. Bearings are 100 percent factory tested
 - d. Fan Shaft first critical speed is at least 25 percent over maximum operating speed
7. Housing: Extruded or heavy-gage sheet aluminum mounted on rigid support structure
8. Options/Accessories
- a. Provide factory-installed and -wired disconnect device outside motor compartment.
 - b. Provide powered or self-acting backdraft damper.
 - c. Provide 1/2-inch mesh birdscreen on outlet.
 - d. Motor mounted potentiometer dial or Factory-wired, solid-state speed controller, on direct-drive fans.
 - e. Explosion-Proof Units: Provide spark-proof, non-ferrous wheels, spark-proof belt, with explosion-proof motor in separate compartment, arranged for explosive vapor exhaust.
 - f. Provide factory-prefabricated, insulated roof curbs meeting National Roofing Contractor's Association approved standard with nailing strips, etc.

- g. Curb height: Minimum 18-inch, above finished roof. Provide level installation, regardless of roof slope. Type to suit roof construction and provide watertight enclosure.
- h. Cleanout port, grease trap, and hinged access for grease applications.
- i. Finishes as scheduled.
- j. Factory provided Variable Frequency Drives as scheduled.

2.3 IN-LINE CENTRIFUGAL FANS

A. In-Line Centrifugal Fans

- 1. Centrifugal, direct or belt-driven.
- 2. Capacity: As scheduled.
- 3. Fan wheel: Backward-inclined or Forward curved, dynamically and statically balanced
- 4. AC Induction Motors
 - a. Motor enclosures: Open drip-proof as scheduled.
 - b. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and furnished at the specific voltage and phase.
 - c. Mounted on vibration isolators, out of the airstream.
 - d. For motor cooling there shall be fresh air drawn into the motor compartment through an area free of discharge contaminants.
 - e. Accessible for maintenance.
- 5. Electronically Commutated Motor
 - a. Motor enclosures: Open type.
 - b. Motor to be a DC electronic commutation type motor (ECM) specifically designed for fan applications. AC induction type motors are not acceptable. Examples of unacceptable motors are: Shaded Pole, Permanent Split Capacitor (PSC), Split Phase, Capacitor Start and 3 phase induction type motors.
 - c. Motors are permanently lubricated, heavy duty ball bearing type to match with the fan load and pre-wired to the specific voltage and phase.
 - d. Internal motor circuitry to convert AC power supplied to the fan to DC power to operate the motor.
 - e. Motor shall be speed controllable down to 20% of full speed (80% turndown). Speed shall be controlled by either a potentiometer dial mounted at the motor or by a 0-10 VDC signal.
- 6. Shafts and Bearings:
 - a. Fan shaft shall be ground and polished solid steel with an anti-corrosive coating.
 - b. Bearing shall be selected for a minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
 - c. Bearings are 100 percent factory tested.

- d. Fan Shaft first critical speed is at least 25 percent over maximum operating speed.
7. Housing/Cabinet Construction
- a. Square design constructed of heavy gauge galvanized steel and shall include square duct mounting collars.
 - b. Housing and bearing supports shall be constructed of heavy gauge bolted and welded steel construction to prevent vibration and to rigidly support the shaft and bearing assembly.
8. Options/Accessories
- a. Provide factory-installed and -wired disconnect device outside motor compartment.
 - b. Provide powered, Inlet Vane, or self-acting backdraft damper.
 - c. Belt Guards to cover motor and drive.
 - d. Inlet and/or Outlet guard.
 - e. Factory isolation – free standing or housed Neoprene/rubber/spring sized for weight of the fan.
 - f. Motor mounted potentiometer dial or Factory-wired, solid-state speed controller, on direct-drive fans.
 - g. Extended lube lines.
 - h. Explosion-Proof Units: Provide spark-proof, non-ferrous wheels, spark-proof belt, with explosion-proof motor in separate compartment, arranged for explosive vapor exhaust.
 - i. Finishes as scheduled.
 - j. Factor provided Variable Frequency Drives as scheduled.
 - k. Insulated housing.
 - l. Integral light – for ceiling application.
 - m. Additional control and venting accessories to be scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install in accord with manufacturer's recommendations and as specified.
- B. All roof-mounted fans are to have their curb caps secured to the roof curbs.
- C. FAN DYNAMIC BALANCING
 - 1. Have fan dynamic balancing for 7.5 hp and above centrifugal fans performed by experience trained mechanics from factory to include following:
 - 2. Inspection of fans to determine if damage has occurred during storage or installation and coordinate repair of any damages.
 - 3. Inspection of fan drives, including bearing and motor mounts.
 - 4. Inspection of tensioning of drive belts on adjustable and fixed pitch sheaves.

5. X-Y dynamic vibration plot on each fan resulting in a properly balanced installation within factory specifications, performed after system has been balanced and final fixed pitch drive sheaves installed.

END OF SECTION 23 34 00

SECTION 23 36 16 – TERMINAL BOXES – DDC CONTROL**PART 1 - GENERAL****DESCRIPTION**

Provide high velocity terminal boxes, complete with direct digitally controlled velocity controller, electric actuator, velocity pressure pickup device, and attenuator section. Provide reheat coils and fans as scheduled on Drawings and specified herein.

Terminal boxes and fan power boxes shall be pressure independent, and suitable for either constant volume or variable volume service as indicated on the Drawings.

All terminal box controls, whether factory or field installed, shall be fully compatible with and communicate seamlessly with the building's temperature control or building automation system described in Division 23 Section "Controls and Instrumentation".

QUALITY ASSURANCE

Standards: American Refrigeration Institute (ARI), National Fire Protection Association (NFPA), and Underwriters' Laboratories (UL).

ARI-880: Performance rating.

RATINGS AND CAPACITIES

Refer to the Drawings for CFM, noise criteria and other design requirements.

MANUFACTURERS

Johnson Controls, Titus, Anemostat, Trane, Price, and Kreuger.

SUBMITTALS

Shop Drawings: All equipment items specified.

Product Data: Terminal units.

Samples: Not required for review.

Reference Submittals: Not required for review.

Contract Close-Out Information

1. Operating and maintenance data.
2. Owner instruction report.

3. Guarantee.

PART 2 - PRODUCTS

TERMINAL BOXES

General Construction: Galvanized steel, 22 gauge minimum, plenum box with 3/8 inch thick, 1.5 lb. density, fiber-free acoustical thermal lining in accordance with UL 181 and NFPA 90A. Fiberglass lining is not acceptable. Casing leakage shall be less than 13 CFM at 6 inches W.G.

Inlet Dampers: Self-seating against a closed cell foam gasket, pivoted on self-lubricating Delrin bearings, mounted directly to the inlet port, and positively connected to a electric operator. Damper leakage not to exceed 8 CFM at 6 inches W.G. in fully closed position.

Controls

1. Each VAV terminal shall include application specific controls with integral microelectronic flow sensors mounted within a NEMA 1 enclosure. The controllers shall have been connected by suitable tubing to a inlet velocity sensor mounted in the inlet to the terminal.
2. An individual transformer shall be furnished on each VAV terminal to provide power for the controller and the contactors for any required fan and electric heaters at 24 Vac at 50/60 Hz.
3. Each controller shall control zone temperature by varying the airflow into the space using a PI control loop with programmable proportional and integral coefficients. Applications requiring supplemental heat shall utilize a separate PI algorithm, with programmable proportional and integral coefficients to maintain heating temperature setpoint.
4. The controllers shall modulate the damper motors to maintain CFM from each terminal in accordance with the cooling/heating requirements calculated by comparing the sensed space temperature with the setpoint and time of day schedule. Zone temperature shall be controlled to +1 degree F. Airflow shall be controlled down to 250 fpm, and shall be read in 25 fpm increments at velocities greater than 500 fpm.
5. Each controller shall have an internal software clock to implement setpoint changes and changes of control state, in accordance with the resident occupancy. The clocks will be synchronized hourly and automatically following power failures, by a battery backed real-time clock located in the system interface.

Damper Operator: Supply suitable bi-directional 24 volt synchronous electric damper actuators. The motors shall have heavy duty gears and shall contain a magnetic clutch which releases when the damper is driven to either extreme. Stall type actuators or DC actuators without current limiting are not acceptable. The operator shall be sized to accurately and smoothly operate the damper through the expected CFM range of the terminal, against a duct static pressure ranging up to the largest external static pressure scheduled on the Drawings.

Sound Attenuator Section: 22 gauge, galvanized steel with insulation lining to match the terminal box lining, 3 foot length minimum (unless noted otherwise on Drawings).

Velocity Pickup: Ring or cross-shaped, multi-point center averaging type velocity pressure pickup shall be provided by Box Manufacturer. Velocity pickup shall amplify the duct velocity pressure, and maintain control accuracy with inlet ducts in any configuration. Single point or a single inline multiple point velocity pickups will not be accepted.

Hot Water Coil

6. Galvanized steel casing, flanged duct connection at unit discharge, 1/2 inch diameter copper tubes, aluminum fins, solder connections, one or two row serpentine coil (refer to scheduled data on Drawings for performance requirements and required number of rows). All coils shall be factory installed.
7. Insulate the entire exposed perimeter of hot water coil.
8. Provide hot water control valve and operator, compatible with terminal box controls.

PART 3 - EXECUTION

INSTALLATION

Support boxes independent of ceiling system. Coordinate with General Trades Contractor.

Provide access as required for maintenance and repair. All boxes located above the ceiling shall be end discharge unless otherwise noted. All boxes shall deliver the air quantities shown on the Drawings at acceptable sound levels.

Make flexible duct and flexible connections at box duct connections. Provide a transition from the full size of each terminal outlet to the discharge ductwork shown on Drawings. Transition shall be tapered with a 60 degree maximum included angle.

Coordinate installation of controls.

Install hot water piping, valves and specialties.

END OF SECTION 23 36 16

SECTION 23 52 16 – CONDENSING BOILERS**PART 1 - GENERAL****1.1 REFERENCE**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 DESCRIPTION

- A. Section includes gas-fired, fire-tube condensing boilers, trim, and accessories for generating hot water.

1.3 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASME Compliance: Fabricate and label boilers to comply with 2010 ASME Boiler and Pressure Vessel Code.
- C. ASHRAE/IES 90.1 Compliance: Boilers shall have minimum efficiency according to "Gas and Oil Fired Boilers - Minimum Efficiency Requirements."
- D. DOE Compliance: Minimum efficiency shall comply with 10 CFR 430, Subpart B, Appendix N.
- E. UL Compliance: Test boilers for compliance with UL 795. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- F. CSA Compliance: Test boilers for compliance with CSA B51.

1.4 SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for boilers.
 - 2. Include rated capacities, operating characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For boilers, boiler trim, and accessories.

1. Include plans, elevations, sections, mounting and attachment details.
2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Delegated-Design Submittal: For each boiler.

1. Design calculations and vibration isolation base details, signed and sealed by a qualified professional engineer.
 - a. Design Calculations: Calculate requirements for selecting vibration isolators and seismic restraints and for designing vibration isolation bases.
 - b. Vibration Isolation Base Details: Detail fabrication, including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.

1.5 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: For boiler, accessories, and components, from manufacturer.

1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
2. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Other Informational Submittals:

1. ASME Stamp Certification and Report: Submit stamp certificate of authorization, as required by authorities having jurisdiction, and document hydrostatic testing of piping external to boiler.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For boilers to include in emergency, operation, and maintenance manuals.

1.7 WARRANTY

A. Manufacturer's Warranty: Manufacturer agrees to repair or replace components of boilers that fail in materials or workmanship within specified warranty period.

1. Warranty Period for Condensing Boilers:
 - a. Leakage and Materials: 10 years from date of Substantial Completion.

- b. The boiler's pressure vessel is warranted against failure due to thermal shock for the lifetime of the boiler provided the boiler is installed, controlled, operated and maintained in accordance with the installation, operation and maintenance manual.
- c. The pressure vessel and heat exchanger is covered against failures resulting from flue gas corrosion and/or defective material or workmanship for a period of five (5) years from the date of shipment from the factory. Waterside corrosion or scaling is not covered. The manufacturer will repair, replace, exchange or credit at their option, FOB factory, the pressure vessel as defined above, provided this equipment has been installed, operated and maintained by the buyer in accordance with the Installation, Operation and Maintenance Manual.

1.8 DELIVERY

- A. Deliver products to Owner's site. Include all shipping costs in bid (FOB jobsite). Design-Builder's rigger or chosen contractor will unload from truck. Boiler manufacturer and Mechanical Contractor shall coordinate with the rigging contractor all aspects of the rigging requirements.
- B. Rigging to take place per Manufacturer's and Design-Builder's requirements.
- C. A manufacturer's representative shall be required to observe the rigging of the boiler components for conformance with the manufacturer's rigging requirements.
- D. Boilers shall not be stored in areas exposed to weather (outside). Precaution shall be taken to store boiler components as required and recommended by the manufacturer.
- E. Protect units from physical damage. Leave factory shipping covers and protective environmental charges in place until installation by others.

PART 2 - PRODUCTS

2.1 FLOOR-MOUNTED, FORCED-DRAFT, FIRE-TUBE CONDENSING BOILERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. AERCO; A WATTS Brand.
 - 2. Cleaver-Brooks.
 - 3. Fulton Boiler Works, Inc.
- B. Description: Factory-fabricated, -assembled, and -tested, fire-tube, forced-draft, condensing boiler with heat exchanger sealed pressure tight, built on a steel base, including insulated jacket; flue-gas vent; combustion-air intake connections; water supply, return, and condensate drain connections; and controls. Units are to be for water-heating service only.

- C. Primary Heat Exchanger: Corrosion-resistant stainless steel.
- D. Secondary Heat Exchanger: Corrosion-resistant stainless steel.
- E. Combustion Chamber and Flue Pipes: Corrosion-resistant stainless steel or aluminum.
- F. Pressure Vessel: Carbon steel with welded heads and tube connections.
- G. Burner: Natural gas, forced draft.
- H. Blower: Centrifugal fan to operate during each burner-firing sequence and to prepurge and postpurge the combustion chamber.
 - 1. Motors: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 230500 "Common Work Results for HVAC."
 - a. Motor Sizes: Large enough so driven load will not require motor to operate in service factor range above 1.0.
- I. Gas Train: Combination gas valve with manual shutoff and pressure regulator.
- J. Ignition: Direct-spark ignition or silicone carbide hot-surface ignition with 100 percent main-valve shutoff and electronic flame supervision.
- K. Casing:
 - 1. Jacket: Sheet metal, with snap-in or interlocking closures.
 - 2. Control Compartment Enclosures: NEMA 250, Type 1A.
 - 3. Finish: Powder-coated protective finish.
 - 4. Insulation: Minimum 2-inch- thick, mineral-fiber insulation surrounding the heat exchanger.
 - 5. Combustion-Air Connections: Inlet and vent duct collars.

2.2 TRIM

- A. Safety valve(s) shall be ASME Section IV approved side outlet type mounted on the boiler air vent outlet. Size shall be in accordance with code requirements.
- B. Temperature and pressure gauge shall be mounted on the water outlet.
- C. Solid State Low water cut-off probe control with manual reset and test switch.
- D. Manual Reset High Limit Temperature sensor; range not to exceed 210 deg F and shall be an integral device of the Boiler Burner Control and UL Recognized as a limit control.
- E. Outlet water supply sensing probe for operating water limit setpoint.
- F. Return water-sensing probe for operating limit setpoint.

- G. Drain valve
- H. Automatic air vent
- I. Auxiliary low water cutoff
- J. Alarm lights and horn (general alarm light – red, fuel valve light – green, load demand light – white, low water light - amber)
- K. Alarm horn (electronic sounder)
- L. Stack temperature sensor – UL Recognized as a limit control.
- M. Condensate neutralization kit combination tank and trap
- N. Automatic isolation valve, including valve, actuator, and transformer to power isolation valve through the boiler. The valve, actuator, and transformer shall ship loose for field installation and wiring.
 - 1. The isolation valve shall be Bray 2-way resilient seated butterfly valve, model ABL or approved equal, with ANSI 150# flanges, lugged style.
 - 2. The electric actuator shall a Bray Commercial actuator, or approved equal, 24VAC, fail in position, with auxiliary end switch.

2.3 CONTROLS

- A. Boiler operating controls shall include the following devices and features:
 - 1. Control transformer.
 - 2. Set-Point Adjust: All set points shall be adjustable.
 - 3. Electric, factory-fabricated and factory-installed panel to control burner-firing rate, to reset supply-water temperature inversely with outside-air temperature. At 0 deg F outside-air temperature, set supply-water temperature at 140 deg F; at 60 deg F outside-air temperature, set supply-water temperature at 90 deg F.
 - a. Include automatic, alternating-firing sequence for multiple boilers to ensure maximum system efficiency throughout the load range and to provide equal runtime for boilers.
- B. Burner Operating Controls: To maintain safe operating conditions, burner safety controls limit burner operation.
 - 1. High Cutoff: Automatic reset stops burner if operating conditions rise above maximum boiler design temperature.
 - 2. Low-Water Cutoff Switch: Electronic probe shall prevent burner operation on low water. Cutoff switch shall be automatic-reset type.
 - 3. Blocked Inlet Safety Switch: Manual-reset pressure switch factory mounted on boiler combustion-air inlet.
 - 4. Audible Alarm: Factory mounted on control panel with silence switch; shall sound alarm for above conditions.

- C. Building Automation System Interface: Factory install hardware and software to enable building automation system to monitor, control, and display boiler status and alarms.
 - 1. Hardwired Points:
 - a. Monitoring: On/off status, common trouble alarm low-water-level alarm.
 - b. Control: On/off operation, hot-water-supply temperature set-point adjustment.
 - 2. A BACnet communication interface with building automation system shall enable building automation system operator to remotely control and monitor the boiler from an operator workstation. All monitoring and control features, which are available at the local boiler control panel, shall also be available at the remote operator workstation through the building automation system.

2.4 ELECTRICAL POWER

- A. Controllers, Electrical Devices, and Wiring: Electrical devices and connections are specified in electrical Sections.
- B. Single-Point Field Power Connection: Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point field power connection to boiler.
 - 1. House in NEMA 250, Type 12 enclosure.
 - 2. Wiring shall be numbered and color coded to match wiring diagram.
 - 3. Install factory wiring outside of an enclosure in a metal raceway.
 - 4. Field power interface shall be to nonfused disconnect switch.
 - 5. Provide branch power circuit to each motor and to controls with a disconnect switch or circuit breaker.
 - 6. Provide each motor with overcurrent protection.

2.5 VENTING KITS

- A. The flue (exhaust) stack must be AL 29-4C or equivalent material UL-1738/C-UL S636 approved for Category IV condensing, positive pressure applications.
- B. Combustion air shall be through sealed combustion (drawing in fresh air from the outdoors).
 - 1. The air intake piping must be Schedule 40 CPVC or equivalent.
- C. The boiler shall be capable of operating with an exhaust draft not exceeding $-0.04''$ W.C. and a combined air intake and exhaust venting pressure drop not exceeding $+0.35''$ W.C.

2.6 CONDENSATE-NEUTRALIZATION UNITS

- A. Description: Factory-fabricated and -assembled condensate-neutralizing capsule assembly of corrosion-resistant plastic material with threaded or flanged inlet and outlet pipe connections. Device functions to prevent acidic condensate from damaging grain system. It is to be piped to receive acidic condensate discharged from condensing boiler and neutralize it by chemical reaction with replaceable neutralizing agent. Neutralized condensate is then piped to suitable drain.
- B. Capsule features:
 - 1. All corrosion-resistant material.
 - 2. Suitable for use on all natural gas and propane boilers.
 - 3. Includes initial charge of neutralizing agent.
 - 4. Neutralizing agent to be easily replaceable when exhausted.
 - 5. Inlet and outlet pipe connections.
- C. Capsule Configuration:
 - 1. Low-profile design for applications where boiler condensate drain is close to the floor.
 - 2. Easily removed and opened for neutralizing agent replacement.
 - 3. Multiple units may be used for larger capacity.

2.7 SOURCE QUALITY CONTROL

- A. UL Compliance, Gas-Fired: Test gas-fired boilers for compliance with UL 2764. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
- B. Performance Testing: Test and label boilers for efficiency to comply with AHRI 1500.
- C. Burner and Hydrostatic Test: Factory adjust burner to eliminate excess oxygen, carbon dioxide, oxides of nitrogen emissions, and carbon monoxide in flue gas and to achieve combustion efficiency; perform hydrostatic test.
- D. Test and inspect factory-assembled boilers, before shipping, in accordance with 2017 ASME Boiler and Pressure Vessel Code. Factory test boilers for safety and functionality; fill boiler with water, and fire throughout firing range, to prove operation of all safety components.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine roughing-in for concrete equipment bases, anchor-bolt sizes and locations, and piping and electrical connections to verify actual locations, sizes, and other conditions affecting performance of the Work.

1. Final boiler locations indicated on Drawings are approximate. Determine exact locations before roughing-in for piping and electrical connections.
- B. Examine mechanical spaces for suitable conditions where boilers will be installed.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 BOILER INSTALLATION

- A. Equipment Mounting:
 1. Install boilers on cast-in-place concrete equipment base(s). Comply with requirements for equipment bases and foundations.
 2. Comply with requirements for vibration isolation and seismic-restraint devices specified in Section 230548 "Vibration Controls for HVAC Piping and Equipment."
- B. Install gas-fired boilers according to NFPA 54.
- C. Assemble and install boiler trim.
- D. Install electrical devices furnished with boiler but not specified to be factory mounted.
- E. Install control wiring to field-mounted electrical devices.
- F. Assemble unit sections and parts shipped loose or unassembled for shipment purposes. Follow manufacturer's installation recommendations and instructions.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to boiler to allow service and maintenance.
- C. Install condensate drain piping to condensate-neutralization unit and from neutralization unit to nearest floor drain. Piping shall be at least full size of connection. Install piping with a minimum of 2 percent downward slope in direction of flow.
- D. Provide boiler manufacturer recommendation manifold pipe and fittings from each boiler to nearest floor drain or as indicated.
- E. Connect gas piping to boiler gas-train inlet with union. Piping shall be at least full size of gas-train connection. Provide a reducer if required.
- F. Connect hot-water piping to supply- and return-boiler tappings with flange at each connection.
- G. Install piping from safety relief valves to nearest floor drain.

- H. Install piping from safety valves to drip-pan elbow and to nearest floor drain.
- I. Boiler Venting:
 - 1. Field fabricate and install boiler vent and combustion-air intake.
 - 2. Utilize vent and intake duct material, size, and configuration as indicated in boiler manufacturer's instructions and to comply with UL 1738.
- J. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- K. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- L. Install electrical devices furnished by manufacturer, but not factory mounted, according to NFPA 70 and NECA 1.
- M. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.
- N. Install control and electrical power wiring to field-mounted control devices.
- O. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- P. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.
 - 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."
 - 2. Nameplate shall be laminated acrylic or melamine plastic signs with a black background and engraved white letters at least 1/2 inch high.

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Perform installation and startup checks according to manufacturer's written instructions.
 - 2. Leak Test: Hydrostatic test. Repair leaks and retest until no leaks exist.

3. Operational Test: Start units to confirm proper motor rotation and unit operation. Adjust air-fuel ratio and combustion.
4. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - a. Check and adjust initial operating set points and high- and low-limit safety set points of fuel supply, water level, and water temperature.
 - b. Set field-adjustable switches and circuit-breaker trip ranges as indicated.
- C. Boiler will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports.
- E. Arrange with National Board of Boiler and Pressure Vessel Inspectors for inspection of boilers and piping. Obtain certification for completed boiler units, deliver to Owner, and obtain receipt.
- F. Occupancy Adjustments: When requested within 12 months of date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.5 STARTUP AND TESTING

- A. The Commissioning Agent will observe startup and contractor testing of selected equipment. Coordinate the startup and contractor testing schedules with the Manufacturers representative and Commissioning Agent. Provide a minimum of 7 days prior notice.

3.6 COMMISSIONING

- A. Provide commissioning documentation in accordance with the requirements of Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS for all inspection, start up, and contractor testing required above and required by the System Readiness Checklist provided by the Commissioning Agent.
- B. Components provided under this section of the specification will be tested as part of a larger system. Refer to Section 23 08 00 – COMMISSIONING OF HVAC SYSTEMS and related sections for contractor responsibilities for system commissioning.

3.7 DEMONSTRATION AND TRAINING

- A. Train Owner's maintenance personnel to adjust, operate, and maintain boilers. Refer to Section 017900 "Demonstration and Training."
 1. Instructor shall be factory trained and certified.
 2. Provide not less than two hours of training.
 3. Train personnel in operation and maintenance and to obtain maximum efficiency in plant operation.

4. Provide instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
5. Obtain Owner sign-off that training is complete.
6. Owner training shall be held at Project site.

END OF SECTION 23 52 16

SECTION 23 64 26.13 - AIR-COOLED, ROTARY-SCREW WATER CHILLERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes packaged, air-cooled chillers.

1.2 DEFINITIONS

- A. COP: Coefficient of performance. The ratio of the rate of heat removal to the rate of energy input using consistent units for any given set of rating conditions.
- B. DDC: Direct digital control.
- C. EER: Energy-efficiency ratio. The ratio of the cooling capacity given in terms of Btu/h to the total power input given in terms of watts at any given set of rating conditions.
- D. IPLV: Integrated part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and referenced to AHRI standard rating conditions.
- E. kW/Ton: The ratio of total power input of the chiller in kilowatts to the net refrigerating capacity in tons at any given set of rating conditions.
- F. NPLV: Nonstandard part-load value. A single-number part-load efficiency figure of merit calculated per the method defined by AHRI 550/590 and intended for operating conditions other than AHRI standard rating conditions.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 "LEED Sustainable Design Requirements".
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and attachment details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include diagrams for power, signal, and control wiring.

1.4 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, and coordinated with each other, using input from installers of the items involved.
- B. Seismic Qualification Data: Certificates, for chillers, accessories, and components, from manufacturer.
- C. Source quality-control reports.
- D. Field Test Reports: Startup service reports.
- E. Sample warranty.

1.5 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.6 QUALITY ASSURANCE

- A. AHRI Certification: Certify chiller according to AHRI 590 certification program(s).
- B. AHRI Rating: Rate chiller performance according to requirements in AHRI 550/590.
- C. ASHRAE Compliance:
 - 1. ASHRAE 15 for safety code for mechanical refrigeration.
 - 2. ASHRAE 147 for refrigerant leaks, recovery, and handling and storage requirements.
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1.
- E. ASME Compliance: Fabricate and label chiller to comply with ASME Boiler and Pressure Vessel Code: Section VIII, Division 1, and include an ASME U-stamp and nameplate certifying compliance.
- F. Comply with NFPA 70.
- G. Comply with requirements of UL and UL Canada and include label by a qualified testing agency showing compliance.

1.7 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace components of chillers that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Site Altitude: Chiller shall be suitable for altitude in which installed without affecting performance indicated. Make adjustments to affected chiller components to account for site altitude.

2.2 PACKAGED, AIR-COOLED CHILLERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Carrier Global Corporation.
 2. Daikin Applied.
 3. Trane.
- B. Description: Factory-assembled and run-tested chiller complete with base and frame, condenser casing, compressors, compressor motors and motor controllers, evaporator, condenser coils, condenser fans and motors, electrical power, controls, and accessories.
- C. Cabinet:
1. Base: Galvanized-steel base extending the perimeter of chiller. Secure frame, compressors, and evaporator to base to provide a single-piece unit.
 2. Frame: Rigid galvanized-steel frame secured to base and designed to support cabinet, condenser, control panel, and other chiller components not directly supported by base.
 3. Casing: Galvanized steel.
- D. Compressors:
1. Description: Positive displacement, hermetically sealed.
 2. Casing: Cast iron, precision machined for minimum clearance about periphery of rotors.
 3. Rotors: Manufacturer's standard one- or two-rotor design.
 4. Each compressor provided with suction and discharge shutoff valves, crankcase oil heater, and suction strainer.
- E. Service: Easily accessible for inspection and service.
- F. Capacity Control: On-off compressor cycling and modulating slide-valve assembly or port unloaders combined with hot-gas bypass, if necessary, to achieve performance indicated.
1. Maintain stable operation throughout range of operation. Configure to achieve most energy-efficient operation possible.
 2. Operating Range: From 100 to 20 percent of design capacity.

3. Condenser-Air Unloading Requirements over Operating Range: Drop-in, entering condenser-air temperature of 5 deg F drop for each 10 percent in capacity reduction.
- G. Oil Lubrication System: Consisting of pump if required, filtration, heater, cooler, factory-wired power connection, and controls.
1. Provide lubrication to bearings, gears, and other rotating surfaces at all operating, startup, shutdown, and standby conditions including power failure.
 2. Thermostatically controlled oil heater properly sized to remove refrigerant from oil.
 3. Factory-installed and pressure-tested piping with isolation valves and accessories.
 4. Oil compatible with refrigerant and chiller components.
 5. Positive visual indication of oil level.
- H. Vibration Control:
1. Vibration Balance: Balance chiller compressors and drive assemblies to provide a precision balance that is free of noticeable vibration over the entire operating range.
 - a. Overspeed Test: 25 percent above design operating speed.
 2. Isolation: Mount individual compressors on vibration isolators.
- I. Compressor Motors:
1. Hermetically sealed and cooled by refrigerant suction gas.
 2. High-torque, induction type with inherent thermal-overload protection on each phase.
- J. Compressor Motor Controllers:
1. Variable-Frequency Controller:
 - a. Motor controller shall be factory mounted and wired on the chiller to provide a single-point, field-power termination to the chiller and its auxiliaries.
 - b. Description: NEMA ICS 2; listed and labeled as a complete unit and arranged to provide variable speed by adjusting output voltage and frequency.
 - c. Enclosure: Unit mounted, NEMA 250, Type 3R, with hinged full-front access door with lock and key.
 - d. Integral Disconnecting Means: Door-interlocked, UL 489, instantaneous-trip circuit breaker with lockable handle. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 35,000 A.
 - e. Technology: Pulse-width-modulated output suitable for constant or variable torque loads.
 - f. Motor current at start shall not exceed the rated load amperes, providing no electrical inrush.

K. Refrigerant Circuits:

1. Refrigerant: Type as indicated on Drawings.
2. Refrigerant Type: R513A. Classified as Safety Group A1 according to ASHRAE 34.
3. Refrigerant Compatibility: Chiller parts exposed to refrigerants shall be fully compatible with refrigerants, and pressure components shall be rated for refrigerant pressures.
4. Refrigerant Circuit: Each shall include a thermal- or electronic-expansion valve, refrigerant charging connections, a hot-gas muffler, compressor suction and discharge shutoff valves, a liquid-line shutoff valve, a replaceable-core filter-dryer, a sight glass with moisture indicator, a liquid-line solenoid valve, and an insulated suction line.
5. Pressure Relief Device:
 - a. Comply with requirements in ASHRAE 15 and in applicable portions of ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
 - b. ASME-rated, spring-loaded pressure relief valve; single- or multiple-reseating type.

L. Evaporator:

1. Description: Shell-and-tube design.
 - a. Direct-expansion type with fluid flowing through the shell, and refrigerant flowing through the tubes within the shell.
2. Code Compliance: Tested and stamped according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
3. Shell Material: Carbon steel.
4. Shell Heads: Removable carbon-steel heads located at each end of the tube bundle.
5. Fluid Nozzles: Terminated with flanged end connections for connection to field piping.
6. Tube Construction: Individually replaceable copper tubes with enhanced fin design, expanded into tube sheets.

M. Air-Cooled Condenser:

1. Plate-fin coil with integral subcooling on each circuit, rated at 450 psig.
 - a. Construct coil casing of galvanized or stainless steel.
 - b. Construct coils of copper tubes mechanically bonded to aluminum fins.
 - c. Hail Protection: Provide condenser coils with louvers, baffles, or hoods to protect against hail damage.
2. Fans: Direct-drive propeller type with statically and dynamically balanced fan blades, arranged for vertical air discharge.
3. Fan Motors: Totally enclosed nonventilating or totally enclosed air over enclosure, with permanently lubricated bearings. Equip each motor with overload protection integral to either the motor or chiller controls.

4. Fan Guards: Steel safety guards with corrosion-resistant coating.

N. Electrical Power:

1. Factory-installed and -wired switches, motor controllers, transformers, and other electrical devices necessary shall provide a single-point, field-power connection to chiller.
2. House in a unit-mounted, NEMA 250, Type 3R enclosure with hinged access door.
3. Wiring shall be numbered to match wiring diagram.
4. Install factory wiring outside of an enclosure in a raceway.
5. Field-power interface shall be to UL 489, instantaneous-trip circuit breaker with lockable handle.
 - a. Disconnect means shall be interlocked with door operation.
 - b. Minimum withstand rating shall be as required by electrical power distribution system, but not less than 35,000 A.
6. Provide branch power circuit to each motor and to controls with one of the following disconnecting means:
 - a. NEMA KS 1, heavy-duty, fusible switch with rejection-type fuse clips rated for fuses. Select and size fuses to provide Type 2 protection according to IEC 60947-4-1.
 - b. UL 489, motor-circuit protector (circuit breaker) with field-adjustable, short-circuit-trip set point.
7. Provide each motor with overcurrent protection.
8. Overload relay sized according to UL 1995 or an integral component of chiller control microprocessor.
9. Phase-Failure and Undervoltage Relays: Solid-state sensing with adjustable settings.
10. Control Relays: Auxiliary and adjustable time-delay relays.
11. For chiller electrical power supply, indicate the following:
 - a. Current and phase to phase for all three phases.
 - b. Voltage, phase to phase, and phase to neutral for all three phases.
 - c. Three-phase real power (kilowatts).
 - d. Three-phase reactive power (kilovolt amperes reactive).
 - e. Power factor.
 - f. Running log of total power versus time (kilowatt-hours).
 - g. Fault log, with time and date of each.

O. Controls:

1. Standalone and microprocessor based.
2. Enclosure: Share enclosure with electrical power devices or provide a separate enclosure.
3. Operator Interface: Multiple-character digital or graphic display with dynamic update of information and with keypad or touch-sensitive display located on front

of control enclosure. In either imperial or metric units, display the following information:

- a. Date and time.
 - b. Operating or alarm status.
 - c. Operating hours.
 - d. Outdoor-air temperature if required for chilled-water reset.
 - e. Temperature and pressure of operating set points.
 - f. Entering and leaving temperatures of chilled water.
 - g. Refrigerant pressures in evaporator and condenser.
 - h. Saturation temperature in evaporator and condenser.
 - i. No cooling load condition.
 - j. Elapsed time meter (compressor run status).
 - k. Pump status.
 - l. Antirecycling timer status.
 - m. Percent of maximum motor amperage.
 - n. Current-limit set point.
 - o. Number of compressor starts.
4. Control Functions:
- a. Manual or automatic startup and shutdown time schedule.
 - b. Entering and leaving chilled-water temperatures, control set points, and motor load limits. Chilled-water leaving temperature shall be reset based on outdoor-air temperature.
 - c. Current limit and demand limit.
 - d. External chiller emergency stop.
 - e. Antirecycling timer.
 - f. Automatic lead-lag switching.
 - g. Variable evaporator flow.
 - h. Thermal storage.
5. Manually Reset Safety Controls: The following conditions shall shut down chiller and require manual reset:
- a. Low evaporator pressure or high condenser pressure.
 - b. Low chilled-water temperature.
 - c. Refrigerant high pressure.
 - d. High or low oil pressure.
 - e. High oil temperature.
 - f. Loss of chilled-water flow.
 - g. Control device failure.
6. Trending: Capability to trend analog data of up to five parameters simultaneously over an adjustable period and frequency of polling.
7. Security Access: Provide electronic security access to controls through identification and password with at least three levels of access: view only; view and operate; and view, operate, and service.
8. Control Authority: At least four conditions: Off, local manual control at chiller, local automatic control at chiller, and automatic control through a remote source.

9. Interface with DDC System for HVAC: Factory-installed hardware and software to enable the DDC system for HVAC to monitor, control, and display chiller status and alarms.
 - 1) **point>**.
 - b. ASHRAE 135 (BACnet) communication interface with the DDC system for HVAC shall enable the DDC system for HVAC operator to remotely control and monitor the chiller from an operator workstation. Control features and monitoring points displayed locally at chiller control panel shall be available through the DDC system for HVAC.
- P. Insulation: Closed-cell, flexible elastomeric, thermal insulation complying with ASTM C534, Type I for tubular materials and Type II for sheet materials.
- Q. Accessories:
 1. Factory-furnished, chilled-water flow switches for field installation.
 2. Individual compressor suction and discharge pressure gages with shutoff valves for each refrigerant circuit.
 3. Factory-furnished neoprene isolators for field installation.

2.3 SOURCE QUALITY CONTROL

- A. Perform functional tests of chillers before shipping.
- B. Factory run test each air-cooled chiller with water flowing through evaporator.
- C. Factory performance test air-cooled chillers, before shipping, according to AHRI 550/590.
 1. Test the following conditions:
 - a. Design conditions indicated.
 - b. Reduction in capacity from design to minimum load in steps of 10 with condenser air at design conditions.
 2. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.
- D. Factory sound test air-cooled chillers, before shipping, according to AHRI 370.
 1. Test the following conditions:
 - a. Design conditions indicated.
 - b. Chiller operating at calculated worst-case sound condition.
 - c. At four point(s) of varying part-load performance to be selected by Owner at time of test.
 2. Prepare test report indicating test procedures, instrumentation, test conditions, and results. Submit copy of results within one week of test date.

- E. Factory test and inspect evaporator and condenser according to ASME Boiler and Pressure Vessel Code: Section VIII, Division 1.
- F. For chillers located outdoors, rate sound power level according to AHRI 370.

PART 3 - EXECUTION

3.1 CHILLER INSTALLATION

- A. Coordinate sizes, locations, and anchoring attachments of structural-steel support structures.
- B. Install chillers on support structure indicated.
- C. Equipment Mounting:
 - 1. Comply with requirements for vibration isolation devices specified in Section 230548 "Vibration Controls for HVAC Piping & Equipment."
- D. Maintain manufacturer's recommended clearances for service and maintenance.
- E. Charge chiller with refrigerant and fill with oil if not factory installed.
- F. Install separate devices furnished by manufacturer and not factory installed.

3.2 CONNECTIONS

- A. Comply with requirements for piping specified in Section 232113 "Hydronic Piping," and Section 232300 "Refrigerant Piping." Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to chiller to allow service and maintenance.
- C. Evaporator Fluid Connections: Connect to evaporator inlet with shutoff valve, strainer, flexible connector, thermometer, and plugged tee with pressure gage. Connect to evaporator outlet with shutoff valve, balancing valve, flexible connector, flow switch, thermometer, plugged tee with shutoff valve and pressure gage, flow meter, and drain connection with valve. Make connections to chiller with a flange.
- D. Connect each chiller drain connection with a union and drain pipe, and extend pipe, full size of connection, to floor drain. Provide a shutoff valve at each connection.

3.3 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.
 - 2. Verify that refrigerant charge is sufficient and chiller has been leak tested.

3. Verify that pumps are installed and functional.
 4. Verify that thermometers and gages are installed.
 5. Operate chiller for run-in period.
 6. Check bearing lubrication and oil levels.
 7. For chillers installed indoors, verify that refrigerant pressure relief device is vented outdoors.
 8. Verify proper motor rotation.
 9. Verify static deflection of vibration isolators, including deflection during chiller startup and shutdown.
 10. Verify and record performance of fluid flow and low-temperature interlocks for evaporator and condenser.
 11. Verify and record performance of chiller protection devices.
 12. Test and adjust controls and safeties. Replace damaged or malfunctioning controls and equipment.
- B. Inspect field-assembled components, equipment installation, and piping and electrical connections for proper assembly, installation, and connection.
- C. Prepare test and inspection startup reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain chillers.

END OF SECTION 23 64 26.13

SECTION 23 73 43.19 - OUTDOOR, CUSTOM AIR-HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Outdoor, custom air-handling units.

1.2 ACTION SUBMITTALS

A. Product Data: For each air-handling unit.

B. Sustainable Design Submittals:

1. Refer to Section 01 81 13 "LEED Sustainable Design Requirements".

C. Shop Drawings: For each type and configuration of indoor, custom air-handling unit.

1. Prepared by manufacturer's factory employees with review and sign-off by those individuals responsible for manufacturing the air-handling units.
2. Include plans, elevations, sections, and mounting details.
3. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, methods of field assembly, components, and location and size of each field connection.
4. Detail fabrication and assembly of indoor, custom air-handling units, as well as procedures and diagrams.
5. Indicate details of construction with materials description including applicable specified standards and material grades in sufficient detail for reviewers to evaluate point by point compliance with requirements indicated for each air-handling unit.
6. Use actual dimensions of internal equipment in preparing Shop Drawings. Identify mechanical equipment shown on Shop Drawings with equipment designations on Drawings.
7. Thickness and finish of all casing materials with cross references indicated where each is used. Uniquely identify and include information for each different casing construction.
8. Details for each unique casing joint and reinforcing. Indicate wall joints, wall to floor joints, wall to roof joints, floor joints, and roof joints.
9. Roofing details.
10. Assembly details of base and casing for units consisting of multiple sections requiring field assembly.
11. Sizes and dimensioned locations of field connections for ductwork, piping, electrical, and controls.
12. Base and casing penetration and sealing details for factory-installed conduit.

13. Base and casing penetration and sealing details for factory-installed piping including coils.
14. Details of casing connections to field-installed ductwork.
15. Size, shape and layout of base members including localized support of internal components.
16. Base materials, thickness, finishes, lifting provisions, and mounting requirements. Uniquely identify and include information for each different base construction. Clearly indicate for each air-handling unit.
17. Recommended points of field attachment with dimensioned locations.
18. Size and location of each access door, including clearing opening size, with door swing indicated.
19. Size and location of each access panel with service equipment superimposed to show relationship of panel to internal equipment.
20. Drain pans and associated piping, with sizes and locations dimensioned, including relationship to internal equipment.
21. Floor drains and associated piping, with sizes and locations dimensioned, including relation to internal equipment.
22. Coil framework and support including enlarged details showing framework attachment to air-handling unit base, coil attachment to framework, and means for individual coil removal.
23. Mounting details of all internal components, such as fans, filters, and dampers.
24. Hoist rails layout for internal equipment showing size of members, attachments to structure, and serviced equipment superimposed to indicate relationships.
25. Size and location of catwalks, handrails, ladders, and safety cages including construction details and details of attachment to air-handling unit base.
26. Location of receptacles, service lights, and switches.
27. Location of motor controllers and disconnect switches.
28. Size and location of junction boxes used for interface with field electrical power.
29. Point-to-point electrical power wiring diagrams including wire size, conduit size, motor controllers sizes, switch types and ratings, receptacle types and ratings, service light fixture types and ratings.
30. Point-to-point control wiring diagrams including cable types and sizes, conduit sizes, and connected control devices.
31. Point-to-point control tubing diagrams including tubing types and sizes, conduit sizes, and connection controls devices.
32. Control panel drawings drawn to scale showing detailed internal layout.
33. Plans, sections and isometric reviews of hydronic piping systems showing pipe, fittings, flanges, unions, valves, vents, strainers, accessories, specialties and insulation.
34. Indicate code, operating, and maintenance clearances drawn to scale using dashed lines.
35. Indicate weights of internal components, weight of each separately shipped section, and air-handling unit total weight.

D. Comparison Schedule:

1. Submit a schedule to indicate performance of equipment scheduled on Drawings directly compared to performance of submitted equipment.
2. Clearly identify each line in schedule to indicate "Scheduled" where indicating performance scheduled on Drawings and "Submitted" where indicating performance of submitted equipment.

3. Organize schedule to first indicate performance scheduled on Drawings on one line followed by line directly below that indicates performance of submitted equipment.
 4. Comparison schedule shall follow arrangement and organization of scheduled information indicated on Drawings.
 5. Submitted equipment shall have a value for each scheduled value indicated.
- E. Delegated Design Submittals: For vibration isolation indicated to comply with performance requirements and design criteria, including analysis data.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, sections, and other details, or BIM model, drawn to scale and coordinated with all building trades.
- B. Source quality-control reports.
- C. Startup service reports.
- D. Field quality-control reports.
- E. Sample warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 COORDINATION

- A. Coordinate sizes and locations of concrete bases with actual equipment provided.
- B. Coordinate sizes and locations of structural-steel support members, if any, with actual equipment provided.

1.6 FACTORY VISITS FOR PRODUCT INSPECTION

- A. While units are being manufactured, and during factory normal working hours, allow escorted access to manufacturing facility for Owner and Owner's designated representative to verify product compliance with requirements indicated.
- B. Manufacturer shall provide Owner with written notice at least 45 business days before units go into assembly.
- C. Inspection visits shall be scheduled with manufacturer at least 15 business days before visit.
- D. Personnel making visits for purposes of product inspection shall comply with manufacturer requirements for visitors.

1.7 WARRANTY

- A. Warranty: Manufacturer agrees to repair or replace components of air-handling units that fails in materials or workmanship within specified warranty period.
 - 1. Warranty Period: 1 year(s) from date of Substantial Completion.
- B. Extended warranties include, but are not limited to, the following:
 - 1. Complete Air-Handling Unit: Two years from date of Substantial Completion for entire air-handling unit and longer where indicated for individual components.
 - 2. Air-Handling Unit Casing: 25 years from date of Substantial Completion.
 - 3. Air-Handling Unit Roofing: 25 years from date of Substantial Completion.
 - 4. Motors: Two years from date of Substantial Completion
 - 5. Heat Wheels: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.
- B. NFPA Compliance: Comply with NFPA 90A for design, fabrication, and installation of air-handling units and components.
- C. ASHRAE 62.1 Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."
- D. ASHRAE/IES 90.1 Compliance: Applicable requirements in ASHRAE/IES 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."
- E. Delegated Design: Engage a qualified professional specialist, as defined in Section 014000 "Quality Requirements," to design air-handling units, vibration isolation, including comprehensive engineering analysis, using performance requirements and design criteria indicated.
- F. Casing Structural Performance:
 - 1. Unit construction: Double wall galvanized steel.
 - 2. Floor: Capable of withstanding positive/negative 8 inches wg of internal static pressure, without exceeding a deflection of L/300 of span.
 - 3. Walls and Roof: Capable of withstanding positive/negative 8 inches wg of internal static pressure, without exceeding a midpoint deflection of L/200 of span.
- G. Casing Leakage Performance:
 - 1. Casing shall leak less than 0.5% of design CFM at +/-12" w.g. static pressure and have deflection less than L/250.

- H. Casing Thermal Performance:
1. Surface Condensation: Air-handling manufacturer shall evaluate potential for condensation and design and manufacture entire unit casing to prevent condensation at most extreme operating conditions encountered.
 2. Thermal Break: Incorporate a thermal break at each through metal path to prevent condensation from occurring on interior and exterior of casing.
 3. U-Value: Overall U-value or equivalent R-value of casing shall not exceed governing codes and ASHRAE/IES 90.1 while considering the effects of metal-to-metal contact and thermal bridging in calculations.
- I. Air Tunnel Aerodynamic Performance: Position air-handling unit internal components and transition between internal components to maintain uniform airflow; minimize sound levels and energy consumption. Use methods indicated and other means to ensure compliance.
1. Use turning vanes if necessary to direct the air path.
 - a. Design, manufacture, and install vanes in accordance with applicable requirements in ASHRAE and SMACNA guidelines, handbooks, and standards.
 - b. Install vanes firmly in place so that no vane movement occurs at worst-case airflow capacity possible.
 2. Use fan inlet and discharge transitions and other devices to maximize system regain and minimize airborne sound levels.
 3. Center system components such as coils, fans, and filters, vertically and horizontally, in the airstream.
 4. Maintain spacing between components such that airflow patterns to adjacent components are as uniform as possible and that component "dead spots" or "jetted areas" are avoided.
 5. Design and install internal structural supports, piping, and conduit that do not block airflow and impede performance of coils, fans, filters, and other unit components, and service space clearances.
- J. Air-Handling Unit Acoustical Performance:
1. Radiated Noise: Noise radiated from air-handling unit casing shall not exceed following sound pressure levels when measured 3 feet away from any exterior surface of unit. Sound pressure levels indicated in each octave band are in decibels (dB) (reference 20 μ Pa).
 - a. 63 Hz: <Insert value> dB.
 - b. 125 Hz: <Insert value> dB.
 - c. 250 Hz: <Insert value> dB.
 - d. 500 Hz: <Insert value> dB.
 - e. 1000 Hz: <Insert value> dB.
 - f. 2000 Hz: <Insert value> dB.
 - g. 4000 Hz: <Insert value> dB.
- K. Casing Acoustical Performance:

1. Sound Absorption: Minimum acceptable sound absorption coefficient and noise reduction coefficient (NRC) of perforated inside casing assemblies when tested by an independent testing laboratory in accordance with ASTM C423 and ASTM E795:
 - a. 125 Hz: <Insert value> dB.
 - b. 250 Hz: <Insert value> dB.
 - c. 500 Hz: <Insert value> dB.
 - d. 1000 Hz: <Insert value> dB.
 - e. 2000 Hz: <Insert value> dB.
 - f. 4000 Hz: <Insert value> dB.
 - g. NRC: <Insert value>.

- L. Safety:
 1. Comply with OSHA regulations.
 2. Exposed sharp edges and corners of metal shall be protected or rounded to prevent injury to personnel not wearing gloves.
 3. Cover exposed ends of screws with plastic or metal covers to prevent injury to personnel coming in contact with screws.

- M. Serviceability:
 1. Hoisting Provisions: Fans and motors weighing more than 200 lb to have full-length hoist rails mounted over the equipment to facilitate service, removal, and replacement.
 2. Mounting Location: Install internal components in readily accessible locations to facilitate ease of service and replacement.
 3. Service Access:
 - a. Internal components shall be serviceable through access sections with doors indicated on Drawings.
 - b. Internal components shall be removable and replaceable through access doors or panels.
 - c. Review requirements for access doors and panels indicated and recommend additional access doors and panels if required for uninhabited service, removal, and replacement of components.
 4. Tripping Hazards: Floors in accessible sections of air-handling unit shall be free of standing seams, reinforcing, supports, or section splits located in the walking path that is capable of causing a tripping hazard. Locate section splits immediately adjacent to internal walls.

- N. Quality: Type and thickness of materials indicated are the minimum acceptable. Provide better-quality materials of a heavier thickness if required to comply with performance requirements indicated.
 1. If manufacturer's standard construction exceeds requirements indicated, use manufacturer's standard construction.

2. If manufacturer's standard construction does not comply with requirements indicated, modify manufacturer's standard construction to comply with requirements.
- O. Vibration Performance: Air-handling unit manufacturer shall evaluate vibration of internal components installed inside of air-handling units and include internal vibration isolation required to limit the vibration transmitted to the building at a low enough level that vibration is not perceived by building occupants.

2.2 CAPACITIES AND CHARACTERISTICS

- A. See equipment schedules on Drawings.

2.3 OUTDOOR, CUSTOM AIR-HANDLING UNITS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Daikin Applied .
 2. Nortek Air Solutions.
 3. Trane Custom.
- B. Unit Arrangement And Configuration:
 1. Arrangement: Project-specific arrangement and configuration of air-handling units indicated on Drawings. Do not deviate from requirements indicated.
 2. Mounting Requirements: Units mounted on vibration isolation roof curbs.
 3. Multiple Sections, Splits: Air-handling unit manufacturer to determine number of sections and location of section splits required for each air-handling unit in accordance with the following criteria:
 - a. Physical size and weight of each section, on-site path of travel, and methods for erection and installation. Air-handling manufacturer to review criteria with Installer before preparing Shop Drawings.
 - b. Maximize physical size of each air-handling unit section considering, shipping, moving, erecting, and installation.
 - c. Minimize the number of air-handling unit sections requiring field assembly. Preference is for single-piece air-handling units where possible.
- C. Air-Handling Unit Base:
 1. Performance:
 - a. Air-handling unit manufacturer shall design and assemble air-handling unit casing and internal components for attachment and support by air-handling unit structural base.
 - b. Design air-handling units to be lifted from only the air-handling unit structural base and not the casing.

- c. Support air-handling units from only the perimeter base unless otherwise indicated on Drawings.
 - d. Air-handling unit manufacturer to size and locate intermediate structural base supports as required to comply with structural performance indicated for air-handling unit floors.
 - e. Level base before factory assembly of air-handling unit casing and internal components to ensure proper fit and alignment.
2. Structural Member Size:
- a. Air-handling unit manufacturer shall select size of base members and construction of base to withstand the rigors of loading, unloading, shipping, and rigging without damage to air-handling unit components or misalignment of factory-assembled components.
 - b. Depth and weight of structural members shall be selected by air-handling unit manufacturer to comply with performance requirements indicated.
 - c. Depth of perimeter base members is not less than size indicated on Drawings.
3. Structural Member Spacing: Positioned as required to comply with requirements indicated, but not to exceed 24 inches.
4. Materials: structural carbon steel, ASTM A36/A36M.
5. Carbon-Steel Finish: Carbon-steel bases shall be shot-blasted, cleaned, prepared, and hot-dip galvanized after fabrication.
6. Welding Filler Metals: Comply with AWS welding codes for welding materials appropriate for thickness and chemical analysis of material being welded.
- a. Use welding materials with corrosion properties equal to material being welded.
7. Welding Procedures:
- a. Structural Welding Codes: AWS D1.1/D1.1M for carbon steel.
 - b. Join structural members to one another using continuous welds.
 - c. After welding and fabrication, deburr and grind exposed welds to provide smooth surfaces free of sharp edges.
8. Penetrations through Base Perimeter: Sealpipe, tubing, and conduit penetrations through base perimeter members to provide a watertight assembly.
9. Section Joints: Air-handling units consisting of multiple sections for field assembly shall be joined with structural joining plates.
- a. Joining plate material type to match base.
 - b. Joining plate of thickness required to join sections without resulting in a permanent deflection, minimum 1/2 inch thick.
 - c. Continuously weld joining plates to each mating end of base.
 - d. Joining plates shall not extend beyond outer edge of adjoining base.
 - e. Plates to include at least three equally spaced holes for field connection using factory-furnished threaded hardware of a nominal diameter of at least 1/2 inch.

10. Lifting Provisions: Air-handling unit manufacturer to design and install lifting lugs of size and location required to comply with performance requirements indicated.
11. Curb Cap:
 - a. For air-handling units installed on a continuous perimeter curb, provide air-handling unit base with a continuous structural angle counterflashing.
 - b. Angle shall extend down vertical face of curb to completely cover wood nailer.
 - c. Coordinate inside dimension of angle counterflashing with curb dimension and roofing. Provide adequate clearance between angle counterflashing and roofing over curb.

D. Unit Casings:

1. Casing Assembly:
 - a. Appearance:
 - 1) Exposed exterior surfaces of casing shall have a neat and finished appearance free of standing seams, exposed reinforcing, and other casing protrusions more than 0.25 inch beyond the exterior skin surface.
 - 2) Interior surfaces of casing shall have a neat and finished appearance free of standing seams, exposed reinforcing, and other casing protrusions more than 0.25 inch beyond the skin surface.
 - b. Dissimilar Metals: Isolate dissimilar metals that are in contact to prevent galvanic action and corrosion.
 - c. Framing and Supports: Interconnect and support individual casing wall and roof panels using either formed panel construction or framed construction with structural support members. For framed casing construction, materials used to construct casing of structural support members shall be as follows:
 - 1) Casings with Aluminum Outer and Inner Skins: Aluminum extrusions in accordance with ASTM B211 Alloy 6063 T6.
 - 2) Casings with Galvanized-Steel Outer and Inner Skins: Galvanized steel.
 - 3) Casings with Galvanized-Steel Outer Skin and Aluminum or Stainless Steel Inner Skins: Stainless steel.
 - 4) Casings with Stainless Steel Outer and Inner Skins: Stainless steel.
 - d. Seals: Seal interior and exterior joints and seams to make casing air- and watertight. Trim factory-applied sealant flush with adjacent surface.
 - e. Double-Wall Casings: Consisting of insulation sandwiched between an outer and inner metal wall. Use double-wall casings to construct air-handling units unless septum casings are required.
 - f. Septum Casings: Triple-wall construction consisting of a solid metal inner wall sandwiched between insulation layers that are covered with metal walls. Use septum casings for applications having performance requirements that are not achievable with double-wall casings.
 - g. Penetrations: Seal voids around conduit, piping and tubing penetrations.

- h. Floors: Route conduit, pipe, and tube within a floor-mounted pipe sleeve.
 - 1) Sleeve:
 - a) Fabricate sleeve of aluminum or stainless steel pipe.
 - b) Extend top of sleeve above adjacent floor surface to prevent standing water on floor from entering annular space of sleeve.
 - c) Seal weld sleeve to top of floor for an air- and watertight seal.
 - d) Seal annular void of sleeve using an adjustable compression seal.

- i. Floor Openings with Metal Grating:
 - 1) Factory install walk-on safety gratings over any floor opening large enough to create a safety hazard for operators including, but not be limited to, supply-, return-, and exhaust-air openings.
 - 2) Bar Grating:
 - a) Materials: Use hot-dip galvanized-steel grating for galvanized-steel floors.
 - b) Air-handling unit manufacturer shall select depth and thickness of grating bars to limit deflection to 1/360 of span when subjected to a dynamic load of not less than 500 lb.
 - c) Industry-standard welded grating with bars at least 1-1/2 inches deep by at least 3/16 inch thick with nominal 1-3/16-inch main bar spacing and 4-inch cross bar spacing.
 - d) Source: Product manufacturer specializing in metal gratings.
 - e) Grating bearing surface shall extend beyond clear opening in floor at least 2 inches.
 - 3) Mounting Frame:
 - a) Mount grating in a continuous structural angle or bar frame so no ends of grating bars are exposed. Top of frame to be flush with top of grating.
 - b) Secure grating to frame with threaded hardware so grating does not move when walked on but can be easily removed from top to gain access behind grating.
 - c) Continuously weld mounting frame to air-handling unit floor.
 - d) For applications with automatic dampers installed at floor openings, elevate height of mounting frame and grating to enclose entire damper assembly including jackshaft so walk-on surface of grating is above damper assembly.

- j. Waterproof Floors: Continuously weld floor joints, seams, and penetrations to completely seal floor. Roll all edges of floor up at least 1 inch to create a shallow tub capable of holding standing water.

- k. Duct Connections - Direct to Casing: Frame and reinforce unit casing around perimeter of unit duct openings to accommodate direct attachment of field-installed ductwork. Coordinate requirements with Installer to accommodate field connection.

- I. Duct Connections - Elevated Off Casing:
 - 1) Terminate with angle flange face elevated 3 inches from exterior surface of casing.
 - 2) Flange Thickness: 0.25 inch.
 - 3) Flange face with holes located not more than 4 inches o.c., starting at corners, and sized for 0.375-inch- diameter, field-installed hardware.
 - 4) Size flange face to mate to full face of duct flange.
 - a) Clear inside dimension of unit connection to match clear inside dimension of duct.
 - b) For connections to acoustically lined ducts, increase unit flange face to accommodate thickness of liner so end of duct liner is concealed by air-handling unit flange.
2. Materials for Outer Skin of Casing Walls and Roofs:
 - a. Galvanized-Steel Solid Sheet: ASTM A653/A653M; G90 coating; minimum (nominal) 18 gauge thick.
 - b. Application: See Drawings for application of different materials indicated.
3. Materials for Inner Skin of Casing Walls and Roofs:
 - a. Galvanized-Steel Solid and Perforated Sheet: ASTM A653/A653M; G90 coating, minimum (nominal) 18 gauge thick.
 - b. Application: See Drawings for application of different materials indicated.
4. Materials for Floor Walking Surface:
 - a. Galvanized-Steel Solid Sheet: ASTM A653/A653M; G90 coating; minimum (nominal) 14 gauge thick.
 - b. Carbon-Steel Diamond Treadplate: ASTM A786/A786M, painted finish; minimum (nominal) 0.125 inch thick.
 - c. Application: See Drawings for application of different materials indicated.
5. Materials for Underside of Floor Insulation:
 - a. Galvanized-Steel Solid Sheet: ASTM A653/A653M; G90 coating, minimum (nominal) 16 gauge thick.
 - b. Application: See Drawings for application of different materials indicated.
6. Materials for Internal Walls:
 - a. Galvanized-Steel Solid Sheet: ASTM A653/A653M; G90 coating; minimum (nominal) 16 gauge thick.
 - b. Application: See Drawings for application of different materials indicated.
7. Surfaces in Contact with Airstream:
 - a. Comply with ASHRAE 62.1 and NFPA 90A.

- b. Glass or mineral-fiber insulation installed behind perforated metal shall be encapsulated to prevent insulation fibers from entering the airstream by using a tightly woven glass cloth material that does not impact the acoustical absorption properties of insulation.
8. Insulation for Casing Walls and Roofs Not Exposed to Airstream:
 - a. Materials Not Exposed to Airstream: injected or sprayed polyurethane foam or polyurethane foam board insulation with a minimum nominal density of 2 lb/cu. ft..
 - b. R-Value: Minimum R-25.
 - c. Thickness: 4 inches.
 - d. Insulation shall completely fill the casing cavity so no voids exist and provide mid-span, no-through metal, internal thermal break design.
9. Insulation for Casing Walls and Roofs Exposed to Airstream:
 - a. Materials Exposed to Airstream: Glass or mineral-fiber board insulation with a minimum density of 2 lb/cu. ft..
 - b. R-Value: Minimum R-8.
 - c. Thickness: Minimum 2 inches.
 - d. Insulation shall completely fill the casing cavity so no voids exist.
10. Insulation for Casing Floors:
 - a. Materials: injected or sprayed polyurethane foam or polyurethane foam board insulation with a minimum nominal density of 2 lb/cu. ft..
 - b. R-Value: Minimum R-8.
 - c. Thickness: Minimum 2 inches.
 - d. Insulation shall completely fill the casing cavity so no voids exist.
11. Access Doors:
 - a. Application: Install access doors in air-handling units at locations indicated on Drawings.
 - b. Adjustment: Design doors for field adjustment capable of maintaining specified leakage rate.
 - c. Mounting Height: Install bottom of door frame within 2 inches of air-handling unit floor walking surface.
 - d. Performance: Leakage as required to satisfy overall unit leakage performance indicated, but not more than 1.0 cfm per door when tested at 10 inches wg.
 - e. Fabrication: Formed and reinforced, constructed of same materials and thicknesses as casing.
 - f. Swing: Arrange doors to be opened against pressure, unless otherwise indicated on Drawings.
 - g. Frame: galvanized steel or stainless steel with welded mitered corners.
 - h. Handles:
 - 1) Secure door closed using not less than twolatches with handles located at quarter points along door height.

- 2) If three latches with handles are included, install one at midpoint of door height and equally space others.
 - 3) Air-handling unit manufacturer has option to use a multipoint latching mechanism that is operable from a single door handle located at midpoint of door height, but secures door to frame at top, bottom, and handle location.
 - 4) Include door handles on outside and inside of door to allow operator access to open and close door from outside and inside of unit.
 - 5) Field adjustable to accommodate changes to fit and gasket compression.
 - 6) Durable product capable of withstanding repeated opening and closing of door while operating under design pressure without damage.
- i. Hinges: minimum of three hinges or full-length, concealed, stainless steel piano hinge.
 - j. Gasket:
 - 1) Design: Specially formed with an internal air chamber specifically designed to seal on two surfaces without taking a permanent set.
 - 2) Dual Gaskets: Primary and secondary gasket.
 - 3) Location: Install gaskets around entire perimeter of doors or frames.
 - 4) Material: EPDM, neoprene, or santoprene.
 - 5) Protection: Seat gasket in a protective metal ribbed chamber integral to door or door frame to protect gasket from damage by operator incidental contact.
 - 6) Service: Field replaceable.
 - 7) Adhesive-backed tape-type gaskets adhered to a single flat surface are unacceptable.
 - k. Size of Door Frame Clear Opening: Large enough to allow for unobstructed access for inspection and maintenance of air-handling unit's internal components.
 - 1) Width: At least 18 inches clear inside of door frame.
 - 2) Height: Full clear height of unit casing up to a maximum height of 60 inches clear inside of door frame.
 - 3) Door sizes indicated on Drawings.
 - l. Safety Latches and Stops:
 - 1) Safety Latches: Install safety latch with retainers on outward swing doors that do not open against pressure to allow restricted travel for purpose of pressure relief and so that doors do not open uncontrollably due to inside pressure.
 - 2) Stops: Install cushioned door stops on inward swinging doors where necessary to limit door travel that could potentially damage the door or internal components.
 - m. Locks: Include each access door with an integral key lock. Pad locks are unacceptable.

- 1) Incorporate key lock into door handle where feature is available.
- 2) A common key shall be used to lock and unlock access doors of all air-handling unit(s).
- 3) Include two keys.
- 4) Lock access doors at factory to ensure that unauthorized access is in place before air-handling unit packaging and shipment.

n. Nameplates:

- 1) On each access door, include a nameplate defining the access to service within. Nameplates shall be included for, but not be limited to, the following:
 - a) Dampers.
 - b) Filters.
 - c) Cooling Coils.
 - d) Heating Coils.
 - e) Electric Heaters.
 - f) Heat Wheels.
 - g) Supply Fans.
 - h) Exhaust Fans.
 - i) Return Fans.
 - j) Humidifiers.
 - k) Air-handling unit designation.
 - l) Where door access is to multiple components, list all components accessed. For example: Filter/Cooling Coil.
 - m) For each door that does not open against static pressure, include a warning sign stating: "DANGER: DOOR UNDER PRESSURE. DO NOT OPEN WITH FAN ON."
- 2) Lettering Size and Style: At least 1-inch- high, block style.
- 3) Material: Lettering engraved in black plastic on a white plastic back. Engraving shall penetrate through black plastic so lettering reads white.
- 4) Attachment: Attach nameplates to door using high-strength bonding cement and stainless steel screws.
- 5) Mounting Location:
 - a) For access doors without windows, locate top of nameplate 6 inches from top of door and center in door width.
 - b) For access doors with windows, locate nameplate directly above window frame and center in door width.
 - c) Align nameplates of all doors for uniform placement.

12. Access Panels:

- a. Performance: Leakage as required to satisfy overall unit leakage performance indicated.
- b. Fabrication: Formed and reinforced panels of same material and thickness as casing.

- c. Fasteners: Adjustable, reusable type for multiple operations without degradation due to reuse. Do not use screws capable of stripping.
 - d. Arrangement: Panels removable from exterior side of casing.
 - e. Gasket: EPDM, neoprene, or santoprene similar to access doors, applied around entire perimeter of panels or frames.
 - f. Location and Size:
 - 1) Coils and Electric Heaters: Oversized access panel to allow removal and replacement without impacting adjacent casing.
 - 2) Fans: Oversized access panel to allow removal and replacement of entire fan assembly including base without impacting adjacent casing.
 - 3) Heat Wheels and Heat Exchangers: Oversized access panel to allow removal and replacement of internal components without impacting adjacent casing.
 - 4) Humidifiers: Oversized access panel to allow removal and replacement without impacting adjacent casing.
 - g. Nameplates:
 - 1) On each access panel, include a nameplate defining the access to service within. Nameplates shall be included for, but not be limited to, the following:
 - a) Cooling Coils.
 - b) Heating Coils.
 - c) Electric Heaters.
 - d) Heat Wheels.
 - e) Fixed Plate Exchangers.
 - f) Humidifiers.
 - g) Supply Fans.
 - h) Exhaust Fans.
 - i) Return Fans.
13. Standing-Seam Metal Roof: Construct air-handling unit roof casing with standing seams designed for waterproof roofing applications.
- a. Construct air-handling unit roof using same materials and finish as walls.
 - b. Slope roof away from primary access side of unit at not less than 1 percent.
 - c. For air-handling units shipped in multiple sections, include standing-seam joiners at each split with adhesive, hardware, and cover strips for field joining by Installer.
14. Roofing Membrane:
- a. Cover entire roof with a roofing membrane. Extend membrane down sides of unit a sufficient distance to provide a waterproof roof assembly and secure in place with a metal flashing matching casing material and finish.
 - 1) Roofing membrane shall have an elongation of at least 450 percent when tested in accordance with ASTM D412.

- 2) Roofing membrane shall not become brittle at temperatures down to minus 40 deg F.
 - b. Slope unit roof away from primary access side of unit at a slope in accordance with roofing manufacturer's written instructions, but not less than 1 percent.
 - c. Application: Factory or field applied as determined by air-handling unit manufacturer; in accordance with roof manufacturer's written instructions.
 - 1) Field-applied roofing to be supervised by an air-handling unit manufacturer's factory service representative.
15. Liquid-Applied Roofing:
- a. Cover entire roof with a liquid-applied roofing. Extend liquid-applied roofing down sides of unit a sufficient distance to provide a waterproof roof assembly and cover sides with a metal flashing matching casing material and finish.
 - 1) Cured roofing shall have an elongation of at least 500 percent at 77 deg F and at least 300 percent at 0 deg F, when tested in accordance with ASTM D412.
 - 2) Roofing shall not become brittle at temperatures down to minus 40 deg F.
 - b. Slope unit roof away from primary access side of unit at a slope in accordance with roofing manufacturer's written instructions, but not less than 1 percent.
 - c. Application: Factory or field applied as determined by air-handling unit manufacturer; in accordance with roof manufacturer's written instructions.
 - 1) Field-applied roofing to be supervised by an air-handling unit manufacturer's factory service representative.
16. Service Corridors:
- a. Description: Integral walk-in service corridors with heated temperature-controlled indoor environment for weather-protected service access to unit access doors and factory-installed piping electrical and controls.
 - b. Size and Arrangement: As indicated on Drawings.
 - c. Construction: Base, floor, walls, and roof to match air-handling unit.
 - d. Access Doors:
 - 1) Width: Minimum 36-inch clear inside frame opening.
 - 2) For double-door applications, include door frames with removable center mullions for unrestricted access.
 - e. Electrical: Factory install and wire service lights with switches and receptacles.

- f. Indoor Environmental Control: Factory install HVAC equipment required to thermostatically controlled indoor environment to maintain following indoor conditions:
 - 1) Minimum Temperature: 50.
 - g. Field Connections to Factory-Installed Piping, Electrical, and Controls: Arranged to make field connections to factory terminations inside of service. Frame openings in air-handling unit floor to accommodate field connections.
- E. Internal Structural Supports:
- 1. General:
 - a. Air-handling unit manufacturer shall design and assemble air-handling unit internal structural supports for attachment and support by air-handling unit structural base.
 - b. Factory install structural supports for internal support casing if required to comply with casing structural performance.
 - c. Factory install hoist beams and rails over equipment to comply with performance requirements for service.
 - 2. Structural Member Size and Spacing:
 - a. Size: Air-handling unit manufacturer shall select size of members and construction to do the following:
 - 1) Withstand the rigors of loading, unloading, shipping and rigging without damage to air-handling unit components or misalignment of factory-assembled casing and components.
 - 2) Comply with performance requirements indicated.
 - b. Spacing: Positioned as required to comply with requirements.
 - 3. Materials: structural carbon steel, ASTM A36/A36M structural stainless steel, ASTM A276/A276M, Type 304L or structural stainless steel, ASTM A276/A276M, Type 316L.
 - a. Structural Supports: Angle channel I or W beam shapes or tube shapes selected by air-handling unit manufacturer for application.
 - b. Hoist Beams for Internal Components (Spanning Full Width of Unit): I or W beam shapes.
 - 4. Carbon-Steel Finish, Mill Galvanized: Mill-galvanized carbon steel with weld damaged areas cleaned, prepared, and painted with galvanized paint after fabrication.
 - 5. Carbon-Steel Finish: Carbon-steel bases shall be shot-blasted, cleaned, prepared, and painted or hot-dip galvanized after fabrication.
- F. Factory-Manufactured, Vibration Isolation Roof Curbs:

1. General:

- a. Curb mounted rooftop units shall be isolated on roof top spring isolation curb consisting of galvanized curb sections with integral vertical and laterally restrained isolators formed to fit the contractor supplied rooftop equipment. The spring isolation curb and acoustical treatment package shall provide a space and adjacent space noise criteria of NC 35 within the areas of the building.

The noise control manufacturer shall provide the following acoustical and pressure drop calculations, as part of the submittal package complete with a stamp from a professional engineer, to demonstrate that the resultant noise level in the indoor occupied space served by AHU-8,9,10 shall meet the above noise criteria through the following noise paths:

- 1) Supply Air Noise
- 2) Return Air Noise
- 3) Duct Breakout Noise
- 4) Supply Air Pressure Drop Including System Effects
- 5) Return Air Pressure Drop Including System Effects

- b. If the noise level in the occupied spaces exceeds the specified noise criteria level, it will be the financial responsibility of the noise control manufacture to provide product and labor to achieve the specified criteria. The current schedule is based on the sound power levels of the "basis of design" air handling units. Additional noise control required as a result of the purchase of noisier air handling units will be the financial responsibility of the purchasing Contractor.

The total noise contribution from other sources other than the AHU's must be at least 5 dB below the specified noise criteria. Use sound power levels of actual equipment to be installed on project. Analysis shall include breakout noise calculations.

- c. If products other than those of the basis of design manufacturer are supplied on the project, the purchasing Contractor assumes full performance, project schedule and monetary responsibility for meeting the project noise criteria, including any retrofit work that may be required.
- d. The silencers and the Custom Solution Noise Control Spring Isolation Roof Curb shall be built complete by the noise control manufacturer as an integral unit.

2. Construction

- a. The curb shall bear directly on the roof structure and shall be flashed and waterproofed into the roof's membrane waterproofing system by the installing contractor.
- b. The curb shall be constructed from a minimum of 16 ga G90 galvanized perimeter steel with a factory attached wood nailer. The perimeter steel seams shall be continuously welded. The galvanized perimeter curb steel shall be attached to a structural steel frame that incorporates a minimum of 4 restrained spring isolators that supports the rooftop unit.

- c. The curb shall have factory installed lifting points
- d. Curb sides and ends shall be capable of accepting 51 mm (2") external insulation furnished and installed by the roofing contractor or factory installed.
- e. The isolation springs shall be of the vertical and laterally restrained type. The springs shall be designed to be laterally stable and properly selected to provide minimum specified deflection with 50% additional travel to solid. Isolation springs shall be powder coated for corrosion resistance and have a minimum static spring deflection of 2 inches as scheduled.
- f. The isolation shall allow 6 mm (1/4") movement before resisting wind loads in any lateral direction.
- g. The perimeter of the curb shall have a flexible neoprene air and weather seal joining the upper and lower curb sections. There shall also be a continuous closed cell sponge material above the top of the spring isolation curb to provide a waterproof seal between the rooftop units.
- h. The spring isolation curb structure shall be shipped pre-assembled. Additional acoustic accessories shall be shipped loose for field installation.
- i. Curb shall be supplied with PE stamped, IBC compliant overturn calculations for site specific wind and seismic conditions.
- j. All acoustic installation hardware shall be provided by the isolation curb manufacturer.

G. Centrifugal Plenum Fans:

1. Operating Performance:

- a. Air-handling unit manufacturer shall account for, and include in, submitted fan selections any static pressure drops associated with unit, and system effect due to fan operating in the air-handling unit.
 - 1) Add additional static pressure to fan scheduled total static pressure.
 - 2) If fan motor horsepower is increased, notify Architect.
- b. Fans shall have sharply rising pressure characteristics at operating point and stable in operation. Fan horsepower characteristics shall be self-limiting and non-loading.
- c. Fan speed, brake horsepower, and sound power levels indicated are maximum acceptable.
- d. Motor horsepower, airflow rate, and static pressure are minimum acceptable. Motor horsepower shall be capable of handling maximum horsepower of fan at scheduled speed.
- e. Fan air performance ratings shall be based on tests in accordance with ASHRAE 51/AMCA 51 and AMCA 210.
- f. Base fans sound ratings on AMCA 300 and calculation methods in accordance with AMCA 301.
- g. At a minimum, fans shall have AMCA class indicated on Drawings.
 - 1) Fan operating limits shall be in accordance with AMCA 99 for AMCA class indicated.
 - 2) If AMCA class is not indicated, use AMCA 99 as basis for determining AMCA class.

- 3) AMCA class selected shall be capable of accommodating a plus 10 percent increase to fan static pressure indicated on Drawings.
- h. Motor starting torque shall exceed fans speed-torque requirements.
2. Vibration Balance:
 - a. Each fan/motor assembly shall be factory balanced to AMCA 204, BV-5, Balance Quality Grade G1.0 or better through entire operating speed range from minimum speed to maximum speed. If minimum speed is not indicated on Drawings, assume minimum speed to be 10 percent of design speed.
 - b. Identify and record each speed and speed range within the fan operating range that could cause potential vibration problems.
 - c. Submit test reports as an information submittal for Project record.
3. Operation and Service Requirements:
 - a. Each fan/motor assembly shall be capable of lock-out/tag-out procedure without interrupting operation of other fans in air-handling unit.
 - b. Design and incorporate features to permit safe, rapid, and economical maintenance.
4. Fan Base:
 - a. Mount fan, motor, and drive on a structural-steel or an aluminum base; except, where indicated on Drawings, install fan on a concrete-filled inertia base.
 - b. Include base and vibration isolators in accordance with requirements indicated.
 - c. Electrically weld the base.
 - d. Size and design the base construction to withstand the rigors of shipping and rigging.
 - e. Include the base with lifting lugs or holes.
 - f. Construct base with gusseted brackets to accommodate spring isolators indicated.
5. Fan Panel:
 - a. Construct fan panel of aluminum or powder-coated steel.
 - b. Support fan wheel and bearings from a structural aluminum or powder-coated steel framework.
 - c. Reinforce and brace fan panel to prevent vibration and pulsation.
 - d. Include stiffeners to form a rigid panel that is free of structural resonance and vibration.
6. Fan Inlet and Wheel Cone:
 - a. Precision-spun or die-formed, matched inlet and wheel cone to ensure streamlined airflow into the wheel and full loading of blades.
 - b. Inlet and wheel cones shall be hyperbolic.

- c. Inlet cone shall be a single piece, constructed of aluminum or powder-coated carbon steel.
 - d. Fasten inlet cone to fan panel using bolts, nuts and washers to provide a positive and secure attachment that can be field removable.
 - e. Inlet cones that are held in place using retaining clips are unacceptable.
7. Fan Wheel:
- a. Fan blades shall be a true hollow airfoil shape, continuously welded to backplate and wheel cone.
 - b. Construct blades of aluminum, reinforced for AMCA fan class and operating conditions scheduled.
 - c. Design blades to provide smooth and aerodynamic airflow over all surfaces of blade.
 - d. Construct fan hubs of cast aluminum or cast-iron ASTM A48/A48M Class 20A and better, with integral bracing for extra strength and stiffness.
 - 1) Castings shall be sound and free of shrink holes, blow holes, cracks, scale, blisters, or other similar injurious defects.
 - 2) Clean surfaces of castings by blasting, pickling, or other standard method.
 - 3) Mold-parting fins and remains of gates and risers shall be chipped, filed, and ground flush.
 - 4) Design hubs to maintain a high resistance to fatigue and low relative wheel imbalance.
 - e. Hubs shall be keyed and setscrewed to shaft for positive attachment.
 - f. Construct the wheel backplates of aluminum.
 - g. Statically and dynamically balance fan wheel before fan is assembled.
 - h. Select entire rotating assembly so first critical speed is at least 30 percent greater than fan design speed and at least 20 percent greater than maximum AMCA class speed.
8. Fan Drive:
- a. Direct drive, arrangement 4 in accordance with AMCA 99 for single-width, single-inlet fans.
 - b. Adjust wheel width and diameter to match motor speed while providing performance scheduled.
 - c. Fasten fan wheel directly to motor shaft using a key and setscrew as previously specified.
 - d. Construct motor base and pedestal of aluminum or powder-coated carbon-steel plate.
 - e. Fan Speed Limitation: Fan speed at design conditions indicated shall not exceed speed on motor nameplate for direct-drive applications. Do not select fans to operate at motor speeds greater than motor nameplate.
9. Protective Screens: Factory furnish and install protective screens on fan inlet and discharge.
- a. Expanded metal welded to a painted carbon-steel or stainless steel frame.

- b. Screens shall comply with OSHA requirements.
 - c. Screens shall be constructed of stainless steel.
 - d. Fasten screens to fan frame for easy removal by maintenance personnel.
10. Welding:
- a. Use AWS- or ASME-certified welders to weld materials required by application.
 - b. All welds shall be continuous full penetration welds.
11. Hardware: Hex-head, high-strength 300 series stainless steel.
12. Nameplates:
- a. Construct nameplates and rotation arrows of aluminum or 300 series stainless steel.
 - b. Securely fasten nameplate and rotation arrow to fan housing using pins or sheet metal screws.
 - c. Locate nameplates in a highly visible location on motor side of fan.
 - d. Engrave the following information on nameplate:
 - 1) Manufacturer, address, phone number, and website address.
 - 2) Manufacturer model number.
 - 3) Serial number.
 - 4) Manufacturing date.
 - 5) Fan size.
 - 6) Fan schedule equipment designation (may be listed on a separate nameplate if there is insufficient space).
 - 7) Design airflow.
 - 8) Design static pressure.
 - 9) Design fan speed.
 - 10) AMCA fan class.
 - e. Air-Handling Unit Factory Assembly:
 - f. Internal Access: Include each fan with internal access from upstream sides as indicated on Drawings.
 - g. Removal and Replacement: Each fan shall be independently removable and replaceable through a removable access panel installed in air-handling unit casing.
 - h. Fan Supports:
 - 1) Construct a freestanding and self-supporting structural framework to support each fan individually from and independent of adjacent fans.
 - 2) Construct frame work from aluminum, galvanized steel, or stainless steel.
- H. Fan Motors:
- 1. Standard: Comply with NEMA MG 1 unless more stringent requirements are indicated.
 - 2. Description: NEMA MG 1,, as required to comply with capacity and torque characteristics; medium-induction motor.

- a. Performance:
 - 1) Capacity and Torque Characteristics: Sufficient to start, accelerate, and operate connected loads at designated speeds, at installed altitude and environment, with indicated operating sequence, and without exceeding nameplate ratings or considering service factor.
 - 2) Efficiency: NEMA Premium Efficiency rating complying with NEMA MG 1.
 - 3) Motor Horsepower: Minimum size as indicated on Drawings. Motor shall operate fan under all conditions indicated without exceeding motor nameplate and without use of motor service factor.
 - 4) Inverter-Duty Rating: Comply with minimum requirements of Class F or Class H insulation, suitable for "inverter-duty" or "drive-duty" applications in accordance with NEMA MG 1. Motor operation through a variable-frequency controller shall not adversely affect the motor performance, operation, useful life, and warranty.
 - 5) Service Factor: 1.15.
 - 6) Temperature Rise: Match insulation rating.
3. Enclosure Type: TEFC.
4. Shaft Grounding System:
 - a. Shaft grounding system to protect bearings from induced voltage.
 - b. Shaft grounding system shall have low drag (less than 0.05 percent of motor horsepower), and shall operate for a minimum of three years without periodic maintenance or adjustments.
 - c. Mounting: External or internal to motor enclosure.
5. Frame:
 - a. Frames with integrally cast feet unless other requirements of driven equipment require a different arrangement.
 - b. Frame, front and back end brackets, and front and back end bearing intercaps constructed of cast iron, ASTM A48/A48M, Class 25 or better.
6. Rotor:
 - a. Fabricate rotor frame from die-cast aluminum, copper, or associated alloys.
 - b. Key rotors to motor shaft.
 - c. Rotating assembly shall be dynamically balanced to within limits defined in NEMA MG 1.
 - d. Motors shall have the entire rotating assembly between bearing inner caps coated with a corrosion-resistant coating.
7. Stator:
 - a. Copper windings shall be spike resistant to withstand 1600 peak V.
 - b. Entire wound and insulated stator coated with a coating to protect against moisture and corrosion.
8. Shaft:

- a. Solid shaft fabricated of Type 304 stainless steel, accurately turned, ground and polished, and inspected for accuracy.
 - b. End of shaft with drilled hole for use in field measurements.
9. Bearings:
- a. Grease-lubricated ball or roller bearings.
 - b. ABMA 11 L-10 motor bearing life of 100,000 hours.
 - c. Bearing Lubrication:
 - 1) Factory lubricate motor bearings using a premium moisture-resistant polyurea thickened grease with rust inhibitors suitable for extreme operating temperatures encountered.
 - 2) Coordinate special requirements that may impact lubrication and include appropriate lubrication.
 - d. Grease Fittings:
 - 1) Equip each bearing housing with an easily accessible grease inlet.
 - 2) Fit grease inlets with a grease fitting and protective fitting cap.
 - 3) Equip inlets with an automatic grease relief fitting to prevent excessive greasing.
 - 4) Equip each bearing housing with grease drain and threaded plug.
10. Conduit Box:
- a. Material same as frame.
 - b. For motor frames 365T and below, furnish conduit boxes sized with internal volumes in accordance with NEMA MG 1.
 - c. For motor frames larger than 365T, furnish conduit boxes one size larger than NEMA MG 1.
 - d. Coordinate the location and mounting of conduit box with driven equipment manufacturer.
 - e. Factory mount conduit box on motor.
11. Grounding: NRTL-listed clamp-type grounding lug mounted in conduit box.
12. Motor Leads:
- a. Non-wicking type, Class F temperature rating or better and permanently numbered over entire length for identification.
 - b. Lead terminals shall be manufacturer's standard.
13. Condensate Drains:
- a. Motor with drain holes at the lowest point for drainage of condensate.
 - b. Each drain hole with a threaded removable plug.
14. TEFC Motor Fans: Corrosion-resistant construction, non-sparking, metallic or non-metallic, bi-directional, and keyed to shaft.
- a. Motor Fan Cover: Steel.

15. Hardware: Hex-head, high-strength, zinc-plated carbon steel or stainless steel.
 16. Lifting Eyebolts: Eyebolt threaded into frame receptacle and design to prevent moisture and other foreign material from entering motor cavity when eyebolt is removed.
 17. Nameplates:
 - a. Construct nameplates of aluminum or stainless steel and attach to motor frame with aluminum, stainless steel, or brass drive pins.
 - b. Engrave or stamp data on the nameplate.
 - c. At a minimum, include nameplate data in accordance with NEMA MG 1. Also include ABMA bearing designation for the drive and opposite end bearing.
 18. Paint: Successfully pass 500-hour salt spray test for corrosion in accordance with ASTM B117.
- I. Vibration Isolation:
1. General:
 - a. Provide fans inside air-handling units with base and vibration isolation indicated on Drawings.
 2. Inertia Bases:
 - a. Description: Reinforced structural base designed for concrete infill with integral bolting provisions for fan mounting.
 - b. Design and Performance:
 - 1) Weight of inertia base including concrete infill a minimum of 1.5 times the operating weight of fan.
 - 2) Base thickness not less than 1/12 of longest span.
 - 3) Minimum base thickness is as follows:
 - a) Up to 15 HP: 6 inches.
 - b) 20 to 50 HP: 8 inches.
 - c. Construction:
 - 1) Base Materials: Structural carbon steel, ASTM A36/A36M.
 - a) Carbon-Steel Finish, Mill Galvanized: Mill-galvanized carbon-steel bases with weld-damaged areas cleaned, prepared, and painted with galvanized paint after fabrication.
 - b) Carbon-Steel Base Finish: Carbon-steel bases cleaned in accordance with SSPC SP-1, and hot-dip galvanized after fabrication.
 - 2) Reinforcing Bars: Carbon steel, ASTM A615/A615M, sized for a maximum stress of 20,000 psi when subjected to both static and dynamic loads, and welded in place.

- 3) Floor: Design inertia base with solid floor in bottom for concrete placement after base installation. Seal to prevent leakage or seepage.
 - a) Galvanized-Steel Solid Sheet: ASTM A653/A653M; G90 coating, minimum (nominal) 18 gauge thick.
 - b) Stainless Steel Solid Sheet: ASTM A240/A240M or ASTM A480/A480M; Type 304; No. 2D finish; minimum (nominal) 18 gauge thick.
 - 4) Isolator Brackets: Gusseted, height-saving brackets.
 - 5) Welding Filler Metals: Comply with AWS welding codes for welding materials appropriate for thickness and chemical analysis of material being welded.
- d. Air-Handling Unit Factory Assembly: Install fans with inertia bases where indicated on Drawings.
- 1) Coordinate placement of inertia bases with design of air-handling unit structural base. Make provisions for attachment and support.
 - 2) Coordinate inertia base mounting provisions with spring isolators.
3. Spring Isolators:
- a. Performance:
 - 1) Deflection: Minimum deflection indicated on Drawings. Use a greater deflection if required to maintain an isolator efficiency of at least 98 percent under all operating conditions encountered. Calculate isolator efficiency using actual support conditions considering the rigidity of structure.
 - 2) Laterally stable freestanding open-spring mounting.
 - 3) Spring diameter not less than 0.8 of compressed spring height at rated load and in the installed and operating condition.
 - 4) Reserve travel to solid shall be equal to a minimum of 50 percent of rated deflection and in no case less than 25 percent of rated deflection in an installed and operating condition.
 - 5) Ratio of horizontal stiffness to vertical stiffness equal to approximately one.
 - 6) Design and install so that ends of springs remain parallel.
 - 7) Select springs that are non-resonant with equipment related frequencies and natural frequencies of support structure.
 - 8) Springs shall not take a permanent set when compressed to coil bind.
 - b. Construction:
 - 1) Coat springs with PVC or neoprene. Color-code springs to allow positive identification after installation.

- 2) Construct baseplates, spring retainers, and other components of galvanized carbon steel or stainless steel. Etch and paint aluminum components.
 - 3) Use nuts, bolts, and washers and other associated hardware constructed of stainless steel.
 - 4) Isolators with integral leveling bolts.
 - 5) Baseplates with holes and isolation grommets for bolting.
 - 6) Bond nominal 1/4-inch- thick, neoprene friction pad to baseplate.
4. Thrust Restraints:
- a. In sets of two or more, thrust restraints shall consist of springs in series with neoprene isolators.
 - b. Coordinate and select deflection of thrust restrains with equipment being restrained.
 - c. Thrust restraints complete with rods and adjustment nuts, plus angle brackets and backing plates for attachment to substrate and equipment being restrained.
5. Elastomeric Grommets:
- a. Elastomeric grommets shall be a combination of neoprene washer and bushing.
 - b. Elastomer shall be 56-durometer maximum.
 - c. Grommets formed to prevent bolts from directly contacting the secured item.
6. Flexible Connections:
- a. Construct flexible connection galvanized-steel or stainless steel edges firmly attached to waterproof and fire-retardant fabric.
 - b. Fabric shall be 6 inches wide or more.
 - c. Suitable for operation in extreme temperatures encountered.
 - d. NRTL listed for application and complying with NFPA 90A.
7. Air-Handling Unit Factory Assembly:
- a. Use precompression -type height-saving brackets with isolators having 2-1/2 inch deflection or greater, to limit exposed bolt length.
 - b. Install spring isolators plumb and adjust isolators that are not plumb under operating conditions to make plumb.
 - c. Adjust isolators to prevent stress transfer to equipment.
 - d. Verify that installed isolators and mounting systems permit equipment motion in all directions.
 - e. Restrain fans with isolated thrust resistors to limit displacement to 1/4 inch. Design for the maximum lateral thrust the fan can develop.
 - f. Adjust or include additional resilient restraints to flexibly limit fan lateral motion to 1/4 inch during startup and operation of equipment.
 - g. Anchor restraints to fixed supports having a stiffness greater than the thrust encountered.

- h. Include at least 2-inch operating clearance between fan bases and walking surface of air-handling unit floor. Before startup, clean out foreign matter between bases and equipment to prevent short circuit.
 - i. Flexible Connections:
 - 1) Install flexible connections at connections to fans.
 - 2) Install flexible connections in accordance with SMACNA standards and manufacturer's written instructions.
 - 3) Make fabric joints on the flat run, not the corners, with overlap to provide an area sufficient to make a positive seal.
 - 4) Apply adhesive between fabric layers.
 - 5) Attach connections using screws or bolts.
 - 6) Reinforce fabric if required to keep fabric from collapsing and impacting airflow into fan.
- J. Hydronic Coils:
- 1. Sourcing Option: In lieu of sourcing hydronic coils from a specialty coil manufacturer, air-handling unit manufacturer has option to furnish in-house hydronic coils that achieve equal or better performance while complying with other requirements indicated.
 - 2. General: Provide air-handling units with hydronic coils where indicated on Drawings.
 - 3. Description: Plate fin coils constructed of staggered tubes mechanically expanded into continuous collars that are die formed into plate fins.
 - 4. Design and Performance:
 - a. Capacities, face area, and number of rows indicated on Drawings are minimum acceptable.
 - b. Air pressure drop, water pressure drop, fin spacing, and face velocity indicated on Drawings are the maximum acceptable.
 - c. Coils shall be counterflow design, air to fluid. Fluid supply shall enter air leaving side of coil and exit air entering side.
 - d. Design coils to be drainable.
 - 1) Coils shall have all circuits drainable when coils are installed in horizontal position and level.
 - 2) Coil supply header shall be furnished with a drain connection at lowest point on header.
 - e. Design coils to be self-venting.
 - 1) Supply connection near bottom of supply header.
 - 2) Return connection near top of return header.
 - 3) Furnish coil returnheader with a vent connection at highest point on header.
 - f. Coils supply and return piping connections on same end of coil.
 - g. Coils shall be rated for system operating pressures and temperatures encountered by installation, but not less than 200 psig.
 - h. Coil selection criteria, unless otherwise indicated on Drawings, are as follows:

- 1) Face Velocity: Maximum of 500 fpm.
 - 2) Fluid Tube Velocity (at Design Flow Rate):
 - a) Maximum: 6 fps.
 - b) Minimum: 3 fps.
 - 3) Fluid Header Velocity: Maximum of 6 fps.
 - a) Fin Height: Maximum of 48 inches.
 - b) Fin Spacing: Maximum of 12 fins per inch.
 - i. Cooling coils shall have no moisture carryover at design conditions. Install moisture eliminators on discharge face of coil if it is necessary to eliminate moisture carryover.
5. Casing and Tube Sheets:
- a. Depth: Extend coil casing and tube sheets a minimum of 1/2 inch beyond face of fins on both entering and leaving side.
 - b. Casing and Tube Sheet Materials:
 - 1) Cooling Coils: Stainless steel, ASTM A240/A240M or ASTM A480/A480M, Type 304L or Type 316L, No. 2D finish.
 - 2) Heating Coils:
 - a) Stainless steel, ASTM A240/A240M or ASTM A480/A480M, Type 304L or Type 316L, No. 2D finish.
 - b) Galvanized steel, ASTM A653/A653M, G90 coating.
 - c. Top and Bottom Casings:
 - 1) Flange face minimum of 1-1/2 inches; double flange edge for rigidity and ease of removal with secondary flange face minimum of 1/2 inch.
 - 2) Thickness:
 - a) Coils with Fin Length of up to 72 Inches: Minimum of 16 gauge thick.
 - b) Coils with Fin Length Exceeding 72 Inches: Minimum of 16 gauge thick.
 - d. End Tube Sheets:
 - 1) Tube sheet holes rolled to prevent chaffing of tubes during thermal expansion and contraction.
 - 2) Flange face minimum of 1-1/2 inches.
 - 3) Thickness: Minimum of 16 gauge thick.
 - e. Intermediate Tube Sheets:
 - 1) Tube sheet holes rolled to prevent chaffing of tubes during thermal expansion and contraction.

- 2) Space intermediate tube sheets a maximum of 48 inches o.c. and locate to provide equal spacing between tube sheet across coil tube length.
 - 3) Flange face minimum of 1/2 inch.
 - 4) Thickness: Minimum of 16 gauge thick.
- f. Holes: Include number, size, and location of holes in casing and end tube sheets required for coil installation.
6. Fins:
- a. Materials:
 - 1) Aluminum: 0.0075 inch thick.
 - b. Collars: Full collars for accurate fin spacing and maximum tube contact while leaving no surface of tube exposed.
 - c. Fin Configuration: Flat face fins without ripples.
7. Headers:
- a. Construct header of seamless copper, ASTM B75/B75M drawn temper of diameter and wall thickness based on coil size, flow rate, design pressure, design temperature, and circuiting.
 - b. Tube-to Header Connections: Tube-to-header holes shall intrude inward so landed surface area is three times the core tube thickness, to provide enhanced header to tube joint integrity. Tubes shall evenly extend within the ID of the header no more than 0.12 inch.
 - c. Header Top and Bottom Caps: End caps shall be die-formed and installed on the ID of header such that the landed surface area is three times the header wall thickness.
 - d. Drains: Include low point of supply header with a NPS 1/2 drain connection. Extend copper or red brass pipe through air-handling unit casing and terminate end with male national pipe threads (MNPT). Pipe shall be threaded on both ends to facilitate easy field removal and replacement.
 - e. Vents: Include high point of return header with a NPS 1/2 vent connection. Extend copper or red brass pipe through air-handling unit casing and terminate end with MNPT. Pipe shall be threaded on both ends to facilitate easy field removal and replacement.
 - f. Supply and Return Connections:
 - 1) Terminate ends with MNPT.
 - 2) Connections to header shall be either copper tube with brazed ASME B16.18 threaded male adapters or red brass pipe with machine-threaded MNPT connections. Pipe shall extend through air-handling unit casing and be threaded on both ends to facilitate easy field removal and replacement.
 - 3) Connections NPS 2-1/2 and larger shall have a bronze ASME 16.24 threaded flanges attached to threaded connections to provide for a flanged field connection. Select flange class, Class 150 or Class 300, for system pressure and temperature encountered.

- g. Protect openings of supply, return, vent, and drain connections with a threaded cap to prevent entry of dirt into the coil.
8. Tubes:
 - a. Material: Copper, ASTM B75/B75M annealed temper or ASTM B280 drawn temper; 90/10 cupronickel alloy, ASTM B122/B122M.
 - b. Tube Nominal Diameter: 1/2 or 5/8 inch before expanding, selected to provide performance indicated.
 - c. Tube Nominal Wall Thickness: As required by performance, minimum of 0.025 inch thick.
9. Tube Return Bends: 180-degree bends brazed to tubes; material, wall thickness, and nominal diameter to match tubes.
 - a. Tube Return Bend Nominal Wall Thickness: As required by performance, minimum of 0.025 inch thick.
10. Brazing: High-temperature brazing alloy with not less than 5 percent silver when brazing like non-ferrous materials together and more than 30 percent silver when brazing ferrous to non-ferrous materials.
11. Comply with Section 230546 "Coatings for HVAC" for corrosion-resistant coating. See Drawings for coils requiring a corrosion-resistant coating.
12. Coatings: Where indicated on Drawings, coat coils with one of the following coatings for additional corrosion protection:
 - a. Baked phenolic.
 - b. Cathodic epoxy.
 - c. Water-based flexible epoxy polymer.
 - d. Water-based synthetic flexible polymer.
13. Hardware: Use hex-head bolts, nuts, and washers constructed of Type 304 or Type 316 stainless steel.
14. Nameplate: Aluminum or stainless steel nameplate with brass or stainless steel chain for each coil, with the following data engraved or embossed:
 - a. Manufacturer name, address, telephone number, and website address.
 - b. Manufacturer model number.
 - c. Serial number.
 - d. Manufacturing date.
 - e. Coil identification (indicated on Drawings).
 - f. Coil fin length.
 - g. Coil fin height.
 - h. Coil weight with fluid/without fluid.
 - i. Coil casing material and thickness.
 - j. Coil fin material and thickness.
 - k. Coil tube material and thickness.
 - l. Coil header material and thickness.
15. Cleaning: Residual manufacturing oils and solid contaminants shall be removed internally and externally by completely submersing the coil in an environmentally

- acceptable degreasing solution that is chemically compatible with the coil material.
16. Air-Handling Unit Factory Assembly:
- a. Coil Connections: Extend each coil connection through casing access panel and terminate connections, approximately 4 inches beyond exterior face of access panel, and seal each penetration as indicated. Casing access panels shall be removed and reinstalled with coils installed inside air-handling units.
 - b. Internal Access: Include each coil with internal access from downstream and upstream sides as indicated on Drawings.
 - c. Removal and Replacement: Each coil shall be independently removable and replaceable through a removable access panel installed in air-handling unit casing.
 - d. Supports for Coils:
 - e. Construct a freestanding and self-supporting structural framework to support each coil individually from and independent of adjacent coils.
 - f. Construct framework for cooling coils, from aluminum or stainless steel structural shapes.
 - g. Construct frame work for heating coils from aluminum or stainless steel structural shapes.

K. Drain Pans:

1. General:
 - a. Include a drain pan for each cooling and heating coil and at other locations indicated.
 - b. Continuously weld drain pan seams, joints, and mitered corners to make the assembled drain pan watertight.
 - c. Drain pans shall be located under the entire coil and provide full coil coverage including coil return bends and headers.
 - d. Slope drain pans in multiple directions toward low point drain connection at a uniform slope of at least 1 percent from high point to low point.
 - e. Include stainless steel blank-offs to prevent air from bypassing around coil.
2. Bottom Drain Pans:
 - a. Mounting Location, Recessed in Floor: Air-handling unit manufacturer has option to recess bottom drain pan into the floor or install drain pan above air-handling unit floor walking surface.
 - b. Mounting Location, Above Floor: Bottom drain pan shall be installed above air-handling unit floor walking surface. Do not recess drain pan into unit base.
 - c. Grating: Install removable stainless steel grating on top of drain pan.
 - d. Material: 300 series stainless steel ASTM A240/A240M or ASTM A480/A480M, a minimum of 16 gauge thick.
 - e. Minimum Depth: 1.5 inches.
 - f. Extend drain pan beyond air entering face of coil casing at least 3 inches.
 - g. Extend drain pan beyond air leaving face of coil casing at least 12 inches.

- 1) Where moisture eliminators are required to prevent moisture carryover, extend drain pan beyond leaving face of moisture eliminator in lieu of the leaving face of coil.
- h. Drain Pan Connection:
 - 1) Stainless steel threaded half-coupling welded to lowest point of drain pan.
 - 2) Location: See Drawings.
 - 3) Minimum Nominal Connection Size: NPS 1.
- i. Drain Pipe:
 - 1) Air-handling unit manufacturer to connect full size drain pipe to each drain pan connection. Option to use one of following pipe materials:
 - a) Copper tube with threaded male adapter, brazed or soldered to ends.
 - b) Stainless steel pipe with threaded MNPT ends.
 - 2) Extend drain pipe and terminate 3 inches beyond exterior face of casing.
- L. Electric Heaters:
 1. General:
 - a. Provide air-handling units with electric heaters where indicated on Drawings.
 - b. NRTL listed for zero clearance to combustible surface, regardless of heater capacity.
 2. Design and Performance:
 - a. Heaters and installation shall comply with NFPA 70.
 - b. Scheduled capacity (kW) is minimum acceptable.
 - c. Air pressure drop and face velocity are maximum acceptable.
 - d. Rate heaters output capacity at voltage, phase, and hertz indicated on Drawings.
 - e. Arrange capacity control to minimize stratification.
 - f. Equally balance heater electrical load for each step across all three phases.
 - g. Part-Load Operation: Include multiple heaters configured in a series arrangement with operation staged if required for uninterrupted heater operation over the full range of air-handling unit airflow down to the minimum airflow indicated.
 3. Heating Elements:
 - a. Open Elements:

- 1) Open-coil resistance wire of 80 percent nickel and 20 percent chromium; supported and insulated by floating ceramic bushings recessed into casing openings, fastened to supporting brackets, and mounted in a frame.
 - 2) Safety Screens: Install safety screens to protect operators from accidentally coming in direct connect with elements.
- b. Finned Tubular Elements:
- 1) Coiled resistance wire of 80 percent nickel and 20 percent chromium; center-mounted and surrounded by compacted magnesium-oxide powder in tubular-steel sheath; with spiral-wound, copper-plated, steel fins continuously brazed to sheath.
 - 2) Finish finned tubular elements with a baked-on aluminum paint, and mount in a frame.
 - 3) Each element individually removable from terminal box.
 - 4) Use threaded stainless steel element terminals and hardware.
4. Frame: Galvanized or stainless steel; include intermediate element support brackets equally spaced at a maximum of 36 inches o.c. across heater element length.
5. Terminal Box/Control Panel: Unit or remote mounting arrangement indicated on Drawings; with disconnection means and overcurrent protection.
- a. Enclosure: NEMA 250, Type 1 or Type 12 enclosure complying with UL 50.
 - b. Full face hinged door.
 - c. Factory insulate base of terminal box to prevent condensation from occurring within box.
 - d. Mount terminal box control panel on exterior surface of air-handling unit casing. Gasket and seal air-handling unit cabinet penetrations.
 - e. Install a laminated elementary wiring diagram on inside face of heater control panel door or in another protected location than visible be service personnel. Wiring diagram shall match installation.
6. Controls:
- a. Safety Controls: Each heater with following factory-mounted safety controls:
 - 1) Disk-type thermal cutout switch with automatic reset.
 - 2) Primary linear thermal limit cutout switch with automatic reset.
 - 3) Secondary linear thermal limit cutout switch with local manual reset.
 - 4) Airflow Proving Switch: Diaphragm-operated pressure differential type; with pressure range selected to ensure reliable operation throughout full range of air-handling unit airflow down to minimum airflow indicated.
 - b. Staging Control: Magnetic contactors for switching stages of heat except for air-handling units located in occupied spaces, include mercury contactors for switching stages of heat.

- c. SCR Control: Silicon-controlled rectifier (SCR) for 100 percent stepless capacity control.
 - d. Remote Monitoring and Control: Include control devices necessary to interface with remote-control signals including the following:
 - 1) Heater on/off control.
 - 2) Monitoring heater on/off status.
 - 3) High-temperature alarm.
 - 4) Low-airflow alarm.
 - 5) Heater capacity control.
7. Electrical:
- a. Single-Point Field Power Connection: Install and wire the heater to accommodate a single field electrical connection for electrical power.
 - b. Disconnecting Means: Provide each heater with a main electrical power, door mounted and interlocking, and disconnecting means to prevent access into panel, unless switched in the off position.
 - 1) Nonfused disconnect switch with lockable handle.
 - 2) Minimum Short-Circuit Current Rating: As required by electrical power distribution system, but not less than 42,000 A.
 - c. Factory install and wire branch circuit fusing, or circuit breakers in accordance with NFPA 70.
 - d. Pilot Lights: Include labeled pilot lights on face of control panel for the following:
 - 1) Power on.
 - 2) Low-airflow alarm.
 - 3) High-temperature alarm.
 - 4) One for each stage on.
 - e. Terminations: Wire terminations and field interface terminations to labeled terminal strips.
 - f. Control Transformer: Size control circuit transformer for required load, plus 75 VA.
 - g. Labeling: Label each electrical device with a laminated phenolic tag.
 - h. Use only NRTL-labeled electrical components.
8. Nameplate: Include the following data:
- a. Manufacturer name, address, telephone number, and website address.
 - b. Manufacturer model number.
 - c. Serial number.
 - d. Manufacturing date.
 - e. Coil identification (indicated on Drawings).
9. Air-Handling Unit Factory Assembly:

- a. Support individual heater assemblies within unit from a structural framework constructed of galvanized steel or stainless steel.
 - b. Provide each heater assembly with access from upstream sides.
 - c. Make provisions in arrangement and installation to mitigate uneven airflow patterns within unit for proper heater operation.
- M. Cartridge Filters:
1. Description: Factory-fabricated, dry, extended-surface, disposable, air filters with media formed in mini-pleats and arranged in a V-shape pattern.
 2. Performance:
 - a. Filtration Efficiency, ASHRAE 52.2 MERV Rating: 13.
 - b. Energy Cost Index: Five star rating.
 - c. Initial Air Pressure Drop: With face velocity of 500 fpm, clean filter pressure drop shall not exceed the following:
 - 1) MERV 11 and MERV 11A: 0.21 inch wg.
 - 2) MERV 13 and MERV 13A: 0.25 inch wg.
 - 3) MERV 14 and MERV 15A: 0.27 inch wg.
 - 4) MERV 16 and MERV 16A: 0.60 inch wg.
 - d. Manufacturer-Recommended Final Air Pressure Drop: 1.0 inches wg.
 - e. Pressure Differential without Failure: 10 inches wg.
 - f. Temperature Rating: 175 deg. F.
 3. Certification:
 - a. AHRI: Tolerances in accordance with AHRI 850 (I-P) and AHRI 851 (SI).
 - b. ASHRAE: Tested and rated in accordance with ASHRAE 52.2.
 - c. UL: UL 900 listed.
 4. Size:
 - a. Nominal size of individual filters indicated on Drawings:
 - b. Nominal Filter Size:
 - 1) Face: 24 by 24 inches.
 - 2) Depth: 12 inches.
 - c. Actual Filter Size: Suitable for installation in an industry-standard filter holding frame.
 5. Filter Media Surface Area: Each filter shall contain at least 200 sq. ft. for a filter with a nominal 24-by-24-inch face.
 6. Construction:
 - a. Media: Microfine glass media formed into mini-pleats and arranged in V-shape patterns.
 - b. Media Frame: Plastic or corrosion-resistant metal.
 - c. Adhesive: Fire-retardant bonding adhesive where bonding media to frame.

- N. Pleated Panel Filters:
 - 1. Description: Factory-fabricated, self-supported, extended-surface, pleated, panel-type, disposable air filters.
 - 2. Performance:
 - a. Filtration Efficiency, ASHRAE 52.2 MERV Rating: 8.
 - b. Energy Cost Index: Five star rating.
 - c. Initial Air Pressure Drop: With face velocity of 500 fpm, clean filter pressure drop shall not exceed the following:
 - 1) MERV 8 and MERV 8A:
 - a) Depth 1 Inch (25 mm): 0.23 inch wg.
 - b) Depth 2 Inches (50 mm): 0.31 inch wg.
 - c) Depth 4 Inches (100 mm): 0.27 inch wg.
 - 2) MERV 9 and MERV 9A:
 - a) Depth 2 Inches (50 mm): 0.30 inch wg.
 - b) Depth 4 Inches (100 mm): 0.27 inch wg.
 - d. Manufacturer-Recommended Final Air Pressure Drop: 1.0 inch wg.
 - e. Pressure Differential without Failure: 2 inches wg.
 - f. Temperature Rating: 200 deg F.
 - 3. Certification:
 - a. AHRI: Tolerances in accordance with AHRI 850 (I-P) and AHRI 851 (SI).
 - b. ASHRAE: Tested and rated in accordance with ASHRAE 52.2.
 - c. UL: UL 900 listed.
 - 4. Filter Media Surface Area: Each filter shall contain the following minimum media surface area for a filter with a nominal 24-by-24-inch face:
 - a. Depth 1 Inch (25 mm): 9.8 sq. ft..
 - b. Depth 2 Inches (50 mm): 17.3 sq. ft..
 - c. Depth 4 Inches (100 mm): 27.7 sq. ft..
 - 5. Construction:
 - a. Media: Cotton and synthetic blend of fibers arranged in a series of pleats attached to and supported by a corrosion-resistant welded-wire grid. Coat media with an antimicrobial agent.
 - b. Filter Media Casing: High wet strength (28-point) beverage board that is bonded around the periphery to eliminate air bypass.
 - 1) Diagonal support members across upstream and downstream filter face constructed of same material as casing shall ensure pleat spacing and stability.
 - c. Adhesive: Fire-retardant bonding adhesive where bonding media to casing.

O. ASHRAE-Rated Filter Holding Frames:

1. Filter Holding Frames for ASHRAE-Rated Filters:

- a. Fabricate filter holding frames with mitered corners and reinforce frame to maintain a durable, rugged, true square shape.
- b. Construct frames of galvanized or stainless steel. Use stainless steel frames in applications exposed to corrosive airstreams.
- c. For applications with pre-filter and final filters sharing the same filter holding frame, frames shall be suitable for supporting and holding both pre-filter and final filters in frame with both filters serviceable from upstream (entering air) side.
- d. Frame Depth: At least 2.75 inches.
- e. Gaskets: Continuous, suitable for same operating temperature as filters.
- f. Filter Clips: Each filter holding frame with spring clip fasteners at each corner. Spring clips shall allow filters to be removed and replaced without use of tools.
- g. Frames shall be industry-standard size to provide interchangeability of filters from other manufacturers.

2. Air-Handling Unit Factory Installation:

- a. Air-handling unit manufacturer shall furnish filters and provide filter holding frames, retaining clips, and filter support structures.
- b. Furnish filter quantity, size, type, and performance indicated on Drawings.
- c. Install filter frames in a flat vertical position for horizontal airflow.
- d. Install holding frames in accordance with manufacturer's written instructions and to prevent passage of unfiltered air. Include additional gaskets as necessary.
- e. Secure individual holding frames together to build a multiple filter bank.
- f. Construct galvanized-steel or stainless steel support structure to hold frames and filters.
 - 1) Design support structure for maximum system operating pressures encountered equal to fan shutoff pressure.
 - 2) Design and fabricate support structure to limit deflection across filter bank to 1/360 of the span when subjected to a 200-lb lateral force applied at any point on the filter holding frame assembly.

P. Filter Gauges:

1. Provide a gauge to indicate pressure differential between entering and leaving side of each filter bank. Panel filter bank separate from cartridge filter bank.
 - a. Where multiple filters share a common frame, include a separate gauge for each filter bank.
 - b. Include a metal spacer constructed of same material as filter frame for one of the filters installed in filter bank to accommodate pressure differential measure across both upstream and downstream filters.
2. Gauge shall have a nominal 4-inch- diameter face.

3. Select range of gauge to be approximately twice the dirty filter pressure drop.
4. Provide each gauge with vent valves to allow for re-zeroing the gauge without removing tubing connections.
5. Include static pressure sensors on entering and leaving side of each filter bank.
6. Air-Handling Unit Factory Assembly:
 - a. Mount each filter gauge on exterior surface of unit casing near associated filter sections.
 - b. Mount center of gauges 60 inches above bottom of air-handling unit structural base.
 - c. Connect static pressure sensors to filter gauges using copper or stainless steel tubing and compression type fittings.
 - d. Support tubing at intervals not greater than 60 inches o.c.

Q. Automatic Dampers:

1. General: Provide air-handling units with automatic dampers where indicated on Drawings.
 - a. Unless otherwise indicated, use parallel-blade configuration for two-position control, for equipment isolation service, and when mixing two airstreams. For other applications, use opposed-blade configuration.
 - b. Factory assemble multiple damper sections to provide a single damper assembly of size required by application.
 - c. Damper actuator shall be factory installed by damper manufacturer as integral part of damper assembly. Coordinate actuator location and mounting requirements with damper manufacturer.

2. Rectangular Dampers with Aluminum Blades:
 - a. Performance:
 - 1) Leakage: AMCA 511, Class 1A. Damper leakage rate shall meet or exceed current ASHRAE 90.1 standard.
 - 2) Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, figure 5.3.
 - 3) Velocity: Up to 4000 fpm.
 - 4) Temperature: Minus 40 to plus 185 deg F.
 - 5) Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
 - 6) Damper shall have AMCA seal for both air leakage and air performance.

 - b. Construction:
 - 1) Frame:
 - a) Material: ASTM B211, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick.
 - b) Hat-shaped channel with integral flange(s). Flange mating face shall be a minimum of 1 inch.
 - c) Width not less than 5 inches.

- 2) Blades:
 - a) Hollow, airfoil, extruded aluminum.
 - b) Parallel- or opposed-blade configuration as required by application.
 - c) Material: ASTM B211, Alloy 6063 T5 aluminum, 0.07 inch thick.
 - d) Width not to exceed 6 inches.
 - e) Length as required by close-off pressure, not to exceed 48 inches.
 - 3) Seals:
 - a) Blades: Replaceable, mechanically attached extruded silicone, vinyl, or plastic composite.
 - b) Jams: Stainless steel, compression type; or replaceable, mechanically attached extruded silicone.
 - 4) Axles: 0.5-inch- diameter stainless steel, mechanically attached to blades.
 - 5) Bearings:
 - a) Molded synthetic or stainless steel sleeve mounted in frame.
 - b) Where blade axles are installed in vertical position, include thrust bearings.
 - 6) Linkage:
 - a) Concealed in frame.
 - b) Constructed of aluminum and stainlesssteel.
 - c) Hardware: Stainless steel.
 - 7) Additional Corrosion Protection for Corrosive Environments:
 - a) Include anodized finish for aluminum surfaces in contact with airstream. Anodized finish shall be a minimum of 0.0007 inch thick.
 - b) Axles, damper linkage, and hardware shall be constructed of Type 316L grade stainless steel.
- c. Airflow Measurement: Where indicated, include damper assembly with integral airflow monitoring.
- 1) Zero- to 10-V dc or 4- to 20-mA scaled output signal for remote monitoring of actual airflow.
 - 2) Accuracy shall be within 2 percent of actual flow rate between the range of minimum and design airflow. For applications with a large variation in range between the minimum and design airflow, configure damper sections and flow measurement assembly as required to comply with stated accuracy over the entire modulating range.
 - 3) Include a straightening device as part of flow measurement assembly to achieve the specified accuracy with configuration indicated.
 - 4) Suitable for operation in untreated and unfiltered air.

- 5) Include temperature and altitude compensation and correction to maintain accuracy over temperature range encountered at site altitude.
 - 6) Include automatic zeroing feature.
- d. Airflow Control: Where indicated, provide damper assembly with integral airflow measurement and control.
- 1) A factory-furnished and -calibrated controller shall be programmed, in nonvolatile EPROM, with application-specific airflow set point and range.
 - 2) Controller and actuator shall communicate to control the desired airflow.
 - 3) Controller shall receive a 0- to 10-V dc input signal and report a 0- to 20-mA output signal that is proportional to airflow.
 - 4) Airflow measurement and control range shall be suitable for operation between 150 to 2000 fpm.
 - 5) Ambient Operating Temperature Range: Minus 40 to plus 140 deg F.
 - 6) Ambient Operating Humidity Range: 5 to 95 percent relative humidity, noncondensing.
 - 7) Provide unit with control transformer rated for not less than 85 VA. Include transformer with primary and secondary protection and primary disconnecting means. Coordinate requirements with field power connection.
 - 8) Include screw terminals for interface to field wiring.
 - 9) Factory mount electronics within a NEMA 250, Type 1 painted steel enclosure.
3. Rectangular Dampers with Insulated Aluminum Blades:
- a. General: Unless otherwise indicated on Drawings, install insulated aluminum blade dampers in applications where dampers close to outdoors.
 - b. Performance:
 - 1) Leakage: AMCA 511, Class 1A. Leakage shall not exceed 3 cfm/sq. ft. against 1-inch wg differential static pressure and shall not exceed 4.9 cfm/sq. ft. against 4-inch wg differential static pressure at minus 40 deg F.
 - 2) Pressure Drop: 0.1 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, figure 5.3.
 - 3) Velocity: Up to 4000 fpm.
 - 4) Temperature: Minus 100 to plus 185 deg F.
 - 5) Pressure Rating: Damper close-off pressure equal to fan shutoff pressure with a maximum blade deflection of 1/200 of blade length.
 - 6) Damper shall have AMCA seal for both air leakage and air performance.
 - c. Construction:
 - 1) Frame:
 - a) Material: ASTM B211, Alloy 6063 T5 extruded-aluminum profiles, 0.08 inch thick.

- b) C-shaped channel with integral flange(s). Mating face shall be a minimum of 1 inch.
 - c) Width not less than 4 inches.
 - d) Entire frame shall be thermally broken by means of polyurethane resin pockets, complete with thermal cuts.
 - e) Damper frame shall be insulated with polystyrofoam on four sides.
- 2) Blades:
- a) Hollow shaped, extruded aluminum.
 - b) Blades shall be internally insulated with expanded polyurethane foam and shall be thermally broken. Complete blade shall have an insulating factor of R-2.29 and a temperature index of 55.
 - c) Parallel- or opposed-blade configuration as required by application.
 - d) Material: ASTM B211, Alloy 6063 T5 aluminum, 0.08 inch thick.
 - e) Width not to exceed 6 inches.
 - f) Length as required by close-off pressure, not to exceed 48 inches.
- 3) Seals: Blade and frame seals shall be of flexible silicone and secured in an integral slot within the aluminum extrusions. Option to use stainless steel compression-type frame seals..
- 4) Axles: 0.44-inch- diameter stainless steel, mechanically attached to blades.
- 5) Bearings:
- a) Bearings shall be composed of a celcon inner bearing fixed to axle, rotating within a polycarbonate outer bearing inserted in the frame, resulting in no metal-to-metal or metal-to-plastic contact.
 - b) Where blade axles are installed in vertical position, include thrust bearings.
- 6) Linkage:
- a) Concealed in frame.
 - b) Constructed of aluminum and stainlesssteel.
 - c) Hardware: Stainless steel.
- 7) Additional Corrosion Protection for Corrosive Environments:
- a) Include anodized finish for aluminum surfaces in contact with airstream. Anodized finish shall be a minimum of 0.0007 inch thick.
 - b) Axles, damper linkage, and hardware shall be constructed of Type 316L stainless steel.
4. Damper Actuators:

a. General:

- 1) Actuators shall operate related damper(s) with sufficient reserve power to provide smooth modulating action or two-position action and proper speed of response at velocity and pressure conditions to which damper is subjected.
- 2) Actuators shall produce sufficient power and torque to close off against the maximum system pressures encountered. Actuators shall be sized to close off against the fan shutoff pressure as a minimum requirement.
- 3) Total damper area operated by an actuator shall not exceed 80 percent of manufacturer's maximum area rating.
- 4) Include one actuator for each damper assembly where possible. Multiple actuators required to drive a single damper assembly shall operate in unison.
- 5) Avoid use of excessively oversized actuators, which could overdrive and cause linkage failure when the damper blade has reached either its full open or closed position.
- 6) Use jackshafts and shaft couplings in lieu of blade-to-blade linkages when driving axially aligned damper sections.
- 7) Include mounting hardware and linkages for connecting actuator to damper.
- 8) Select actuators to fail in desired position in the event of a power failure.
- 9) Actuator Fail Positions: As indicated below:
 - a) Exhaust Air: Close.
 - b) Outdoor Air: Close.
 - c) Supply Air: Open.
 - d) Return Air: Open.
 - e) .

b. Type: Motor operated, with or without gears, electric and electronic.

c. Voltage:

- 1) Voltage selection is delegated to professional designing control system.
- 2) Actuator shall deliver torque required for continuous uniform movement of controlled device from limit to limit when operated at rated voltage.
- 3) Actuator shall function properly within a range of 85 to 120 percent of nameplate voltage.

d. Construction:

- 1) Less Than 100 W: Fiber or reinforced nylon gears with steel shaft, copper alloy or nylon bearings, and pressed steel enclosures.
- 2) 100 up to 400 W: Gears ground steel, oil immersed, shaft-hardened steel running in bronze, copper alloy, or ball bearings. Operator and gear trains shall be totally enclosed in dustproof cast-iron, cast-steel, or cast-aluminum housing.

- 3) Greater Than 400 W: Totally enclosed reversible induction motors with auxiliary hand crank and permanently lubricated bearings.
- e. Field Adjustment:
- 1) Spring return actuators shall be easily switchable from fail open to fail closed in the field without replacement.
 - 2) Provide gear-type actuators with an external manual adjustment mechanism to allow manual positioning of the damper when actuator is not powered.
- f. Two-Position Actuators: Single direction, spring return, or reversing type.
- g. Modulating Actuators:
- 1) Capable of stopping at all points across full range, and starting in either direction from any point in range.
 - 2) Control Input Signal:
 - a) Proportional: Actuator drives proportional to input signal and modulates throughout its angle of rotation. Suitable for 0- to 10- or 2- to 10-V dc and 4- to 20-mA signals.
 - b) Pulse-Width Modulation (PWM): Actuator drives to a specified position in accordance with a pulse duration (length) of signal from a dry-contact closure, triac sink, or source controller.
 - c) Programmable Multifunction:
 - d) Control input, position feedback, and running time shall be factory or field programmable.
 - e) Diagnostic feedback of hunting or oscillation, mechanical overload, mechanical travel, and mechanical load limit.
 - f) Service data, including at a minimum, number of hours powered, and number of hours in motion.
- h. Position Feedback:
- 1) Equip two-position actuators with limits switches or other positive means of a position indication signal for remote monitoring of open and close position.
 - 2) Equip modulating actuators with a position feedback through current or voltage signal for remote monitoring.
 - 3) Include a position indicator and graduated scale on each actuator indicating open and closed travel limits.
- i. Fail-Safe:
- 1) Where indicated, provide actuator to fail to an end position.
 - 2) Internal spring return mechanism to drive-controlled device to an end position (open or close) on loss of power.
 - 3) Batteries, capacitors, and other non-mechanical forms of fail-safe operation are acceptable only where uniquely indicated.
- j. Integral Overload Protection:

- 1) Provide against overload throughout the entire operating range in both directions.
- 2) Electronic overload, digital rotation sensing circuitry, mechanical end switches, or magnetic clutches are acceptable methods of protection.

k. Damper Attachment:

- 1) Unless otherwise required for damper interface, provide actuator designed to be directly coupled to damper shaft without need for connecting linkages.
- 2) Attach actuator to damper drive shaft in a way that ensures maximum transfer of power and torque without slippage.
- 3) Bolt and setscrew method of attachment is acceptable only if included with at least two points of attachment.

l. Temperature and Humidity:

- 1) Temperature: Suitable for operating temperature range encountered by application with minimum operating temperature range of minus 20 to plus 120 deg F.
- 2) Humidity: Suitable for humidity range encountered by application; minimum operating range shall be from 5 to 95 percent relative humidity, noncondensing.

m. Enclosure:

- 1) Suitable for ambient conditions encountered by application.
- 2) Provide actuator enclosure with a heater and controller where required by application.
- 3) NEMA 250, Type 2 for all applications except.
- 4) NEMA 250, Type 4 or Type 4X for applications.

n. Stroke Time: Select operating speed to be compatible with equipment and system operation.

- 1) Operate damper from fully closed to fully open within 15 seconds.
- 2) Operate damper from fully open to fully closed within 15 seconds.
- 3) Move damper to failed position within 15 seconds.
- 4) Actuators operating in smoke-control systems shall comply with governing code and NFPA requirements.

o. Sound:

- 1) Spring Return: 62 dBA.
- 2) Non-Spring Return: 45 dBA.

R. Smoke Dampers:

1. General: Air-handling unit manufacturer shall furnish and factory install smoke dampers inside air-handling units where indicated on Drawings.
2. Rectangular Smoke Dampers with Aluminum Blades:

- a. General: Air-handling unit manufacturer shall furnish and factory install smoke dampers inside air-handling units where indicated on Drawings.
 - b. Performance:
 - 1) Leakage: In accordance with UL 555S, Class 1.
 - 2) Pressure Drop: 0.05 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, figure 5.3.
 - 3) Velocity: Up to 4000 fpm.
 - 4) Temperature: 250 deg F.
 - 5) Pressure Rating: 8.0 inches wg.
 - c. Certification: NRTL listed and labeled in accordance with UL 555S, Class 1.
 - d. Construction:
 - 1) Frame:
 - a) Material: ASTM B211, Alloy 6063 T5 extruded-aluminum profiles, 0.07 inch thick.
 - b) Hat-shaped channel with integral flange(s). Flange mating face shall be a minimum of 1 inch.
 - c) Width not less than 5 inches.
 - 2) Blades:
 - a) Hollow, extruded airfoil shape.
 - b) Material: ASTM B211, Alloy 6063 T5 aluminum, 0.07 inch thick.
 - c) Width not to exceed 6 inches.
 - d) Length as required by close-off pressure, not to exceed 48 inches.
 - 3) Seals:
 - a) Blades: Replaceable, mechanically attached extruded silicone.
 - b) Jams: Stainless steel, compression type.
 - 4) Axles: 0.5-inch- diameter stainless steel, mechanically attached to blades.
 - 5) Bearings:
 - a) Molded synthetic or stainless steel sleeve mounted in frame.
 - b) Where blade axles are installed in vertical position, include thrust bearings.
 - 6) Linkage:
 - a) Concealed in frame.
 - b) Constructed of aluminum and stainless steel.
 - c) Hardware: Stainless steel.
3. Rectangular Smoke Dampers with Galvanized-Steel Blades:

- a.
- b. General: Air-handling unit manufacturer shall furnish and factory install smoke dampers inside air-handling units where indicated on Drawings.
- c. Performance:
 - 1) Leakage: In accordance with UL 555S, Class 1.
 - 2) Pressure Drop: 0.07 inch wg at 1500 fpm across a 24-by-24-inch damper when tested in accordance with AMCA 500-D, figure 5.3.
 - 3) Velocity: Up to 4000 fpm.
 - 4) Temperature: 250 deg F.
 - 5) Pressure Rating: 8.0 inches wg.
- d. Certification: NRTL listed and labeled in accordance with UL 555S, Class 1.
- e. Construction:
 - 1) Frame:
 - a) Material: Galvanized steel, minimum 0.06 inch thick.
 - b) Hat-shaped channel with integral flange(s). Flange mating face shall be a minimum of 1 inch.
 - c) Width not less than 5 inches.
 - 2) Blades:
 - a) Hollow, airfoil shape.
 - b) Material: Galvanized steel, minimum 0.06 inch thick.
 - c) Width not to exceed 6 inches.
 - d) Length as required by close-off pressure, not to exceed 48 inches.
 - 3) Seals:
 - a) Blades: Replaceable, mechanically attached extruded silicone.
 - b) Jams: Stainless steel, compression type.
 - 4) Bearings:
 - a) Stainless steel sleeve type mounted in frame.
 - b) Where blade axles are installed in vertical position, include thrust bearings.
 - 5) Linkage:
 - a) Concealed in frame.
 - b) Constructed of galvanized steel.
 - c) Hardware: Steel with corrosion-resistant finish.
- f. Actuator:

- 1) Type: Electric, with electrical characteristics compatible with field power supply.
- 2) Action: modulating or two position.
- 3) Control Signal: Individual damper assemblies with multiple actuators shall be factory wired to operate in unison from a single control signal.
- 4) Fail Position: Closed or open, as indicated on Drawings.
- 5) Mounting on Damper: External.
- 6) Quantity: Provide each damper assembly with least number of actuators possible for application.
- 7) Speed of Response:
 - a) Damper blade operation shall have a controlled movement of at least 5 seconds when travelling from open to close to reduce the potential for damage to duct system and connected equipment.
 - b) Damper closure shall not be instantaneous under any condition.
 - c) Operating time for completion of 90-degree damper travel, from open to close, or from close to open, shall not exceed the more stringent of the following: NFPA references indicated, governing codes, 15 seconds

g. Blade Position Switches:

- 1) Provide damper assemblies with limit switches to provide remote indication of damper blade positions.
- 2) Provide separate limit switches for remote indication of damper blade open position and damper blade closed position.
- 3) Actuators equipped with remote position indication as an integral part of actuator is acceptable in lieu of separate limit switches only if actuator with integral remote position indication is NRTL listed in accordance with UL 555S.

S. Heat Wheels:

1. Performance:

- a. Heat wheels shall be engineered by manufacturer to provide a highly reliable, low-maintenance product for use under continuous operation over an extended operating period of not less than 20 years. Provide supporting documentation if requested to show how features of product design comply with performance indicated.
- b. Products with ratings that exceed indicated pressure drop, fall short of sensible and latent recovery performance indicated, or transfer contaminants in excess of requirements indicated are unacceptable and should not be submitted for review and approval.
- c. Fully-assembled and -installed heat wheel shall be suitable for use in air systems that supply air to tenant occupied space and shall comply with NFPA 90A and governing building codes.

2. Testing and Certification:

- a. Thermal Performance: Certification by a qualified independent testing organization documenting the following:
 - 1) Sensible and latent recovery efficiencies conducted in accordance with ASHRAE 84 with results presented in accordance with ASHRAE 84 and AHRI 1060 (I-P) and AHRI 1061 (SI).
 - 2) Sensible, latent, and pressure loss performance over a range of operating points as required by ASHRAE 84 and specifically for actual airflow conditions required by Project.
 - b. Cross Contamination: Cross-contamination performance reports to validate compliance with requirements indicated.
 - 1) Testing shall be performed in a test facility complying with ASHRAE 84 for tracer gas testing.
 - c. Flame and Smoke: NRTL test report listing flame-spread index and smoke-developed index of media when tested in accordance with ASTM E84 to comply with requirements indicated.
 - d. Microbial Resistance: Test report documenting ability of wheel faces and transfer media to actively limit microbial growth.
 - 1) Testing completed by a qualified research institution or testing laboratory using common live bacterial cultures to document antimicrobial performance with 95 percent mortality effectiveness.
 - e. Corrosion Resistance: Test report summarizing acid resistance effectiveness of media face coating completed in accordance with ASTM corrosion-test methodologies.
3. Rotors:
- a. Construct rotor media of aluminum base material precoated with a desiccant before forming into honeycomb media structure consisting of circular spiral layers.
 - b. Aluminum base material shall be at least 0.0015 inch thick before coating.
 - c. Media layers shall be joined together using adhesive to bond between flat and corrugated media layers.
 - d. Media Coating:
 - 1) Coat media surfaces with a non-migrating solid adsorbent desiccant layer before forming into the structure to ensure that all surfaces are coated.
 - 2) Desiccant coating shall be inorganic and use a 3 Angstrom molecular sieve to achieve desired 3 Angstrom selectivity, excluding contaminants larger than 3 Angstroms while effectively transferring water vapor.
 - 3) In addition to desiccant coating applied to aluminum substrate, cover two faces of rotor with a two-part polymer coating specifically chosen for chemical resistance and corrosion protection. Coating shall be selected to provide life expectancy indicated when exposed to airstreams encountered.

- 4) Media exposed to airstream shall exhibit effective antimicrobial action to protect against development and spread of microbial contaminants.
 - 5) Rotor media with applied coatings and adhesive shall have a flame-spread index of 0 and a smoke-developed index of 5 when tested in accordance with ASTM E84.
- e. Media depth shall be determined by heat wheel manufacturer to achieve performance indicated.
 - f. Media shall not transfer pollutants typically encountered in an indoor air environment having room operations and functions indicated.
 - g. Media shall be cleanable without degrading performance over time.
 - h. Dry particles up to 800 microns shall pass freely through the media.
 - i. Provide segmented rotor media to allow for field installation and replacement of one section at a time without requiring side access. Removal and replacement shall be made while facing rotor media face.
 - j. Rotor media shall be held in place by a rigid structural spoke system made of extruded aluminum.
 - k. Coat exposed surfaces of aluminum spoke system for corrosion protection.
 - l. Rotor structural spoke system shall be designed and manufactured to provide for field installation of media without possibility of media deformation or misfit.
 - m. Media shall be secured within structural spoke system by mechanical means, relying on a formed friction fit without use of adhesives or silicone.
 - n. Rotors that cannot be installed in air-handling units as a single complete factory assembly coming from heat wheel manufacturer shall be remotely assembled by trained factory service personnel that are employed by heat wheel manufacturer.
4. Purge Sector:
- a. Factory-set, field-adjustable purge sector designed to limit cross contamination to less than 0.04 percent of that of exhaust airstream concentration into supply airstream.
 - b. Factory-set, field-adjustable purge sector designed to eliminate cross contamination of exhaust airstream into supply airstream.
5. Seals:
- a. Maintenance-free "non-contact" type to eliminate wear, excessive drag, and resulting added horsepower required for motor drive system, while still being capable of resisting high-pressure differences.
 - b. Equip rotor with labyrinth seals, which at no time shall make contact with any rotating surface of rotor face.
 - 1) Seals shall be field adjustable and set to within factory-specified tolerances.
 - 2) Provide multi-pass seals with four labyrinth stages for optimum performance or alternative design with documented test results showing comparable performance.

- c. Seal shall be secured to housing either by an extruded-aluminum strip with adjustment slots for fastening bolts to the casing frame or by using adjustable clips. Clips shall be made of stainless steel or other noncorrosive material to resist corrosion and possible damage to transfer media.
6. Shafts:
- a. Shaft supporting rotor between bearings shall be one piece, solid steel, accurately turned, ground, polished, and ring gauged for accuracy.
 - b. Machine and polish shaft within bearing contact area to comply with bearing manufacturer's written recommended tolerances.
 - c. Use a dial indicator to inspect shafts for roundness and straightness.
 - d. Coat exposed surfaces of shaft with a corrosion-inhibitive coating.
 - e. Shaft shall be machined to provide a shoulder against bearings for a positive locked position to eliminate any lateral movement of rotor due to axial bearing loads.
7. Bearings:
- a. Support rotor shaft by two pillow block tapered roller bearings designed for an ABMA 11 L-10 life of at least 200,000 hours.
 - b. Bearings shall be maintainable and replaceable without removal of rotor from its casing or media from spoke support system.
 - c. Grease fittings for each bearing shall be easily accessible and within view of bearing.
 - d. Reverse Rotation: Clutch bearing and extended shaft, or equivalent alternative, to prevent reverse rotation and ensure that wheel can only rotate in direction commensurate with effective purge operation.
8. Frame and Housing:
- a. Design frame to limit deflection of rotor due to air pressure loss to less than 0.03125 inch, as measured at the outer radius, during maximum rated airflow condition when exposed to a wheel pressure differential of 25 percent above design conditions.
 - b. Construct rigid frame of welded structural galvanized steel or stainless steel.
 - c. Designed and manufactured in one, two, or more sections as required by application to provide a rigid structure, when completely assembled, capable of supporting rotor.
 - 1) For horizontal airflow applications, support rotor at each end only with no additional support under center.
 - 2) For vertical airflow applications, provide one additional bottom center support.
 - 3) Clearly mark each section of multiple section units for easy installation.
 - d. Construct housing of galvanized-steel or stainless steel formed sheets designed to prevent corrosion.

- e. Housing shall be reinforced as required to provide a solid mounting surface of peripheral and radial seals, to maintain a fixed distance between rotor surface and any housing part.
 - f. There shall be no special requirement to provide air-handling unit casing side access for future rotor removal and service. All rotor service shall be performed from inside air-handling unit at face of rotor.
 - g. Requirements for Painted Frame and Housing:
 - 1) Comply with painting manufacturer's written preparation and application requirements.
 - 2) Treat galvanized steel that is not phosphatized with a phosphate rinse to ensure that paint adheres.
 - 3) Apply rust-inhibiting primer before applying finishing coats.
 - 4) Apply multiple coats to achieve dry film thickness required for protection indicated.
 - 5) Finish coat color to be Selected by Architect.
 - 6) Painted products shall have no deterioration when subjected to the following:
 - a) Salt spray test in accordance with ASTM B117 with 5 percent salt solution fog at 95 deg F for a period of 500 hours.
 - b) Acid-resistance test in accordance with ASTM D3260 with 15-minute exposure to 10 percent hydrochloric acid at room temperature.
9. Motor and Drive Assembly:
- a. Motor Enclosure: Totally enclosed.
 - b. Motor nameplate horsepower shall exceed maximum load of driven assembly.
 - c. Multiple belt-drive assembly shall be automatically tensioned and arranged to eliminate any side-to-side movements and slippage.
 - d. Motor and drive assembly shall be easily accessible and visible for inspection and maintenance.
 - e. Drive assembly, except motor, shall have a life expectancy of 45,000 hours.
10. Variable-Frequency Controller:
- a. Variable-speed control of rotor through a variable-frequency controller.
 - b. Digital programming with a manual-speed adjustment on the front face of controller.
 - c. Rotor drive system shall allow for a turndown ratio of 80:1 (20 to 0.25 rpm).
 - d. Controller with switchable control either locally on front of controller or remotely by a control system.
 - e. Controller with a motor-rated disconnect switch or circuit breaker having a withstanding rating greater than that required by field electrical power system, but not less than 42,000 A.
 - f. Controller mounted in a NEMA 250, Type 4 enclosure.

11. Rotation Sensor: Proximity-type rotation sensor and target to provide rotational speed (rpm) analog signal and wheel stop digital alarm signal for interface to remote-control system.
12. Monitoring and Control:
 - a. Single-Source Responsibility: Heat wheel manufacturer shall provide a complete monitoring and control package for heat wheel with controller, local display, operator interface, sensors, switches, transmitters, accessories, components, devices, and programming for a complete and operating heat wheel to ensure that responsibility for heat wheel and its operation resides with one source.
 - b. Enclosure:
 - 1) House controller and control devices in a NEMA 250, Type 4 enclosure.
 - 2) Enclosure with LCD screen to allow viewing and changing parameters.
 - 3) Enclosure with full front face hinged door and lockable handle.
 - 4) Air-handling unit manufacturer shall mount enclosure of outside of air-handling unit casing in vicinity of heat wheel.
 - c. DDC with the following:
 - 1) Conversion of temperature and relative humidity readings into grains, dew point, and enthalpy.
 - 2) Calculation and reporting of real-time unit effectiveness.
 - 3) Calculation and reporting of accumulation of energy (Btu) recovered over time.
 - 4) With user input of energy costs, calculation and accumulation of dollars saved over time.
 - 5) An alarm output if wheel is not rotating and not rotating in correct direction.
 - 6) Programming for integration of enthalpy-based summer-winter change over, frost prevention and supply temperature control such that they also function correctly as the wheel speed is modulated.
 - 7) Communications and data transfer for remote monitoring and control through ASHRAE 135 (BACnet) interface.
 - 8) Option to achieve conversion and calculations indicated is for heat wheel manufacturer to employ building controls provider, to provide a field-installed DDC with LCD to be mounted directly adjacent to heat wheel manufacturer monitoring and control enclosure.
 - d. Four, field-mounted, high-precision dry-bulb temperature and either wet-bulb temperature or humidity sensors shall be provided by heat wheel manufacturer to air-handling unit manufacturer for factory mounting in accordance with heat wheel manufacturer's written instructions to measure dry-bulb temperature and either wet-bulb temperature or humidity at each of four energy wheel airstreams.
 - 1) Sensors shall be wired to controller or controller expander board located within enclosure.

- e. Wheel Rotation: Rotation detector module to detect a rotating wheel, and correct direction of rotation and speed.
 - f. Active Monitoring and Control of Purge: Manufacturer's standard method to ensure that proper purge operation is maintained actively in response to changes in system airflows and pressures that normally occurs with a variable-volume system and where pressure changes appreciably due to filter loading and damper modulation.
13. Air-Handling Unit Factory Assembly:
- a. Internal Access: Provide each heat wheel with internal access from downstream and upstream sides as indicated on Drawings.
 - b. Removal and Replacement: Each heat wheel shall be independently removable and replaceable through a removable access panel installed in air-handling unit casing.
 - c. Drain Pans: In applications capable of formation of frost, install condensate drain pans to collect and drain water to exterior of air-handling unit casing.
 - d. Supports for Heat Wheel:
 - 1) Construct a freestanding and self-supporting structural framework to support each heat wheel individually from and independent of adjacent heat wheels.
 - 2) Construct frame work from aluminum, galvanized-steel, or stainless steel structural shapes.
 - e. Comply with heat wheel manufacturer's written installation instructions.
- T. Air-Handling Unit Factory Drain Piping And Piping Insulation:
- 1. General:
 - a. Air-handling unit manufacturer to factory install piping inside air-handling units.
 - b. If more than one material is listed, material selection is by air-handling unit manufacturer.
 - 2. Copper Tubing:
 - a. Tubing: Drawn-temper, ASTM B88, Type L or Type DWV in accordance with ASTM B306.
 - b. Fittings: Wrought-copper and copper alloy, ASME B16.22, pressure fittings.
 - c. Unions: Cast-copper-alloy, MSS SP-123, hexagonal-stock body; female NPT threaded ends.
 - d. Solder Filler Metals: ASTM B32, lead-free alloys, and water-flushable flux in accordance with ASTM B813.
 - 3. Floor Drain Piping:
 - a. Schedule 40 aluminum or stainless steel pipe with threaded ends or copper tube with soldered threaded male adapters.

- b. Factory install a dedicated drain pipe for each floor drain and extend pipe to access side of air-handling unit.
 - 1) Terminate pipe with a threaded pipe cap 3 inches beyond exterior face of air-handling unit casing. Threaded pipe cap material to match pipe material.
 - 2) Pipe size to match size of floor drain connection.
- 4. Drain Pan Piping:
 - a. Schedule 40 aluminum or stainless steel pipe with threaded ends or copper tube with soldered threaded male adapters.
 - b. Factory install drain piping for drain pan(s). Install a dedicated drain pipe for each drain pan serving different air-handling unit internal components. Where multiple drain pans serve like components interconnect drain piping to a single drain pipe for field connection.
 - 1) Where interconnecting cooling coil condensate drain pans from upstream and downstream sides of cooling coil, provide pipe with a water seal trap configured to prevent air bypass.
 - 2) Terminate pipe with a threaded pipe cap 3 inches beyond exterior face of air-handling unit casing. Threaded pipe cap material to match pipe material.
 - 3) Drain pipe size to match size of drain pan connection.
- 5. Piping Insulation:
 - a. Factory insulate bottom cooling coil drain pan pipe with 1-inch- thick, flexible elastomeric insulation where pipe is located under and outside of the air-handling unit casing but within the air-handling unit base.
- U. Air-Handling Unit Factory Hydronic Piping and Piping Insulation:
 - 1. Chilled-Water Piping:
 - a. Design Pressure and Temperature: See Drawings.
 - b. Pipe: ASME B36.10M, carbon steel ASTM A53/A53M, with beveled or plain ends; seamless longitudinal joints, Grade B; standard weight.
 - c. Fittings, Threaded: Malleable iron, ASME B16.3; Class 150.
 - d. Fittings, Butt Welded: ASME B16.9, wrought-steel ASTM A234/A234M, Grade WPB, seamless or welded, wall thickness to match adjoining pipe.
 - e. Flanges, Weld: Weld-neck, forged carbon-steel, ASME B16.5; Class 150.
 - f. Unions, Threaded: Malleable iron, ASME B16.39; Class 150.
 - g. Strainers: Y-pattern; body and cap constructed of cast-iron, ASTM A126, Class B, removable basket constructed of Type 304 or Type 316 stainless steel with openings not larger than 0.032 inch; Class 125.
 - h. Valves:
 - 1) Ball: Two-piece with threaded ends, MSS SP-110, 600 WOG; cast-bronze or forged copper-alloy body, stainless steel vented ball,

- corrosion-resistant plastic-coated handle, extended stem, and stationary outer sleeve to protect insulation vapor seal.
- 2) Butterfly: Lugged body; MSS SP-67; cast-iron, ductile-iron, or cast-steel body; stainless steel disk, EPDM seat, and lever or gear operator; rated for system pressure, but not less than 250-psig bi-directional dead-end shutoff with downstream flange removed.
- 3) Check: Globe-style, MSS SP-125; cast-iron ASTM A126 body, stainless steel spring, and bronze seat; Class 125.

- i. Vents: Cast-iron body, stainless steel float, NPS 1/2 or larger inlet connection.
- j. Flow Meters: In-line electromagnetic type with integral display and accuracy within 3 percent of reading.
- k. Pressure Gauges: Bourdon-tube, ASME B40.100 with Grade A accuracy; metal case with nominal 4-1/2-inch shatter-resistant glass face and NPS 1/2 threaded brass connection.
- l. Test Plugs: Brass or stainless steel body with core inserts and gasketed and threaded cap, extension for insulation; threaded NPS 1/2 connection.
- m. Thermometers: Bi-metal actuated, ASME B40.200 with 1 percent accuracy; adjustable-angle stainless steel case with nominal 5-inch shatter-resistant glass face. Include thermometers with stainless steel extended-neck thermowells.
- n. Air-Handling Unit Factory Assembly: Factory install a complete piping system inside air-handling units as indicated on Drawings.
 - 1) NPS 2 and smaller with threaded fittings, strainers, and valves. Larger sizes with welded joints, fittings, and flanges for valves and strainers.
 - 2) Arrange piping with sufficient clearance between piping and other components to accommodate removal and replacement of installed components.
 - 3) Gradually slope piping for venting and drainage.
 - 4) Include threaded drain connections and ball valves with threaded hose-end, cap, and chain at all low points in piping.
 - 5) Comply with requirements indicated on Drawings.
 - 6) Make connections to coils with a flange or union.
 - 7) Connect to each coil inlet with shutoff valve, test plug, strainer pressure gauge and thermometer.
 - 8) Connect to each coil outlet with balancing valve, test plug, pressure gauge thermometer flow meter and shutoff valve.
 - 9) Connect each coil drain connection with a drain valve, which is full size of drain connection.
 - 10) Connect each coil vent connection with automatic vent, which is full size of vent connection.
 - 11) Include with each strainer a blowdown connection consisting of a nipple and threaded ball valve with threaded hose-end, cap, and chain.

- 2. Chilled-Water Piping Insulation and Identification:
 - a. Insulation: Preformed, cellular glass; minimum 2 inches thick.

- b. Adhesive: Compatible with insulation material and recommended in writing by insulation manufacturer.
- c. Jacket: PVC, color selected by Architect, 20 mils thick.
- d. Air-Handling Unit Factory Assembly: Continuously insulate and vapor seal piping system throughout its entire length. Insulate all surface capable of forming condensation.
 - 1) Install high-density insulation insert products, consisting of two 180-degree halves, at pipe hangers and supports. Material density sufficient to accommodate loading without deformation.
 - 2) Insulation thickness determined by air-handling unit manufacturer to comply with governing codes, ASHRAE/IES 90.1, and minimum thickness indicated and to prevent condensation.
 - 3) Insulate piping system only after successful completion of pressure tests.
 - 4) Install adhesive-backed acrylic identification labels indicating pipe size service and direction of flow at multiple locations sufficient for operators to easily follow the flow path. Each branch pipe should have at least one label.

3. Heating Water Piping:

- a. Design Pressure and Temperature: See Drawings.
- b. Pipe: ASME B36.10M, carbon steel ASTM A53/A53M, with beveled or plain ends; seamless longitudinal joints, Grade B; standard weight.
- c. Fittings, Threaded: Malleable iron, ASME B16.3; Class 150.
- d. Fittings, Butt Welded: ASME B16.9, wrought-steel ASTM A234/A234M, Grade WPB, seamless or welded, wall thickness to match adjoining pipe.
- e. Flanges, Weld: Weld-neck, forged carbon-steel, ASME B16.5; Class 150.
- f. Unions, Threaded: Malleable iron, ASME B16.39; Class 150.
- g. Strainers: Y-pattern; body and cap constructed of cast-iron, ASTM A126, Class B, removable basket constructed of Type 304 or Type 316 stainless steel with openings not larger than 0.032 inch; Class 125.
- h. Valves:
 - 1) Ball: Two-piece with threaded ends, MSS SP-110, 600 WOG; cast-bronze or forged copper-alloy body, stainless steel vented ball, corrosion-resistant plastic-coated handle, and extended stem.
 - 2) Butterfly: Lugged body; MSS SP-67; cast-iron, ductile-iron, or cast-steel body; stainless steel disk, EPDM seat, and lever operator; rated for system pressure, but not less than 250-psig bi-directional dead-end shutoff with downstream flange removed.
 - 3) Check: Globe-style, MSS SP-125; cast-iron ASTM A126 body, stainless steel spring, and bronze seat; Class 125.
- i. Vents: Cast-iron body, stainless steel float, NPS 1/2 or larger inlet connection.
- j. Flow Meters: In-line electromagnetic type with integral display and accuracy within 3 percent of reading.

- k. Pressure Gauges: Bourdon-tube, ASME B40.100 with Grade A accuracy; metal case with nominal 4-1/2-inch shatter-resistant glass face and NPS 1/2 threaded brass connection.
 - l. Test Plugs: Brass or stainless steel body with core inserts and gasketed and threaded cap, extension for insulation; threaded NPS 1/2 connection.
 - m. Thermometers: Bi-metal actuated, ASME B40.200 with 1 percent accuracy; adjustable-angle stainless steel case with nominal 5-inch shatter-resistant glass face. Include thermometers with stainless steel extended-neck thermowells.
 - n. Air-Handling Unit Factory Assembly: Factory install a complete piping system inside air-handling units as indicated on Drawings.
 - 1) NPS 2 and smaller with threaded fittings, strainers, and valves. Larger sizes with welded joints, fittings, and flanges for valves and strainers.
 - 2) Arrange piping with sufficient clearance between piping and other components to accommodate removal and replacement of installed components.
 - 3) Gradually slope piping for venting and drainage.
 - 4) Include threaded drain connections and ball valves with threaded hose-end, cap, and chain at all low points in piping.
 - 5) Comply with requirements indicated on Drawings.
 - 6) Make connections to coils with a flange or union.
 - 7) Connect to each coil inlet with shutoff valve, test plug, strainer pressure gauge and thermometer.
 - 8) Connect to each coil outlet with balancing valve, test plug, pressure gauge thermometer flow meter and shutoff valve.
 - 9) Connect each coil drain connection with a drain valve, which is full size of drain connection.
 - 10) Connect each coil vent connection with automatic vent, which is full size of vent connection.
 - 11) Include each strainer with a blowdown connection consisting of a nipple and threaded ball valve with threaded hose-end, cap, and chain.
4. Heating Water Piping Insulation and Identification:
- a. Insulation: Preformed, cellular glass; minimum 2 inches thick.
 - b. Adhesive: Compatible with insulation material and recommended in writing by insulation manufacturer.
 - c. Jacket: PVC, color selected by Architect, 20 mils thick.
 - d. Air-Handling Unit Factory Assembly: Continuously insulate and seal piping insulation system throughout its entire length.
 - 1) Install high-density insulation insert products, consisting of two 180-degree halves, at pipe hangers and supports. Material density sufficient to accommodate loading without deformation.
 - 2) Insulation thickness determined by air-handling unit manufacturer to comply with governing codes, ASHRAE/IES 90.1, and minimum thickness indicated and to prevent condensation.

- 3) Insulate piping system only after successful completion of pressure tests.
- 4) Install adhesive-backed acrylic identification labels indicating pipe size service and direction of flow at multiple locations sufficient for operators to easily follow the flow path. Each branch pipe should have at least one label.

5. Piping Hangers and Supports:

- a. Finish: Galvanized metallic coatings including pregalvanized, hot-dip galvanized, or electro-galvanized.
- b. Hangers: MSS-SP-58, Type 1.
- c. Supports: MSS-SP-58, Type 4, Type 24, or Type 37.
- d. Threaded Rods: Continuous-thread rod, nuts, and washer made of galvanized steel or stainless steel.
- e. Strut: MFMA-4, continuous slotted stainless steel, Type 304 channel with inturred lips.
- f. Air-Handling Unit Factory Assembly:
- g. Ridgely support piping from internal structure in accordance with governing codes and MSS SP-58.

V. Drains:

1. Floor Drains:

- a. Drain Body: Fabricate floor drain body of NPS 4 or larger aluminum or stainless pipe and weld a plate of same material to the bottom. Option to fabricate an aluminum or stainless steel rectangular box drain at least 4 by 4 inches of material at least 0.1 inch thick.
- b. Drain Connection: Weld a nominal NPS 2 half coupling in side of drain body located within 1 inch from bottom.
- c. Drain Cover: Perforated plate, at least 0.1 inch thick, or grating, fabricated from aluminum or stainless steel. Drain cover shall be supported and secured in place by drain body, but not fastened to drain body with fasteners.
- d. Fluid Seal: Seal floor drain body to air-handling unit floor for a watertight installation.
- e. Mounting: Recess floor drain body into structural base. Top of floor drain to be slightly recessed below air-handling unit finished floor for unobstructed gravity flow from floor into drain.
- f. Application:
 - 1) Install floor drains in air-handling unit floors at locations indicated on Drawings.

W. Factory-Assembled Electrical:

1. Factory install service light fixtures and switches, and receptacles for each air-handling unit.
 - a. Locate in a convenient and field-accessible location.

- b. Installation shall comply with NFPA 70.
 - c. Wire, Conduit, and Enclosures:
 - 1) Minimum Conduit Size: 3/4 inch.
 - 2) Materials: Metal, with a corrosion-resistant finish.
 - 3) Supports: Support conduits, boxes, and enclosures using corrosion-resistant fastening hardware constructed of stainless steel.
 - 4) Conduit: Locate conduit inside the air-handling unit casing. Conduit installed on exterior of air-handling unit casing is unacceptable.
 - 5) Wire: Copper, rated for 600 V, solid wire for size No. 10 AWG and smaller and stranded wire for larger sizes.
 - 6) Minimum Wire Size: No. 12 AWG.
 - 7) Each circuit shall have a ground wire.
 - 8) Install wire in conduit.
 - d. Boxes, Conduit Outlet Bodies, and Enclosures:
 - 1) Located in Airstream: NEMA 250, Type 4X.
 - 2) Located in Service Corridor: NEMA 250, Type 4.
 - e. Seals: Seal pathways to prevent air leakage between air-handling unit exterior and interior, and between internal component sections.
 - f. Service Lighting Applications:
 - 1) Provide quantity of 20-A branch circuits required to power service light fixtures.
 - 2) For air-handling units consisting of multiple stacked tiers, provide separate circuits for top and bottom tiers of air-handling units.
 - 3) Factory install a main disconnect switch for interfacing air-handling power for service lighting with single-point field power wiring connection.
 - g. Receptacle Applications:
 - 1) Factory wire receptacles to a main disconnect switch for interfacing air-handling power for receptacles with a single-point field power wiring connection.
2. Main Disconnect Switches: Factory-install main disconnect switch mounted on air-handling unit casing exterior for interface of factory power wiring with field power wiring.
- a. Specification Grade; "Heavy Duty Type"; "quick-make," "quick-break" construction.
 - b. Three pole, nonfused.
 - c. 600 V rated.
 - d. Minimum Short-Circuit Current Rating: As required by electrical power distribution system, but not less than 42,000 A.
 - e. Enclosure:
 - 1) Located in Service Corridor: NEMA 250, Type 4.

- f. Operating handle shall be of box-mounted type that directly drives switch mechanism.
 - g. Disconnect switch shall use a flange-operated visible blade that is close coupled to a vertical-lift-type handle that achieves a positive visible indication of disconnect with cover open or closed.
 - h. Disconnect switch shall have a defeatable, front-accessible, mechanical interlock to prevent opening of cover when switch is in "ON" position, and to prevent turning switch "ON" when the door is open.
 - i. Include a solid neutral as required by authorities having jurisdiction.
 - j. Disconnect switch shall have a ground lug for ground wire termination.
 - k. Operating handle shall be lockable in open position.
 - l. Horsepower rated.
 - m. Feed through or double lugged.
3. Interior Service Light Fixtures:
- a. LED Luminaires:
 - 1) Suitable for wet locations and operation in cold- and hot-temperature extremes encountered; dust and moisture resistant.
 - 2) High-impact, UV-stabilized fiberglass housing and acrylic lens.
 - 3) Light Color: 5000 K.
 - 4) Light Output: 2000 lumens.
 - 5) Driver: 1 percent dimming.
 - b. Vaportight Fixtures:
 - 1) Suitable for wet locations and operation in cold- and hot-temperature extremes encountered; dust and moisture resistant.
 - 2) Cast-aluminum housing and guard with heat-resistant, tempered, clear glass globe.
 - 3) LED A21 Series Lamps:
 - a) Light Color: 5000 K.
 - b) Light Output: 1700 lumens.
 - c. Application:
 - 1) Provide service light fixtures where indicated on Drawings.
4. Toggle Switches for Service Light Fixtures:
- a. Single-Pole Switches, 120/277 V, 20 A: Comply with UL 20 and FS W-S-896.
 - b. Toggle Switch Box and Cover: Mount toggle switch in a metal outlet box with cast-aluminum or stainless steel cover. Weatherproof where exposed to outdoors.
 - c. Application:
 - 1) Factory install switching configuration (single, three way, or four way) required to operate a single service light fixture or group of service

- 2) light fixtures from any access door that opens to respective service light fixtures.
 - 2) Factory install service light switches at locations indicated on Drawings.
5. Receptacles:
- a. Isolated-Ground Duplex Receptacles, 125 V, 20 A:
 - 1) Description: Straight blade; equipment grounding contacts shall be connected only to green grounding screw terminal of the device and with inherent electrical isolation from mounting strap. Isolation shall be integral to receptacle construction and not dependent on removable parts. Two pole, three wire, and self-grounding.
 - 2) Configuration: NEMA WD 6, Configuration 5-20R.
 - 3) Standards: Comply with UL 498 and FS W-C-596.
 - b. Duplex GFCI Receptacles, 125 V, 20 A:
 - 1) Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 - 2) Configuration: NEMA WD 6, Configuration 5-20R.
 - 3) Type: Non-feed through.
 - 4) Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
 - c. Receptacle Box and Cover: Mount receptacle in a metal outlet box with cast-aluminum or stainless steel cover. Weatherproof where exposed to outdoors.
 - d. Applications: Factory install a receptacle in a convenient and field-accessible location on air-handling unit exterior of casing at locations indicated on Drawings.
6. Power Supply to Fan Motors:
- a. Factory install a for each fan motor.
 - 1) Locate in a convenient and field-accessible location on unit exterior.
 - 2) Installation shall comply with NFPA 70.
 - 3) Wire, Conduit, and Enclosures:
 - a) Minimum Conduit Size: 3/4 inch.
 - b) Materials: Metal, corrosion resistant.
 - c) Motor Termination: Flexible conduit, NRTL listed, not to exceed 36 inches long.
 - d) Supports: Support conduits, boxes, and enclosures using corrosion-resistant fastening hardware.
 - e) Wire: Copper, rated for 600 V, solid wire for size No. 10 AWG and smaller and stranded wire for larger sizes.
 - f) Minimum Wire Size: No. 12 AWG.
 - g) Each circuit shall have a ground wire.
 - h) Install wire in conduit.

- 4) Boxes, Conduit Outlet Boxes, and Enclosures:
 - a) Located in Airstream: NEMA 250, Type 4X.
 - b) Located in Service Corridor: NEMA 250, Type 4.

7. Disconnect Switches:
 - a. Specification Grade; "Heavy Duty Type"; "quick-make," "quick-break" construction.
 - b. Three pole, nonfused.
 - c. 600 V rated.
 - d. Minimum Short-Circuit Current Rating: As required by electrical power distribution system, but not less than 42,000 A.
 - e. Enclosure:
 - 1) Located in Service Corridor: NEMA 250, Type 4.
 - f. Operating handle shall be of box-mounted type that directly drives switch mechanism.
 - g. Disconnect switch shall use a flange-operated visible blade that is close coupled to a vertical-lift-type handle that achieves a positive visible indication of disconnect with cover open or closed.
 - h. Disconnect switch shall have a defeatable, front-accessible, mechanical interlock to prevent opening of cover when switch is in "ON" position, and to prevent turning switch "ON" when the door is open.
 - i. Include a solid neutral as required by authorities having jurisdiction.
 - j. Disconnect switch shall have a ground lug for ground wire termination.
 - k. Operating handle shall be lockable in open position.
 - l. Horsepower rated.
 - m. Feed through or double lugged.

8. Motor Field Power Junction Box:
 - a. Provide junction box with internal wire terminal block mounted on unit exterior for interface with field power wiring.
 - 1) Provide for each motor not installed with a factory disconnect or controller with integral disconnect.
 - b. Factory install internal wiring and conduit to motor.

9. Motor Controllers:
 - a. NEMA ICS 2, Class A, full-voltage, non-reversing, motor-rated controller.
 - b. Configured for control of single- or multispeed motors as indicated.
 - c. Enclosure: Hinged full-front access door with lock and key.
 - 1) Located in Service Corridor: NEMA 250, Type 4.
 - d. Externally Operated Disconnect: Nonfused disconnect switch with lockable handle.

- e. Short-Circuit Current Rating: As required by electrical power distribution system, but not less than 42,000 A.
 - f. Hand-Off-Auto Switch: Mounted on face of enclosure.
 - g. Push-to-Test Run Status Pilot Lights: NEMA ICS 2, heavy-duty type.
 - h. Control Relays: Time-delay relays.
 - i. Phase-Failure, Phase-Reversal, Undervoltage Relays: Solid-state sensing circuit with adjustable undervoltage setting and isolated output contacts for hardwired connection.
 - j. Elapsed-Time Meters: Numerical readout in hours on face of enclosure.
 - k. Number-of-Starts Counter: Numerical readout on face of enclosure.
10. Variable-Frequency Controllers:
- a. Description: NEMA ICS 2; arranged to achieve motor variable speed by adjusting output voltage and frequency.
 - b. Enclosure: Unit mounted, with hinged full-front access door with lock and key.
 - 1) Located in Service Corridor: NEMA 250, Type 4.
 - c. Externally Operated Disconnect: Nonfused disconnect switch with lockable handle.
 - d. Minimum Short-Circuit Current Rating: As required by electrical power distribution system, but not less than 42,000 A.
 - e. Technology: Pulse-width-modulation (PWM) output with insulated gate bipolar transistors (IGBT); suitable for variable torque loads.
 - f. Controller shall consist of a rectifier converter section, a digital/analog driver regulator section, and an inverter output section.
 - g. Output Rating: Three phase; with voltage proportional to frequency throughout voltage range.
 - h. Output signal shall be programmed to not cause mechanical vibration issues with fan drive assembly.
 - i. Operating Requirements:
 - 1) Input AC Voltage Tolerance: 10 percent.
 - 2) Input frequency tolerance of 60 Hz, plus or minus 2 Hz.
 - 3) Capable of driving full motor load, without derating.
 - 4) Minimum Efficiency: 96 percent at 60 Hz, full load.
 - 5) Minimum Displacement Primary-Side Power Factor: 95 percent.
 - 6) Overload Capability: 1.05 times the full-load current for 7 seconds.
 - 7) Starting Torque: As required by fan and motor drive assembly.
 - 8) Speed Regulation: 1 percent.
 - 9) Speed Range: 10:1 speed range.
 - 10) To avoid equipment resonant vibrations, include critical speed lockout circuitry to allow bands of operating frequency at which controller shall not operate continuously.
 - 11) Capable of being restarted into a motor coasting in either the forward or reverse direction without tripping.
 - j. Controller Adjustability Capabilities: Minimum and maximum output frequency, acceleration and deceleration, and current limit.

- k. Self-Protection and Reliability Features: Subjecting the controller to any of the following conditions shall not result in component failure or need for replacement:
 - 1) Surge suppression.
 - 2) Loss of input signal protection.
 - 3) Critical frequency rejection.
 - 4) Overtemperature.
 - 5) Short circuit at controller output.
 - 6) Ground fault at controller output. Variable-frequency controller shall be able to start a grounded motor.
 - 7) Open circuit at controller output.
 - 8) Input undervoltage.
 - 9) Input overvoltage.
 - 10) Loss of input phase.
 - 11) Reverse phase.
 - 12) AC line switching transients.
 - 13) Instantaneous overload, line to line or line to ground.
 - 14) Sustained overload exceeding 100 percent of controller rated current.
 - 15) Starting a rotating motor.

- l. Motor Protection: Controller shall protect motor against overvoltage and undervoltage, phase loss, reverse phase, overcurrent, overtemperature, and ground fault.
- m. Automatic Reset and Restart:
 - 1) Capable of multiple restarts after controller fault or on return of power after an interruption and before shutting down for manual reset or fault correction.
 - 2) Capable of automatic restart on phase-loss and overvoltage and undervoltage trips.

- n. Visual Indication: On face of controller; indicating the following conditions:
 - 1) Power on.
 - 2) Run.
 - 3) Overcurrent and overvoltage.
 - 4) Motor speed (percentage).
 - 5) Various faults with alarm status.
 - 6) Input kilovolt amperes.
 - 7) Power factor.
 - 8) Input kilowatts and kilowatt-hours.
 - 9) Three-phase input and output voltage.
 - 10) Three-phase input and output current.
 - 11) Output frequency.
 - 12) Elapsed operating time (hours).
 - 13) Diagnostic and service parameters.

- o. Operator Interface: Start-stop and auto-manual selector with manual-speed-control potentiometer.

- p. Hardwired Control Signal Interface: A minimum of two analog inputs (0 to 10 V or 0/4 to 20 mA) and four programmable digital inputs.
- q. Remote Communication Interface: ASHRAE 135 BACnet IP.
- r. Line Conditioning:
 - 1) Input line conditioning.
 - 2) Output filtering.
 - 3) EMI/RFI filtering.
- s. Bypass Controller:
 - 1) Bypass Mode: Field-selectable automatic or manual.
 - a) In automatic mode, include fail-safe control logic to automatically transfer fan motor operation from failed variable-frequency controller to bypass controller.
 - 2) Type: Integrated NEMA ICS 2, Class A, full-voltage, non-reversing, motor-rated controller to operate fan motor if variable-frequency controller is not operational.
 - 3) Arrangement: Configure power supply to bypass controller and variable-frequency controller to completely isolate power to variable-frequency controller while operating fan motor through bypass controller for safe servicing of variable-frequency controller.
 - 4) Enclosure: Install bypass controller in same enclosure as variable-frequency controller.
 - 5) Remote Monitoring: Include control relay for remote indication of bypass controller operation.

X. Smoke Detectors:

- 1. System, Duct Smoke Detectors: For connection to conventional fire-alarm system. Coordinate requirements with Section 284621.13 "Conventional Fire Alarm System."
 - a. Operating at 24-V dc, nominal.
 - b. Detectors shall be four-wire type.
 - c. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
 - d. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
 - e. Integral Visual-Indicating Light: LED type, indicating detector has operated and power-on status.
 - f. Provide multiple levels of detection sensitivity for each sensor, with alarm-verification feature.
 - g. Duct Smoke Detectors: Photoelectric type complying with UL 268A.
 - 1) Remote indication and test station. Operating key switch initiates an alarm test.
 - 2) Enclosure: NEMA 250, Type 4X; NRTL listed for use with the supplied detector for smoke detection in HVAC systems.

- 3) Sampling Tubes: Design and dimensions as recommended by manufacturer for specific size, air velocity, and installation conditions where applied.
 - 4) Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
2. Nonsystem, Single-Station Duct Smoke Detectors:
- a. Nonsystem smoke detectors shall be listed as compatible with fire-alarm equipment installed or shall have a contact closure interface listed for the connected load.
 - b. Nonsystematic smoke detectors shall meet the monitoring for integrity requirements in NFPA 72.
 - c. Comply with UL 268A; operating at 120 V ac.
 - d. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. The fixed base shall be designed for mounting directly to mounting brackets air-handling unit. Provide terminals in the fixed base for connection to building wiring.
 - 1) Enclosure: NEMA 250, Type 4X; listed for use with the supplied detector.
 - e. Sampling Tubes: Design and dimensions as recommended by manufacturer for specific size, air velocity, and installation conditions where applied.
 - f. Relay Fan Shutdown: Rated to interrupt fan motor-control circuit.
3. Air-Handling Unit Factory Assembly:
- a. Furnish and install smoke detectors inside air-handling units to comply with governing building codes.
 - b. Install smoke detectors in accordance with smoke detector manufacturer's written installation instructions.
 - 1) Sampling tubes shall extend the full width of airstream.
 - 2) Sampling tubes greater than 36 inches long shall be supported on both ends.
 - c. Install smoke detectors within air-handling units in a location that is easily accessible for inspection, repair, and replacement of smoke detector, and in a location that does not hinder access to other internal components.
4. Air-Handling Unit Factory Testing: Functionally test smoke detectors to ensure proper operation in accordance with smoke detector manufacturer's written instructions.
5. Air-Handling Unit Factory Installation of Addressable Smoke Detectors Furnished by Building Fire-Alarm System Supplier:
- a. Where addressable duct smoke detectors are indicated to be installed within air-handling unit casing, air-handling unit manufacturer shall install

- b. duct smoke detector components supplied by building fire-alarm system supplier. Mount duct smoke detector sampling housing on exterior of air-handling unit casing. Locate on accessible side and coordinate with installers before installation.
- c. Seal air-handling unit casing penetrations.
- d. Install duct smoke detector components in accordance with written instructions furnished by supplier.
 - 1) Sampling tubes shall extend the full width of airstream.
 - 2) Sampling tubes greater than 36 inches long shall be supported on both ends.
- e. Photograph installation and transmit photos to fire-alarm system Installer before air-handling unit shipment to ensure proper installation. Fire-alarm system Installer shall review photos and provide written acceptance of installation to air-handling unit manufacturer before air-handling unit shipment.
 - 1) Document date of photos and approval for record purposes.
 - 2) Make corrective measures required by fire-alarm system Installer as required for acceptance.
- f. Coordinate work schedule of air-handling unit manufacturer and fire-alarm system supplier to meet requirements of Project schedule.
- g. See Section 284621.11 "Addressable Fire-Alarm Systems" for additional requirements.

Y. Hardware:

1. Screws:

- a. For Galvanized-Steel Materials: Self-tapping, hex-head, 300 series stainless steel screws with a neoprene gasket encapsulated by a 300 series stainless steel washer.
- b. For Aluminum and Stainless Steel Materials: Self-tapping, hex-head, 300 series stainless steel screws with a neoprene gasket encapsulated by a 300 series stainless steel washer.
- c. Provide protective covers on exposed screws to prevent personnel injury.

2. Bolts, Nuts, and Washers:

- a. For Joining Galvanized and Painted Carbon-Steel Materials: Hex-head, high-strength, 300 series stainless steel.
- b. For Joining Aluminum and Stainless Steel Materials: Hex-head, high-strength, 300 series stainless steel.
- c. Use washers and lock washers at each bolted connection.
- d. Select bolt size and spacing sufficient for load and application.

Z. Welding:

1. Welding Filler Metals: Comply with AWS welding codes for welding materials appropriate for thickness and chemical analysis of material being welded.
 - a. Use welding materials with corrosion properties equal to material being welded.
2. Use welders that are certified to weld at least twice the thickness of the material to be welded. Certification shall be within three months of work being performed.
3. Welds shall be continuous, full-penetration welds unless otherwise indicated. Intermittent welds, stitch welds and tack welds are permitted only in specific applications indicated.
4. Use welders and welding procedures complying with the following:
 - a. Piping Systems: Section IX of the ASME Boiler and Pressure Vessel Code and Section V of ASME B31.1.
 - b. Structural Aluminum: AWS D1.2/D1.2M.
 - c. Structural Carbon Steel: AWS D1.1/D1.1M.
 - d. Structural Stainless Steel: AWS D1.6/D1.6M.
 - e. Sheetmetal: AWS D9.1/D9.1M.

AA. Painting:

1. General:
 - a. Painted OEM components do not require additional coating other than touch-up to damaged areas. Match the touchup coating to surrounding undamaged surfaces.
 - b. Finish miscellaneous surfaces to match continuous surfaces.
 - c. Protect mill galvanized surfaces that are exposed to view, such as raw steel cuts and damage by welding, with multiple coats of matching galvanized paint.
 - d. Protect mill galvanized surfaces that are concealed, such as raw steel cuts and damage by welding, with multiple coats of zinc-rich paint or matching galvanized paint.
 - e. Touch up or entirely repaint surface finishes, damaged during shipment and installation, to the original condition, using original materials and methods.
2. Preparation:
 - a. Submit proposed manufacturer's written preparation and application instructions for information.
 - b. If paint manufacturer's recommended preparation requirements differ from those indicated, use the more stringent requirements.
 - c. Structural carbon steel to be painted shall be deburred, ground smooth, cleaned, and blasted in accordance with SSPC-SP 6/NACE No. 3 or SSPC-SP 10/NACE No. 5.
 - d. Before applying a primer and a finish coat, remove oil and grease from surfaces to be coated using clean rags soaked in thinner in accordance with SSPC-SP 1.
 - e. Treat surfaces to be painted to ensure that paint adheres.

3. Primer:
 - a. Rust-inhibiting type, with a minimum dry film thickness of 1 mil(s) per coat.
 - b. Apply at least two coats of primer to unfinished carbon-steel surfaces and at least one coat of primer to other surfaces.
 - c. Use primer that is compatible with substrate and finish coat.

4. Finish Coat:
 - a. Finish coat painting system shall be alkyd-enamel.
 - b. Use dry film thickness recommended by paint manufacturer for each coat. Total dry film thickness of all finish coats not less than 3 mils.
 - c. Finish coat color shall be selected by Architect and not be limited to manufacturer's standard offering.
 - 1) Submit a written request for color selection and indicate in the request the date color selection must be returned without impacting schedule.

5. Application: Paint the following surfaces with primer and finish coat indicated:
 - a. Unfinished carbon-steel surfaces.
 - b. Exposed mill galvanized-steel surfaces of air-handling unit casing exterior.
 - c. Exposed stainless steel surfaces of air-handling unit casing exterior.

BB. Cleanliness Requirements:

1. General:
 - a. Provide equipment that has been manufactured, shipped, stored, and installed maintaining highest degree of cleanliness possible.
 - b. Owner Cleanliness Inspection: Air-handling unit(s) cleanliness is subject to Owner cleanliness inspection before packaging for shipment.

2. During Manufacturing:
 - a. Clean materials to be free of mill grease, oxidation, dirt, dust, and other impurities before manufacturing and assembly.
 - b. Protect casing materials from contamination during manufacturing and assembly.
 - c. Use sealing materials that do not outgas.
 - d. Provide OEM components and equipment from their respective manufacturers free of grease, oxidation, and dirt. Store OEM components and equipment indoors. Cover and protect OEM components and equipment to maintain cleanliness. Follow OEM instructions for equipment storage.

3. After Manufacturing:

- a. Before shipment, after unit is completely assembled, clean unit inside and out.
 - 1) Vacuum entire inside to remove dirt, dust, and debris using HEPA-filtered vacuum equipment.
 - 2) Purge hard to reach surfaces with dry, oil-free, compressed or bottled nitrogen.
 - 3) Wipe down all surfaces, inside and out, with a residue-free cleaning agent.
 - b. Protect unit to maintain cleanliness.
4. Shipping:
- a. Protect interior and exterior of air-handling unit from exposure to weather dirt, dust, and debris during shipment and rigging.
 - b. Cover openings with puncture-resistant durable coverings to ensure that cleanliness is maintained inside unit while providing an air- and watertight seal.
5. On-Site Storage:
- a. If air-handling unit is to be stored before installation, Installer shall work closely with air-handling unit manufacturer for air-handling unit manufacturer to provide adequate protection at the factory to ensure that cleanliness for both unit interior and unit exterior is maintained. This protection shall remain in place until unit startup is performed.
 - b. For extended periods of storage, provide a means to rotate fan and motor assemblies on a periodic basis (as recommended in writing by manufacturer) without compromising unit cleanliness.

2.4 SOURCE QUALITY CONTROL

A. AHRI Compliance:

1. AHRI 260 (I-P): Air-handling unit sound ratings shall be in accordance with AHRI 260 (I-P), "Sound Rating of Ducted Air Moving and Conditioning Equipment."
2. AHRI 410: Air-handling unit coils shall be rated in accordance with AHRI 410 and shall be listed by AHRI and labeled in accordance with AHRI.
3. AHRI 1060 (I-P) Certification: Air-handling units that include energy wheels shall be rated in accordance with AHRI 1060 (I-P) and shall be listed by AHRI and labeled in accordance with AHRI.

B. AMCA Compliance:

1. AMCA 201: Air-handling unit manufacturer shall evaluate fan's performance within the air-handling unit in accordance with AMCA 201, "Fans and Systems" and account for conditions within the air-handling unit that could be detrimental to fan's performance by adjusting the fan performance indicated on Drawings.

2. AMCA 205 Certification: Air-handling unit fan's fan efficiency grade (FEG) shall be rated in accordance with AMCA 205, "Energy Efficiency Classifications for Fans" and shall bear the AMCA-certified fan efficiency grade seal.
3. AMCA 210 Certification: Air-handling unit fan's air performance shall be rated in accordance with AMCA 210, "Laboratory Methods of Testing Fans for Aerodynamic Performance Rating" and shall bear the AMCA-certified air ratings seal.

C. NFPA Compliance:

1. NFPA 70: Electrical components, devices, and accessories shall be listed and labeled by a qualified testing agency, and marked for intended location and application.
2. NFPA 90A: Design, fabrication, and installation of air-handling units and components shall comply with NFPA 90A.

D. UL Compliance:

1. UL 1995 Certification: Where indicated, air-handling unit components shall be NRTL listed and labeled in accordance with UL 1995, "Standard for Safety Heating and Cooling Equipment."

2.5 SOURCE QUALITY CONTROL - AIR-HANDLING UNIT FACTORY TESTS

A. Witness of Testing: Allow Architect Commissioning Agent and Owner access to place where air-handling units are being tested for witness testing.

1. Submit written notification at least 30 days in advance of testing.
2. Schedule testing at mutually agreeable dates and times.

B. Casing Leakage Test:

1. Perform a leak test for each assembled air-handling unit.
2. Follow testing procedures in accordance with ASHRAE 111.
3. Perform leak test before shipping first air-handling unit of unique size and arrangement.
4. Test results shall indicate that units comply with leakage requirements indicated. Make changes to noncompliant air-handling units and retest until units comply with requirements.
5. Prepare test reports in accordance with ASHRAE 111.
6. Submit test reports indicating test location, documentation of test equipment used, test procedures, test results, test date and time, and full names of personnel performing tests and witnesses. If multiple tests are required to achieve compliance for a single air-handling unit, report shall include test date and time, test results, and full names of personnel performing tests and witnesses of each test with a detailed description and photographs of interim corrective measures made before each retest.

C. Casing Structural Deflection Test:

1. Perform a structural deflection test for each assembled air-handling unit.

2. Pressurize and load air-handling units to the performance criteria indicated for structural deflection. Test air-handling unit floors walls and roofs.
3. Test results shall indicate that units comply with deflection requirements indicated. Make changes to noncompliant air-handling units and retest until units comply with requirements.
4. Submit test reports indicating test location, documentation of test equipment used, test procedures, test results, test date and time, and full names of personnel performing tests and witnesses. If multiple tests are required to achieve compliance for a single air-handling unit, report shall include test date and time, test results, and full names of personnel performing tests and witnesses of each test with a detailed description and photographs of interim corrective measures made before each retest.

D. Functional Run Test:

1. Run test each unit before shipment.
2. Test and balance fans to comply with vibration requirements indicated.
3. Energize each electrical device to ensure it is operational.
 - a. Take meter readings for volts, amperes, and kVAR on each phase leg of each motor.
 - b. Take meter readings for volts, amperes, and kVAR on each single-phase power connection to field power.
4. Exercise each damper to ensure proper operation.
5. Exercise each access door to ensure proper fit.
6. Exercise each valve to ensure proper operation.
7. Submit a written report for each unit tested. Written report shall include, at a minimum, full name of each person witnessing test, detailed list of each unit component tested, condition observed, and corrective action required. Each line item shall have full name of the person doing the checkout and date and time the checkout was performed.

E. Fan Vibration Test:

1. Perform a fan vibration test for each assembled air-handling unit.
2. Energize each fan within the air-handling unit after air-handling unit final assembly and perform a vibration analysis with fan operating at design speed and at all speeds throughout the range from design to minimum speed.
3. Three vibration measurements shall be taken for each bearing in horizontal, vertical, and axial directions. Vibration measurements shall be recorded and consist of vibration amplitude verses frequency with filter-in.
4. Fan bearing measurement points shall be marked or scribed on bearings for permanent record.
5. Test results shall indicate that units comply with vibration requirements indicated. Make changes to noncompliant air-handling units and retest until units comply with requirements.
6. Submit test reports indicating test location, documentation of test equipment used, test procedures, test results, test date and time, and full names of personnel performing tests and witnesses. If multiple tests are required to achieve compliance for a single air-handling unit, report shall include test date

and time, test results, and full names of personnel performing tests and witnesses of each test with a detailed description and photographs of interim corrective measures made before each retest.

F. Acoustical Performance Test:

1. Perform an acoustical performance test for each assembled air-handling unit.
2. Air-handling unit acoustic performance shall be verified by factory test in accordance with AHRI 260 (I-P) or AHRI 261 (SI).
3. Air-handling unit supply-air discharge, return-air inlet, and casing radiated sound components shall be measured with air-handling unit operating at design conditions.
4. Testing Location: Perform testing in a location complying with AHRI 220, "Reverberation Room Qualification and Testing Procedures for Determining Sound Power of HVAC Equipment."
 - a. Test location shall be broadband qualified in accordance with AHRI 220 Section 5.1 and discrete frequency qualified in accordance with Section 5.2.
5. Operating conditions used in acoustic testing shall be verified by test in accordance with AMCA 210 in an AMCA-accredited facility.
6. Test results shall indicate that units comply with acoustical requirements indicated. Make changes to noncompliant air-handling units and retest until units comply with requirements.
7. Submit test reports indicating test location, documentation of test equipment used, test procedures, test results, test date and time, and full names of personnel performing tests and witnesses. If multiple tests are required to achieve compliance for a single air-handling unit, report shall include test date and time, test results, and full names of personnel performing tests and witnesses of each test with a detailed description and photographs of interim corrective measures made before each retest.

G. Airflow Capacity Performance Test:

1. Perform an airflow capacity performance test for each assembled air-handling unit.
2. Operating conditions shall be verified by test in accordance with AMCA 210 in an AMCA-accredited facility.
3. Test results shall indicate that units comply with design airflow requirements indicated. Make changes to noncompliant air-handling units and retest until units comply with requirements.
4. Submit test reports indicating test location, documentation of test equipment used, test procedures, test results, test date and time, and full names of personnel performing tests and witnesses. If multiple tests are required to achieve compliance for a single air-handling unit, report shall include test date and time, test results, and full names of personnel performing tests and witnesses of each test with a detailed description and photographs of interim corrective measures made before each retest.

- H. Hydronic Piping Systems Testing: Pressure test factory-assembled piping systems with compressed air or water at a pressure to comply with governing codes and ASME B31.9, but not less than design pressure indicated.
 - 1. Test results shall indicate that piping systems are without leaks. Make changes to noncompliant piping systems and retest until units comply with requirements.
 - 2. Submit test reports indicating test location, documentation of test equipment used, test procedures, test results, test date and time, and full names of personnel performing tests and witnesses. If multiple tests are required to achieve compliance for a single air-handling unit, report shall include test date and time, test results, and full names of personnel performing tests and witnesses of each test with a detailed description and photographs of interim corrective measures made before each retest.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examine air handling units before installation. Reject units with physical damage, and air-handling unit components that are wet, moisture damaged, or mold damaged.
- B. Equipment Mounting: Install air-handling units at locations indicated on Drawings. Unless, otherwise indicated on Drawings, install air-handling units on concrete equipment bases.
 - 1. Units Mounted on Concrete Bases:
 - a. Install air-handling units on cast-in-place concrete equipment bases. Coordinate sizes and locations of concrete bases with actual equipment provided. Comply with requirements for equipment bases and foundations specified in Section 033000 "Cast-in-Place Concrete."
 - b. Level air-handling unit bases using aluminum or stainless steel shims compatible with air-handling unit base material.
 - c. Fill voids between air-handling unit bases and concrete bases using high-strength non-shrink grout.
 - d. Continuously seal between concrete bases and perimeter of air-handling unit bases with nonhardening sealant.
 - 2. Units Mounted to Structural-Steel Supports: Level unit air-handling bases using aluminum or stainless steel shims compatible with air-handling unit base material. Continuously seal between structural supports and air-handling unit bases with nonhardening sealant.
 - 3. Units Mounted Directly to Finished Floors: Level air-handling unit bases using aluminum or stainless steel shims compatible with air-handling unit base material. Continuously seal between floor and perimeter of air-handling unit bases with nonhardening sealant.
 - 4. Suspended Units: Suspend and laterally brace air-handling units from building structure by attaching to only air-handling unit bases at manufacturer-designated locations.

5. Install air-handling units on curbs following air-handling unit manufacturer's written procedures.
 - a. Install gaskets before setting air-handling units on curbs.
 - b. Secure air-handling units to curbs using stainless steel fasteners.
 - c. Install curb and fasten to structure.
 - d. Coordinate curb requirements, attachment, and location before installation.

C. Roof Openings:

1. Provide exact size and location of roof openings to trade installing structural framing and roof structure.
2. Supervise framing of openings to ensure coordinated installation with air-handling units.

D. Seismic Control: Comply with requirements for seismic-control devices specified in Section 230548 "Vibration and Seismic Controls for HVAC."

E. Equipment Clearances and Access:

1. Arrange installation of air-handling units to provide access space around air-handling units for service and maintenance and for removal and replacement of internal components.
2. Provide clearance and access required by governing codes and NFPA 70.
3. At a minimum, comply with requirements indicated on Drawings and air-handling unit manufacturer's written instructions.

3.2 PROTECTION DURING CONSTRUCTION

A. Exterior Covers: Cover air-handling units during construction with sealed covers to protect air-handling unit casing and externally mounted components from physical damage, dirt, dust and debris, paint splatter, and any other construction materials.

1. Minor physical damage, as determined by Owner, shall be repaired by air-handling unit factory service personnel to factory-finished condition.
2. Replace air-handling units with damage that in any way compromises the performance indicated.

B. Internal Access: Keep access doors locked to maximum extent possible and restrict access to only authorized personnel.

1. Open access doors only during periods authorized work inside air-handling units is required.
2. Coordinate and monitor work inside air-handling units on a shift basis. Lock access doors once work is complete or at the end of each shift.
3. Immediately report unauthorized access and any observed damage to Owner.

3.3 DUCT CONNECTIONS

- A. Connect ducts and plenums to air-handling unit connections.
- B. Connect ducts and plenums to air-handling unit connections with flexible connections.
- C. Provide duct transitions required to make field connections to air-handling units.
- D. Arrange ducts and plenums to provide unobstructed access to inside of air-handling units.

3.4 PIPING CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where installing piping adjacent to air-handling unit, provide unobstructed access to inside of air-handling units for service and maintenance.
- C. Connect piping to air-handling units with flexible connectors.
- D. Drain Pan Piping:
 - 1. Make connections to air-handling unit connections with flanges or unions.
 - 2. Extend drain piping from each air-handling unit connection to nearest equipment or floor drain and arrange piping to maintain clear service aisle paths free of potential tripping hazards.
 - 3. Construct traps near air-handling unit connections to seal airflow from escaping within air-handling unit. Locate traps in a serviceable location that is away from access doors.
 - 4. Install threaded cleanouts at changes in direction.
 - 5. Secure drain piping to structure.
- E. Air-Handling Unit Floor Drain Piping:
 - 1. Make connections to air-handling unit connections with flanges or unions.
 - 2. Extend drain piping from each air-handling unit connection to nearest equipment or floor drain and arrange piping to maintain clear service aisle paths free of potential tripping hazards.
 - 3. Construct traps near air-handling unit connections to seal airflow from escaping within air-handling unit. Locate traps in a serviceable location that is away from access doors.
 - 4. Install threaded cleanouts at changes in direction.
 - 5. Secure drain piping to structure.
- F. Chilled-and Hot-Water Coil Piping:
 - 1. Comply with requirements indicated on Drawings.
 - 2. Make connections to coils with a flange or union.

3. Connect to each coil inlet with shutoff valve, test plug, pressure gauge and thermometer.
4. Connect to each coil outlet with balancing valve, test plug, pressure gauge thermometer flow meter and shutoff valve.
5. Connect each coil drain connection with a drain valve, which is full size of drain connection.
6. Connect each coil vent connection with automatic vent, which is full size of vent connection.

3.5 ELECTRICAL CONNECTIONS

- A. Install field power to each air-handling unit electrical power connection. Coordinate with air-handling unit manufacturer and installers.
- B. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- D. Install electrical devices furnished by manufacturer, but not factory mounted, in accordance with NFPA 70 and NECA 1.
- E. Install nameplate for each electrical connection, indicating electrical equipment designation and circuit number feeding connection.
 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.6 CONTROL CONNECTIONS

- A. Install control and electrical power wiring to field-mounted control devices.
- B. Connect control wiring in accordance with Section 260523 "Control-Voltage Electrical Power Cables."
- C. Install nameplate for each control connection, indicating field control panel designation and I/O control designation feeding connection.
 1. Nameplate shall be laminated acrylic or melamine plastic signs, as specified in Section 260553 "Identification for Electrical Systems."

3.7 STARTUP SERVICE

- A. Engage an air-handling unit factory service representative to perform startup service.
 1. Complete installation and startup checks in accordance with manufacturer's written instructions.
 2. Verify that shipping, blocking, and bracing are removed.

3. Verify that unit is secure on mountings and supporting devices and that connections to piping, ducts, controls, and electrical systems are complete. Verify that proper thermal-overload protection is installed in motors, controllers, and switches.
4. Verify proper motor rotation direction, free fan wheel rotation, and smooth bearing operations. Reconnect fan drive system, align belts, and install belt guards.
5. Verify that bearings, pulleys, belts, and other moving parts are lubricated with factory-recommended lubricants.
6. Verify that outdoor- and return-air mixing dampers open and close, and maintain minimum outdoor-air setting.
7. Comb coil fins for parallel orientation.
8. Verify that proper thermal-overload protection is installed for electric heaters.
9. Install new, clean filters.
10. Verify that automatic volume control and fire and smoke dampers in connected duct systems are in fully open position.

B. Starting procedures for air-handling units include the following:

1. Energize motor; verify proper operation of motor, drive system, and fan wheel. Adjust fan to indicated rpm.
2. Measure and record motor electrical values for voltage and amperage.
3. Manually operate dampers from fully closed to fully open position and record fan performance.

C. Heat Wheel Startup Service:

1. After field installation is complete, a final checkout and startup shall be completed to ensure proper purge adjustment, seal adjustment, control settings, and other key operational functions.
2. Service shall be completed by trained factory service personnel employed by heat wheel manufacturer.
3. Submit a report summarizing findings, adjustments made, and final settings.

3.8 ADJUSTING

- A. Adjust damper linkages for proper damper operation.
- B. Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC" for air-handling system testing, adjusting, and balancing.
- C. Before turning equipment over to Owner for use, adjust air-handling unit components that require further adjustment for proper operation. Consult air-handling unit manufacturer for instruction.
- D. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

- E. Seasonal Adjustments: Make seasonal visits during warranty period to inspect and review operation of equipment. Make necessary adjustments for components observed to require adjustments for proper operation. Prepare and submit a report to Owner documenting each visit, observations, and any adjustments made.

3.9 CLEANING

- A. Cleaning Schedule: After completing system installation and testing, adjusting, and balancing air-handling unit and air-distribution systems, and after completing startup service, and immediately before Owner use, clean air-handling units to remove foreign material and construction dirt and dust.
- B. Unit Interior: Clean air-handling units internally to factory clean condition. Remove foreign material and construction debris, dirt, and dust.
 - 1. Vacuum clean with HEPA-filtered vacuum and then wipe down with cleaning solution.
 - 2. Clean casing floors, roofs, wall surfaces, access doors, and panels.
 - 3. Clean all internal components, such as, coils, dampers, filter frames, fans, and motors.
 - 4. Clean light fixtures and control devices.
- C. Unit Exterior: Clean external surfaces of air-handling units to factory clean condition. Remove foreign material and construction debris, dirt and dust. Vacuum clean with HEPA-filtered vacuum and then wipe down all surfaces with cleaning solution.
- D. Cleaning Materials: Use cleaning materials and products recommended in writing by air-handling unit manufacturer.
- E. Acceptance: Following unit cleaning submit a written request for review and Owner acceptance.

3.10 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Field Fan Vibration Test:
 - 1. Test after air-handling unit installation is complete.
 - 2. Three vibration readings shall be taken for each bearing in horizontal, vertical, and axial directions. Record each reading including vibration amplitude verses frequency.
 - 3. Modify fans that fail to satisfy performance criteria and retest. For every fan that fails test, another fan shall be tested until all fans tested pass criteria on first attempt.
 - 4. Submit a report for each fan tested indicating air-handling unit designation, fan designation, test equipment, procedures, results, date and time, and full name of personnel performing tests and witnesses.

5. Witness Testing:

- a. Provide written notification at least 30 business days in advance of testing.
- b. Testing shall be conducted in presence of testing and balancing agent.
- c. Other parties such as Commissioning Agent, Architect, and Owner shall be invited to witness testing with attendance being optional.

C. Air-handling unit or components will be considered defective if unit or components do not pass tests and inspections.

D. Prepare test and inspection reports.

3.11 OPERATION DURING CONSTRUCTION

A. Operation of air-handling units for temporary cooling, heating, and ventilation is not allowed without Owner authorization.

1. Submit written request for Owner approval by signature with detailed description of operating procedures to be followed including, but not limited to, the following:

- a. Description of construction activities while units are operating.
- b. Operation:
 - 1) Beginning and ending calendar dates.
 - 2) List each day during week.
 - 3) List start and stop time and hours for each day.
- c. Startup procedures and shut-down procedures.
- d. Provisions for routine monitoring of unit operation.
- e. Provisions to prevent and protect against damage to equipment due to adverse operation such as, low temperature, high temperature, over pressure, fire, smoke, electrical over- and undervoltage and current and electrical fault.
- f. Provisions and safeguards for filtration to keep inside of units from getting dirty.
- g. Record keeping.

2. If approved by Owner, units used for temporary cooling, heating, and ventilation during and before interior finish work is complete shall include an unconditional complete unit labor and parts warranty to extend at least two years after the warranty indicated expires.

3. Interior and exterior of air-handling units shall be cleaned to a factory-cleaned condition and clean condition must be accepted by Owner.

B. Filtration during Temporary Use:

1. Protect air-handling system ducts (exhaust air, outdoor air, and return air) with temporary filters installed and supported to prevent filter media from collapse and bypass of unfiltered air. Temporary media shall be installed at each inlet and

- shall have a published filtration efficiency of MERV 8 in accordance with ASHRAE 52.2.
2. Protect air-handling units with open inlets that are not ducted with temporary filters installed and supported to prevent filter media from collapse and by-pass of unfiltered air. Temporary media shall be installed at each inlet and shall have a published filtration efficiency of MERV 8 in accordance with ASHRAE 52.2.
 3. Do not operate air-handling units until both temporary and scheduled permanent air-handling unit particulate filters are in place. Temporary filters must be installed upstream of permanent filters while units are operating.
 4. Replace temporary and permanent filters used during construction when dirty. After end of temporary use, replace permanent filters with new, clean filters before beginning testing, adjusting and balancing.
- C. Comply with SMACNA 008, "IAQ Guidelines for Occupied Buildings under Construction," for procedures to protect HVAC system.

3.12 DEMONSTRATION

- A. Engage air-handling unit manufacturer factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain air-handling units.
- B. Training shall include, but not be limited to, procedures and schedules related to performance, safety, startup and shut down, troubleshooting, servicing, preventive maintenance, and how to obtain replacement parts.
1. Access Doors: Adjustment, gasket removal and replacement, handle removal and replacement, and spare parts.
 2. Access Panels: Removal and replacement, adjustment, gasket removal and replacement, and spare parts.
 3. Coils: Cleaning, combing fins, draining, venting, removal, and replacement.
 4. Controls: Calibration, cleaning, operation, service, removal and replacement, and spare parts.
 5. Damper Assemblies: Cleaning, operation, service, removal and replacement, and spare parts.
 6. Drain Pans: Cleaning, removal, and replacement.
 7. Electric Heaters: Cleaning, operation, service, removal and replacement, and spare parts.
 8. Heat Wheels: Cleaning, operation, service, removal and replacement, and spare parts.
 9. Fan and Motor Assemblies: Cleaning, operation, removal and replacement, service, and spare parts.
 10. Filters: Operation, removal and replacement, frame gasket removal and replacement, clip removal and replacement, and spare parts.
 11. Lights, Receptacles and Switches: Cleaning, operation, service, removal and replacement, and spare parts.
- C. Instructor:

1. Instructor shall be factory trained and certified by air-handling unit manufacturer with current training on equipment installed.
 2. Instructor's credentials shall be submitted for review by Commissioning Agent before scheduling training.
 3. Instructor(s) primary job responsibility shall be Owner training.
 4. Instructor(s) shall have not less than three years of training experience with air-handling unit manufacturer and past training experience on at least three projects of comparable size and complexity.
- D. Schedule and Duration:
1. Schedule training with Owner at least 20 business days before first training session.
 2. Training shall occur before Owner occupancy.
 3. Training shall be held at mutually agreed date and time during normal business hours.
 4. Each training day shall not exceed eight hours of training. Daily training schedule shall allow time for a one-hour lunch period and 15-minute break after every two hours of training.
 5. Perform not less than eight hours of training.
- E. Location: Owner to provide a suitable on-site location to host classroom training.
- F. Training Attendees: Assume three people.
- G. Training Attendance Records: For record purposes, document training attendees at start of each new training session. Record date, time, brief description of training covered during the session, attendee's name, signature, phone number, and e-mail address. Submit scanned copy of sign-in sheet to Owner for each training session.
- H. Training Format: Individual training modules to include classroom training followed by hands-on field demonstration and training.
- I. Training Materials: Provide training materials in electronic format to each attendee.
1. Include instructional videos showing general operation and maintenance that are coordinated with operation and maintenance manuals.
- J. Training Video Recording: Video record each classroom training session and submit an electronic copy to Owner before requesting Owner acceptance of training.
- K. Written Acceptance: Obtain Commissioning Agent written acceptance that training is complete and requirements indicated have been satisfied.

END OF SECTION 23 73 43.19

SECTION 23 81 26 - SPLIT-SYSTEM AIR-CONDITIONERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Split-system air-conditioners.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 "LEED Sustainable Design Requirements".
- C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.3 INFORMATIONAL SUBMITTALS

- A. Warranty: Sample of special warranty.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and maintenance data.

1.5 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. ASHRAE Compliance:
 - 1. Fabricate and label refrigeration system to comply with ASHRAE 15, "Safety Standard for Refrigeration Systems."

2. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment," Section 6 - "Procedures," and Section 7 - "Construction and System Start-up."

- C. ASHRAE/IES Compliance: Applicable requirements in ASHRAE/IES 90.1.

1.6 WARRANTY

- A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of split-system air-conditioning units that fail in materials or workmanship within specified warranty period.

1. Warranty Period:

- a. For Compressor: One year(s) from date of Substantial Completion.
- b. For Parts: One year(s) from date of Substantial Completion.
- c. For Labor: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SPLIT-SYSTEM AIR-CONDITIONERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Carrier Global Corporation.
2. Daikin.
3. Mitsubishi Electric & Electronics USA, Inc.
4. Trane.

- B. Indoor Units (5 tons (18 kW) or Less:

1. Wall-Mounted, Evaporator-Fan Components:

- a. Cabinet: Enameled steel with removable panels on front and ends in color selected by Architect, and discharge drain pans with drain connection.
- b. Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and thermal-expansion valve. Comply with ARI 206/110.
- c. Fan: Direct drive, centrifugal.
- d. Fan Motors:
 - 1) Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements specified in Section 230500 "General Mechanical Requirements."
 - 2) Multitapped, multispeed with internal thermal protection and permanent lubrication.
 - 3) Enclosure Type: Totally enclosed, fan cooled.
 - 4) NEMA Premium (TM) efficient motors as defined in NEMA MG 1.

- 5) Controllers, Electrical Devices, and Wiring: Comply with requirements for electrical devices and connections specified in electrical Sections.
 - 6) Mount unit-mounted disconnect switches on exterior of unit.
- e. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.
- f. Condensate Drain Pans:
- 1) Fabricated with one percent slope in at least two planes to collect condensate from cooling coils (including coil piping connections, coil headers, and return bends) and humidifiers, and to direct water toward drain connection.
 - a) Length: Extend drain pan downstream from leaving face to comply with ASHRAE 62.1.
 - b) Depth: A minimum of 1 inch deep.
 - 2) Single-wall, stainless-steel sheet.
 - 3) Drain Connection: Located at lowest point of pan and sized to prevent overflow. Terminate with threaded nipple on one end of pan.
 - a) Minimum Connection Size: NPS 1.
 - 4) Pan-Top Surface Coating: Asphaltic waterproofing compound.
- g. Air Filtration Section:
- 1) General Requirements for Air Filtration Section:
 - a) Comply with NFPA 90A.
 - b) Minimum MERV according to ASHRAE 52.2.
 - c) Filter-Holding Frames: Arranged for flat or angular orientation, with access doors on both sides of unit. Filters shall be removable from one side or lifted out from access plenum.

C. Outdoor Units (5 tons (18 kW) or Less)

1. Air-Cooled, Compressor-Condenser Components:
 - a. Casing: Steel, finished with baked enamel in color selected by Architect, with removable panels for access to controls, weep holes for water drainage, and mounting holes in base. Provide brass service valves, fittings, and gage ports on exterior of casing.
 - b. Compressor: Hermetically sealed with crankcase heater and mounted on vibration isolation device. Compressor motor shall have thermal- and current-sensitive overload devices, start capacitor, relay, and contactor.
 - 1) Compressor Type: Scroll.
 - 2) Two-speed compressor motor with manual-reset high-pressure switch and automatic-reset low-pressure switch.
 - 3) Refrigerant: R-410A.

- 4) Refrigerant Coil: Copper tube, with mechanically bonded aluminum fins and liquid subcooler. Comply with ARI 206/110.
 - c. Heat-Pump Components: Reversing valve and low-temperature-air cutoff thermostat.
 - d. Fan: Aluminum-propeller type, directly connected to motor.
 - e. Motor: Permanently lubricated, with integral thermal-overload protection.
 - f. Low Ambient Kit: Permits operation down to 45 deg F.
 - g. Mounting Base: Polyethylene.
- D. Accessories:
1. Control equipment and sequence of operation are specified in Section 230900 "Controls and Instrumentation"
 2. Thermostat: Low voltage with subbase to control compressor and evaporator fan.
 3. Thermostat: Wireless infrared functioning to remotely control compressor and evaporator fan, with the following features:
 - a. Compressor time delay.
 - b. 24-hour time control of system stop and start.
 - c. Liquid-crystal display indicating temperature, set-point temperature, time setting, operating mode, and fan speed.
 - d. Fan-speed selection including auto setting.
 4. Automatic-reset timer to prevent rapid cycling of compressor.
 5. Refrigerant Line Kits: Soft-annealed copper suction and liquid lines factory cleaned, dried, pressurized, and sealed; factory-insulated suction line with flared fittings at both ends.
 6. Drain Hose: For condensate.
 7. Monitoring:
 - a. Monitor constant and variable motor loads.
 - b. Monitor variable-frequency-drive operation.
 - c. Monitor economizer cycle.
 - d. Monitor cooling load.
 - e. Monitor air distribution static pressure and ventilation air volumes.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install units level and plumb.
- B. Install evaporator-fan components using manufacturer's standard mounting devices securely fastened to building structure.
- C. Install roof-mounted, compressor-condenser components on equipment supports specified in Section 077200 "Roof Accessories." Anchor units to supports with removable, cadmium-plated fasteners.

- D. Equipment Mounting:
 - 1. Install roof-mounted, compressor-condenser components on polyethylene mounting base.
 - 2. Comply with requirements for vibration isolation devices specified in Section 230548.13 "Vibration Controls for HVAC."
- E. Install and connect precharged refrigerant tubing to component's quick-connect fittings. Install tubing to allow access to unit.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in other Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Where piping is installed adjacent to unit, allow space for service and maintenance of unit.

3.3 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- B. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Remove and replace malfunctioning units and retest as specified above.
- D. Prepare test and inspection reports.

3.4 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain units.

END OF SECTION 23 81 26

SECTION 23 82 36 - FINNED-TUBE RADIATION HEATERS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section includes hydronic, finned-tube radiation heaters.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include details and dimensions of custom-fabricated enclosures.
 - 4. Indicate location and size of each field connection.
 - 5. Indicate location and arrangement of piping valves and specialties.
 - 6. Indicate location and arrangement of integral controls.
 - 7. Include enclosure joints, corner pieces, access doors, and other accessories.
 - 8. Include diagrams for power, signal, and control wiring.
- C. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

PART 2 - PRODUCTS**2.1 HOT-WATER FINNED-TUBE RADIATION HEATERS**

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Modine.
 - 2. Sterling HVAC Products; a Mestek company.
 - 3. Vulcan Radiator; a Mestek company.
 - 4. Zehnder Rittling.

5. Runtal.
 - B. Performance Ratings: Rate finned-tube radiation heaters according to Hydronics Institute's "I=B=R Testing and Rating Standard for Finned-Tube (Commercial) Radiation."
 - C. Heating Elements: Copper tubing mechanically expanded into flanged collars of evenly spaced aluminum fins resting on element supports. One end of tube shall be belled.
 1. Tube Diameter: See Mechanical Schedules.
 2. Fin Size: See Mechanical Schedules.
 3. Fin Spacing: 40 per foot.
 4. Number of Tiers: 1.
 5. Heat Output: See Mechanical Schedules.
 6. Entering-Air Temperature: 65 deg F.
 7. Average Water Temperature: 150 deg F.
 8. Minimum Water Velocity: 1/2 fps.
 - D. Element Supports: Ball-bearing cradle type to permit longitudinal movement on enclosure brackets.
 - E. Front and Rear Panel: Minimum 0.0428-inch- thick steel.
 - F. Floor-Mounted Pedestals: Conceal insulated piping at maximum 36-inch spacing. Pedestal-mounted back panel shall be solid panel matching front panel. Provide stainless-steel escutcheon for floor openings at pedestals.
 - G. Support Brackets: Locate at maximum 36-inch spacing to support front panel and element.
 - H. Finish: Baked-enamel finish in manufacturer's standard color as selected by Architect.
 - I. Damper: Knob-operated internal damper at enclosure outlet.
 - J. Access Doors: Factory made, permanently hinged with tamper-resistant fastener, minimum size 6 by 7 inches, integral with enclosure.
 - K. Enclosure Style: Flat top.
 1. Top Outlet Grille: Extruded-aluminum linear bar grille; pencil-proof bar spacing.
 - a. Mill-finish aluminum.
 - b. Anodized finish, color as selected by Architect from manufacturer's standard colors.
 - c. Painted to match enclosure.
 2. Enclosure Height: 6 inches.
 3. Enclosure Depth: 5-1/2 inches.
 - L. Accessories: Filler sections, corners, relay sections, and splice plates all matching the enclosure and grille finishes.

PART 3 - EXECUTION

3.1 FINNED-TUBE RADIATION HEATER INSTALLATION

- A. Install units level and plumb.
- B. Install enclosure continuously around corners, using outside and inside corner fittings.
- C. Join sections with splice plates and filler pieces to provide continuous enclosure.
- D. Install access doors for access to valves.
- E. Terminate enclosures with manufacturer's end caps except where enclosures are indicated to extend to adjoining walls.
- F. Install valves within reach of access door provided in enclosure.
- G. Install air-seal gasket between wall and recessed flanges or front cover of fully recessed unit.
- H. Install piping within pedestals for freestanding units.

3.2 CONNECTIONS

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping". Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect hot-water finned-tube radiation heaters and components to piping according to Section 232113 "Hydronic Piping".
 - 1. Install shutoff valves on inlet and outlet, and balancing valve on outlet.
- C. Install control valves as required by Section 230900 "Controls and Instrumentation."
- D. Install piping adjacent to finned-tube radiation heaters to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

- A. Perform the following field tests and inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 23 82 36

SECTION 23 82 39.13 - CABINET UNIT HEATERS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Cabinet unit heaters with centrifugal fans and hot-water coils.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Sustainable Design Submittals:
 - 1. Refer to Section 01 81 13 "LEED Sustainable Design Requirements".
- C. Shop Drawings:
 - 1. Include plans, elevations, sections, and details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
 - 3. Include location and size of each field connection.
 - 4. Include details of anchorages and attachments to structure and to supported equipment.
 - 5. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
 - 6. Indicate location and arrangement of piping valves and specialties.
 - 7. Indicate location and arrangement of integral controls.
 - 8. Wiring Diagrams: Power, signal, and control wiring.
- D. Samples: For each exposed product and for each color and texture specified.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, reflected ceiling plans, and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
 - 1. Suspended ceiling components.
 - 2. Structural members to which cabinet unit heaters will be attached.
 - 3. Method of attaching hangers to building structure.
 - 4. Size and location of initial access modules for acoustical tile.
 - 5. Items penetrating finished ceiling, including the following:

- a. Lighting fixtures.
- b. Air outlets and inlets.
- c. Speakers.
- d. Sprinklers.
- e. Access panels.

6. Perimeter moldings for exposed or partially exposed cabinets.

B. Field quality-control reports.

1.4 CLOSEOUT SUBMITTALS

A. Operation and maintenance data.

PART 2 - PRODUCTS

2.1 CABINET UNIT HEATERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Modine.
2. Sterling HVAC Products; a Mestek company.
3. Vulcan Radiator; a Mestek company.
4. Trane.

B. Heaters: Factory-assembled and -tested unit complying with AHRI 440.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.2 PERFORMANCE REQUIREMENTS

A. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and Startup."

B. ASHRAE/IESNA 90.1 Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6 - "Heating, Ventilating, and Air-Conditioning."

2.3 COIL SECTION INSULATION

A. Insulation Materials:

1. Duct-Liner-Type, Glass-Fiber Insulation: ASTM C1071; surfaces exposed to airstream have aluminum-foil facing to prevent erosion of glass fibers.

- a. Thickness: 1/2 inch.
- b. Thermal Conductivity (k-Value): 0.26 Btu x in./h x sq. ft. at 75 deg F mean temperature.
- c. Fire-Hazard Classification: Maximum flame-spread index of 25 and smoke-developed index of 50 when tested in accordance with ASTM E84.
- d. Adhesive: Comply with ASTM C916 and with NFPA 90A or NFPA 90B.
- e. Airstream Surfaces: Surfaces in contact with the airstream comply with requirements in ASHRAE 62.1.

2.4 CABINETS

- A. Material: Steel with baked-enamel finish with manufacturer's standard paint, in color selected by Architect.
 1. Vertical Unit, Exposed Front Panels: Minimum 0.0528-inch- thick galvanized sheet steel, removable panels with channel-formed edges secured with tamperproof cam fasteners.
 2. Recessed Flanges: Steel, finished to match cabinet.
 3. Control Access Door: Key operated.
 4. Extended Piping Compartment: 8-inch- wide piping end pocket.
 5. False Back: Minimum 0.0428-inch- thick steel, finished to match cabinet.
 6. Outdoor-Air Wall Box: Minimum 0.1265-inch- thick, aluminum, rain-resistant louver and box with integral eliminators and bird screen; aluminum louver with baked-enamel finish in color selected by Architect from manufacturer's standard colors.
 - a. Outdoor-Air Damper: Galvanized-steel blades with edge and end seals and nylon bearings; with electronic, two-position actuators.

2.5 FILTERS

- A. Minimum Efficiency Reporting Value and Average Arrestance": In accordance with ASHRAE 52.2.
- B. Minimum Efficiency Reporting Value: In accordance with ASHRAE 52.2.
- C. Material:
 1. Pleated cotton-polyester media, MERV 7.

2.6 COILS

- A. Hot-Water Coil: Copper tube, with mechanically bonded aluminum fins spaced no closer than 0.1 inch and rated for a minimum working pressure of 200 psig and a maximum entering-water temperature of 220 deg F. Include manual air vent and drain.

2.7 CONTROLS

- A. Fan and Motor Board: Removable.

1. Fan: Forward curved, double width, centrifugal, directly connected to motor; thermoplastic or painted-steel wheels and aluminum, painted-steel, or galvanized-steel fan scrolls.
 2. Motor: Permanently lubricated, multispeed; resiliently mounted on motor board. Comply with requirements in Section 230500 "Common Work Results for HVAC."
 3. Wiring Terminations: Connect motor to chassis wiring with plug connection.
- B. Factory, Hot-Water Piping Package: ASTM B88, Type L copper tube with wrought-copper fittings and brazed joints. Label piping to indicate service, inlet, and outlet.
1. Two-way, modulating control valve.
 2. Hose Kits: Minimum 400-psig working pressure, and operating temperatures from 33 to 211 deg F. Tag hose kits to equipment designations.
 3. Two-Piece, Ball Valves: Bronze body with full-port, chrome-plated bronze ball; PTFE or TFE seats; and 600-psig minimum CWP rating and blowout-proof stem.
 4. Calibrated-Orifice Balancing Valves: Bronze body, ball type, 125-psig working pressure, 250 deg F maximum operating temperature; with calibrated orifice or venturi, connection for portable differential pressure meter with integral seals, threaded ends, and equipped with a memory stop to retain set position.
 5. Automatic Flow-Control Valve: Brass or ferrous-metal body, 300-psig working pressure at 250 deg F, with removable, corrosion-resistant, tamperproof, self-cleaning piston spring; factory set to maintain constant indicated flow within plus or minus 10 percent of differential pressure range of 2 to 80 psig.
 6. Y-Pattern, Hot-Water Strainers: Cast-iron body (ASTM A126, Class B); 125-psig minimum working pressure; with threaded connections, bolted cover, perforated stainless-steel basket, and bottom drain connection. Include minimum NPS 1/2 threaded pipe and full-port ball valve in strainer drain connection.
 7. Wrought-Copper Unions: ASME B16.22.
- C. Control devices and operational sequences are specified in Section 230923 "Direct Digital Control (DDC) System for HVAC" and Section 230993.11 "Sequence of Operations for HVAC DDC."
- D. Basic Unit Controls:
1. Control voltage transformer.
 2. Unit-mounted thermostat with the following features:
 - a. Heat-off switch.
 - b. Fan on-auto switch.
 - c. Adjustable deadband.
 - d. Exposed set point.
 - e. Exposed indication.
 - f. Deg F indication.
 3. Unit-mounted temperature sensor.
 4. Unoccupied period override push button.
 5. Data entry and access port.
 - a. Input data includes room temperature and occupied and unoccupied periods.

- b. Output data includes room temperature, supply-air temperature, entering-water temperature, operating mode, and status.
- E. Terminal Controller: DDC.
- 1. Scheduled Operation: Occupied and unoccupied periods on seven-day clock with a minimum of four programmable periods per day.
 - 2. Unoccupied Period Override: Two hours.
 - 3. Unit Supply-Air Fan Operations:
 - a. Occupied Periods: Fan runs continuously.
 - b. Unoccupied Periods: Fan cycles to maintain setback room temperature.
 - 4. Heating-Coil Operations:
 - a. Occupied Periods: Modulate control valve to provide heating if room temperature falls below thermostat set point.
 - b. Unoccupied Periods: Start fan and modulate control valve if room temperature falls below setback temperature.
 - 5. Controller is to have volatile-memory backup.
- F. Interface with DDC System for HVAC Requirements:
- 1. Interface relay for scheduled operation.
 - 2. Interface relay to provide indication of fault at central workstation.
 - 3. Interface is to be BAC-net compatible for central DDC system for HVAC workstation and include the following functions:
 - a. Adjust set points.
 - b. Cabinet unit-heater start, stop, and operating status.
 - c. Data inquiry, including supply-air and room-air temperature.
 - d. Occupied and unoccupied schedules.
- G. Electrical Connection: Factory-wired motors and controls for a single field connection.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas to receive cabinet unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for piping and electrical connections to verify actual locations before unit-heater installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF CABINET UNIT HEATERS

- A. Install cabinet unit heaters to comply with NFPA 90A.
- B. Suspend cabinet unit heaters from structure with elastomeric hangers. Vibration isolators are specified in Section 230548 "Vibration Control for HVAC Piping and Equipment."
- C. Install wall-mounted thermostats and switch controls in electrical outlet boxes at heights to match lighting controls. Verify location of thermostats and other exposed control sensors with Drawings and room details before installation.
- D. Install new filters in each fan-coil unit within two weeks of Substantial Completion.

3.3 CONNECTIONS

- A. Piping installation requirements are specified in Section 232113 "Hydronic Piping," Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Install piping adjacent to machine to allow service and maintenance.
- C. Connect piping to cabinet unit heater's factory, hot-water piping package. Install the piping package if shipped loose.
- D. Comply with safety requirements in UL 1995.
- E. Unless otherwise indicated, install union and gate or ball valve on supply-water connection and union and calibrated balancing valve on return-water connection of cabinet unit heater.
- F. Ground equipment in accordance with Section 260526 "Grounding and Bonding for Electrical Systems."
- G. Connect wiring in accordance with Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
 - 1. Operational Test: After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.
 - 2. Test and adjust controls and safety devices. Replace damaged and malfunctioning controls and equipment.
- B. Units will be considered defective if they do not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 23 82 39.13

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Copper building wire.
2. Connectors and splices.

B. Related Requirements:

1. Section 260523 "Control-Voltage Electrical Power Cables" for control systems communications cables and Classes 1, 2, and 3 control cables.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

PART 2 - PRODUCTS

2.1 COPPER BUILDING WIRE

A. Description: Flexible, insulated, and uninsulated, drawn copper current-carrying conductor with an overall insulation layer or jacket, or both, rated 600 V or less.

B. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Belden Inc.
2. Encore Wire Corporation.
3. General Cable; Prysmian Group North America.
4. Okonite Company (The).
5. Southwire Company.

C. Standards:

1. Listed and labeled as defined in Chicago Electrical Code, by a qualified testing agency, and marked for intended location and use.
2. Conductor and Cable Marking: Comply with wire and cable marking according to UL's "Wire and Cable Marking and Application Guide."

D. Conductors: Copper, complying with ASTM B3 for bare annealed copper and with ASTM B8 for

stranded conductors.

- E. Conductor Insulation:
 - 1. Type THHN and Type THWN-2: Comply with UL 83.

2.2 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors, splices, and lugs of size, ampacity rating, material, type, and class for application and service indicated; listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- B. Jacketed Cable Connectors: For steel and aluminum jacketed cables, zinc diecast with set screws, designed to connect conductors specified in this Section.
- C. Lugs: One piece, seamless, designed to terminate conductors specified in this Section.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders:
 - 1. Copper; solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits:
 - 1. Copper. Solid for No. 12 AWG and smaller; stranded for No. 10 AWG and larger.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN/THWN-2, single conductors in raceway.
- B. Exposed Feeders: Type THHN/THWN-2, single conductors in raceway.
- C. Feeders Concealed in Ceilings, Walls, Partitions, and Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- D. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- E. Feeders Installed below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.
- F. Exposed Branch Circuits, Including in Crawlspace: Type THHN/THWN-2, single conductors in raceway.
- G. Branch Circuits Concealed in Ceilings, Walls, and Partitions: Type THHN/THWN-2, single conductors in raceway.
- H. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN/THWN-2, single conductors in raceway.
- I. Branch Circuits Installed Below Raised Flooring: Type THHN/THWN-2, single conductors in raceway.

- J. Cord Drops and Portable Appliance Connections: Type SO, hard service cord with stainless steel, wire-mesh, strain relief device at terminations to suit application.

3.3 INSTALLATION, GENERAL

- A. Conceal cables in finished walls, ceilings, and floors unless otherwise indicated.
- B. Complete raceway installation between conductor and cable termination points according to Section 260533 "Raceways and Boxes for Electrical Systems" prior to pulling conductors and cables.
- C. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.
- D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- E. Install exposed cables parallel and perpendicular to surfaces of exposed structural members and follow surface contours where possible.
- F. Support cables according to Section 260529 "Hangers and Supports for Electrical Systems."

3.4 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- B. Make splices, terminations, and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 IDENTIFICATION

- A. Identify and color-code conductors and cables according to Section 260553 "Identification for Electrical Systems."
- B. Identify each spare conductor at each end with identity number and location of their end of conductor and identify as spare conductor.

3.6 SLEEVE AND SLEEVE-SEAL INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Install sleeves and sleeve seals at penetrations of exterior floor and wall assemblies. Comply with requirements in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

3.7 FIRESTOPPING

- A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly according to Section 078413 "Penetration Firestopping."

3.8 FIELD QUALITY CONTROL**A. Tests and Inspections:**

1. After installing conductors and cables and before electrical circuitry has been energized, test service entrance and feeder conductors for compliance with requirements.
2. Perform each of the following visual and electrical tests:
 - a. Inspect exposed sections of conductor and cable for physical damage and correct connection according to the single-line diagram.
 - b. Test bolted connections for high resistance using one of the following:
 - 1) Calibrated torque wrench.
 - c. Inspect compression-applied connectors for correct cable match and indentation.
 - d. Inspect for correct identification.
 - e. Inspect cable jacket and condition.
 - f. Insulation-resistance test on each conductor for ground and adjacent conductors. Apply a potential of 500 V(dc) for 300 V rated cable and 1000 V(dc) for 600 V rated cable for a one-minute duration.
 - g. Continuity test on each conductor and cable.

- B. Cables will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports to record the following:

1. Procedures used.
2. Results that comply with requirements.
3. Results that do not comply with requirements, and corrective action taken to achieve compliance with requirements.

END OF SECTION 26 05 19

SECTION 26 05 23 - CONTROL-VOLTAGE ELECTRICAL POWER CABLES**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
 - 1. Control cable.
 - 2. Control-circuit conductors.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.3 INFORMATIONAL SUBMITTALS

- A. Source quality-control reports.
- B. Field quality-control reports.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Flame Travel and Smoke Density in Plenums: As determined by testing identical products according to NFPA 262, by a qualified testing agency. Identify products for installation in plenums with appropriate markings of applicable testing agency.
 - 1. Flame Travel Distance: 60 inch or less.
 - 2. Peak Optical Smoke Density: 0.5 or less.
 - 3. Average Optical Smoke Density: 0.15 or less.
- C. Flame Travel and Smoke Density for Riser Cables in Non-Plenum Building Spaces: As determined by testing identical products according to UL 1666.
- D. Flame Travel and Smoke Density for Cables in Non-Riser Applications and Non-Plenum Building Spaces: As determined by testing identical products according to UL 1685.

2.2 CONTROL CABLE

A. Paired Cable: NFPA 70, Type CMG.

1. Multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with UL 1685.

B. Plenum-Rated, Paired Cable: NFPA 70, Type CMP.

1. Multi-pair, twisted, No. 18 AWG, stranded (19x30) tinned-copper conductors.
2. PVC insulation.
3. Unshielded.
4. PVC jacket.
5. Flame Resistance: Comply with NFPA 262.

2.3 CONTROL-CIRCUIT CONDUCTORS

A. Class 1 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

B. Class 2 Control Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

C. Class 3 Remote-Control and Signal Circuits: Stranded copper, Type THHN/THWN-2, complying with UL 83 in raceway.

D. Class 2 Control Circuits and Class 3 Remote-Control and Signal Circuits That Supply Critical Circuits: Circuit Integrity (CI) cable.

1. Smoke control signaling and control circuits.

2.4 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate cables.

B. Factory test twisted pair cables according to TIA-568-C.2.

C. Cable will be considered defective if it does not pass tests and inspections.

D. Prepare test and inspection reports.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Testcables on receipt at Project site.
 - 1. Test each pair of twisted pair cable for open and short circuits.

3.2 INSTALLATION OF RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceways and Boxes for Electrical Systems" for raceway selection and installation requirements for boxes, conduits, and wireways as supplemented or modified in this Section.
 - 1. Outlet boxes for cables must be no smaller than 4-inch square by 2-1/8 inch deep with extension ring sized to bring edge of ring to within 1/8 inch of the finished wall surface.
 - 2. Flexible metal conduit must not be used.
- B. Comply with TIA-569-D for pull-box sizing and length of conduit and number of bends between pull points.
- C. Install manufactured conduit sweeps and long-radius elbows if possible.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

- A. Comply with NECA 1.
- B. General Requirements for Cabling:
 - 1. Comply with TIA-568-C Series of standards.
 - 2. Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems."
 - 3. Terminate all conductors; cable must not contain unterminated elements. Make terminations only at indicated outlets, terminals, and cross-connect and patch panels.
 - 4. Cables may not be spliced and must be continuous from terminal to terminal. Do not splice cable between termination, tap, or junction points.
 - 5. Cables serving a common system may be grouped in a common raceway. Install network cabling and control wiring and cable in separate raceway from power wiring. Do not group conductors from different systems or different voltages.
 - 6. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - 7. Bundle, lace, and train conductors to terminal points without exceeding manufacturer's limitations on bending radii, but not less than radii specified in BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Install lacing bars and distribution spools.
 - 8. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and



26 05 23 – CONTROL-VOLTAGE ELECTRICAL POWER CABLES - 4

discard cable if damaged during installation and replace it with new cable.

9. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Do not use heat lamps for heating.
10. Pulling Cable: Comply with BICSI ITSIMM, Ch. 5, "Copper Structured Cabling Systems." Monitor cable pull tensions.
11. Support: Do not allow cables to lie on removable ceiling tiles.
12. Secure: Fasten securely in place with hardware specifically designed and installed so as to not damage cables.
13. Provide strain relief.
14. Keep runs short. Allow extra length for connecting to terminals. Do not bend cables in a radius less than 10 times the cable OD. Use sleeves or grommets to protect cables from vibration at points where they pass around sharp corners and through penetrations.
15. Ground wire must be copper, and g r o u n d i n g methods must comply with IEEE C2. Demonstrate ground resistance.

C. Installation of Control-Circuit Conductors:

1. Install wiring in raceways.
2. Use insulated spade lugs for wire and cable connection to screw terminals.
3. Comply with requirements specified in Section 260533 "Raceways and Boxes for Electrical Systems."

D. Installation of Cable Routed Exposed under Raised Floors:

1. Install plenum-rated cable only.
2. Install cabling after the flooring system has been installed in raised floor areas.
3. Below each feed point, neatly coil a minimum of 72 inch of cable in a coil not less than 12 inches in diameter.

3.4 GROUNDING

- A. For data communication wiring, comply with TIA-607-B and with BICSI TDMM, "Bonding and Grounding (Earthing)" Chapter.
- B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.5 IDENTIFICATION

- A. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Identify data and communications system components, wiring, and cabling according to TIA-606-B; label printers must use label stocks, laminating adhesives, and inks complying with UL 969.
- C. Identify each wire at each end and at each terminal with a number-coded identification

tag. Each wire must have a unique tag.

3.6 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Visually inspect cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and patch cords, and labeling of all components.
- B. End-to-end cabling will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 05 23

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes grounding and bonding systems and equipment.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated.

1.3 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Plans showing dimensioned locations of grounding features specified in "Field Quality Control" Article, including the following:
 - 1. Ground rods.
 - 2. Ground rings.
- B. Field quality-control reports.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 467 for grounding and bonding materials and equipment.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
 - 1. Burndy; Hubbell Incorporated, Construction and Energy.
 - 2. ERICO; nVent.
 - 3. Harger Lightning & Grounding.

2.3 CONDUCTORS

- A. Insulated Conductors: Copper or tinned-copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:

1. Solid Conductors: ASTM B3.
 2. Stranded Conductors: ASTM B8.
 3. Tinned Conductors: ASTM B33.
 4. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
- C. Grounding Bus: Predrilled rectangular bars of annealed copper, 1/4 by 4 inch in cross section, with 9/32-inch holes spaced 1-1/8 inch apart. Stand-off insulators for mounting must comply with UL 891 for use in switchboards, 600 V and must be Lexan or PVC, impulse tested at 5000 V.

2.4 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.
- C. Mechanical-Type Bus-Bar Connectors: Cast silicon bronze, solderless compression-type wire terminals, and long-barrel, two-bolt connection to ground bus bar.
- D. Beam Clamps: Mechanical type, terminal, ground wire access from four directions, with dual, tin-plated or silicon bronze bolts.
- E. Cable-to-Cable Connectors: Compression type, copper, or copper alloy.
- F. Cable Tray Ground Clamp: Mechanical type, zinc-plated malleable iron.
- G. Conduit Hubs: Mechanical type, terminal with threaded hub.
- H. Ground Rod Clamps: Mechanical type, copper or copper alloy, terminal with hex head bolt.
- I. Lay-in Lug Connector: Mechanical type, copper rated for direct burial terminal with set screw.
- J. Service Post Connectors: Mechanical type, bronze alloy terminal, in short- and long-stud lengths, capable of single and double conductor connections.
- K. Signal Reference Grid Clamp: Mechanical type, stamped-steel terminal with hex head screw.
- L. Straps: Solid copper, cast-bronze clamp. Rated for 600 A.
- M. Tower Ground Clamps: Mechanical type, copper or copper alloy, terminal two-piece clamp.
- N. U-Bolt Clamps: Mechanical type, copper or copper alloy, terminal listed for direct burial.
- O. Water Pipe Clamps:
1. Mechanical type, two pieces with stainless steel bolts.
 - a. Material: Die-cast zinc alloy.
 - b. Listed for direct burial.
 2. U-bolt type with malleable-iron clamp and copper ground connector.

2.5 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad steel, sectional type; 3/4 inch by 10 ft.

PART 3 - EXECUTION

3.1 APPLICATIONS

- A. Conductors: Install solid conductor for No. 8 AWG and smaller, and stranded conductors for No. 6 AWG and larger unless otherwise indicated.
- B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 2/0 AWG minimum.
 - 1. Bury at least 30 inches below grade.
- C. Grounding Conductors: Green-colored insulation with continuous yellow stripe.
- D. Isolated Grounding Conductors: Green-colored insulation with more than one continuous yellow stripe. On feeders with isolated ground, identify grounding conductor where visible to normal inspection, with alternating bands of green and yellow tape, with at least three bands of green and two bands of yellow.
- E. Grounding Bus: Install in electrical equipment rooms, in rooms housing service equipment, and elsewhere as indicated.
 - 1. Install bus horizontally, on insulated spacers 2-inch minimum from wall, 6 inch above finished floor unless otherwise indicated.
- F. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.2 GROUNDING AT THE SERVICE

- A. Equipment grounding conductors and grounding electrode conductors must be connected to the ground bus. Install a main bonding jumper between the neutral and ground buses.

3.3 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Air-Duct Equipment Circuits: Install insulated equipment grounding conductor to duct-mounted electrical devices operating at 120 V and more, including air cleaners, heaters, dampers, humidifiers, and other duct electrical equipment. Bond conductor to each unit and to air duct and connected metallic piping.

- C. Water Heater, Heat-Tracing, and Anti-frost Heating Cables: Install a separate insulated equipment grounding conductor to each electric water heater and heat-tracing cable. Bond conductor to heater units, piping, connected equipment, and components.
- D. Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Bonding Common with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor and install in conduit.
- C. Ground Rods: Drive rods until the tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. Use exothermic welds for all below-grade connections.
 - 3. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.
 - 1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
 - 2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
 - 3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.
- E. Grounding and Bonding for Piping:
 - 1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
 - 2. Water Meter Piping: Use braided -type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
 - 3. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

- F. Bonding Interior Metal Ducts: Bond metal air ducts to equipment grounding conductors of associated fans, blowers, electric heaters, and air cleaners. Install tinned bonding jumper to bond across flexible duct connections to achieve continuity.
- G. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 ft. apart.
- H. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each steel column, extending around the perimeter of building.
 - 1. Install tinned-copper conductor not less than No. 2/0 AWG for ground ring and for taps to building steel.
 - 2. Bury ground ring not less than 24 inches from building's foundation.
- I. Concrete-Encased Grounding Electrode (Ufer Ground): Fabricate according to NFPA 70; using electrically conductive coated steel reinforcing bars or rods, at least 20 ft. long. If reinforcing is in multiple pieces, connect together by the usual steel tie wires or exothermic welding to create the required length.
- J. Connections: Make connections so the possibility of galvanic action or electrolysis is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact are galvanically compatible.
 - 1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer in order of galvanic series.
 - 2. Make connections with clean, bare metal at points of contact.
 - 3. Make aluminum-to-steel connections with stainless steel separators and mechanical clamps.
 - 4. Make aluminum-to-galvanized-steel connections with tin-plated copper jumpers and mechanical clamps.
 - 5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing the grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 - 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 - 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at individual ground rods. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
 - b. Perform tests by fall-of-potential method according to IEEE 81.
 - 4. Prepare dimensioned Drawings locating each test well, ground rod and ground -rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order,

and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.

- B. Grounding system will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.
- D. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity More Than 1000 kVA: 3 ohms.
 - 2. Substations and Pad-Mounted Equipment: 5 ohms.
- E. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Support, anchorage, and attachment components.
2. Fabricated metal equipment support assemblies.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for the following:
 - a. Slotted support systems, hardware, and accessories.
 - b. Clamps.
 - c. Hangers.
 - d. Anchors.
2. Include rated capacities and furnished specialties and accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Welding certificates.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Delegated Design: Engage a qualified structural professional engineer to design hanger and support system.

2.2 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

- A. Steel Slotted Support Systems: Preformed steel channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inch on center in at least one surface.
 1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 2. Material for Channel, Fittings, and Accessories: Galvanized steel.

3. Channel Width: Selected for applicable load criteria.
 4. Metallic Coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
- B. Aluminum Slotted Support Systems: Extruded-aluminum channels and angles with minimum 13/32-inch diameter holes at a maximum of 8 inch on center in at least one surface.
1. Standard: Comply with MFMA-4 factory-fabricated components for field assembly.
 2. Channel Material: 6063-T5 aluminum alloy.
 3. Fittings and Accessories Material: 5052-H32 aluminum alloy.
 4. Channel Width: Selected for applicable load criteria.
- C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.
- D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for nonarmored electrical conductors or cables in riser conduits. Plugs must have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. The body must be made of malleable iron.
- E. Structural Steel for Fabricated Supports and Restraints: ASTM A36/A36M steel plates, shapes, and bars; black and galvanized.
- F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:
1. Mechanical-Expansion Anchors: Insert-wedge-type, stainless steel, for use in hardened portland cement concrete, with tension, shear, and pullout capacities appropriate for supported loads and building materials where used.
 2. Concrete Inserts: Steel or malleable-iron, slotted support system units are similar to MSS Type 18 units and comply with MFMA-4 or MSS SP-58.
 3. Clamps for Attachment to Steel Structural Elements: MSS SP-58 units are suitable for attached structural element.
 4. Through Bolts: Structural type, hex head, and high strength. Comply with ASTM F3125/F3125M, Grade A325.
 5. Toggle Bolts: Stainless steel springhead type.
 6. Hanger Rods: Threaded steel.

PART 3 - EXECUTION

3.1 SELECTION

- A. Comply with the following standards for selection and installation of hangers and supports, except where requirements on Drawings or in this Section are stricter:
1. NECA NEIS 101

2. NECA NEIS 105.
 - B. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping materials and installation for penetrations through fire-rated walls, ceilings, and assemblies.
 - C. Comply with requirements for raceways and boxes specified in Section 260533 "Raceway and Boxes for Electrical Systems."
 - D. Maximum Support Spacing and Minimum Hanger Rod Size for Raceways: Space supports for EMT, IMC, and ERM as required by the Chicago Electrical Code. The minimum rod size must be 1/4 inch in diameter.
 - E. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted or other support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.
 1. Secure raceways and cables to these supports with single-bolt conduit clamps.

3.2 INSTALLATION OF SUPPORTS

- A. Comply with NECA NEIS 101 for installation requirements except as specified in this article.
- B. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. The minimum static design load used for strength determination must be weight of supported components plus 200lb.
- C. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:
 1. To Wood: Fasten with lag screws or through bolts.
 2. To New Concrete: Bolt to concrete inserts.
 3. To Masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
 4. To Existing Concrete: Expansion anchor fasteners.
 5. To Steel: Beam clamps (MSS SP-58, Type 19, 21, 23, 25, or 27), complying with MSS SP-69.
 6. To Light Steel: Sheetmetal screws.
 7. Items Mounted on Hollow Walls and Nonstructural Building Surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate.
- D. Drill holes for expansion anchors in concrete at locations and to depths that avoid the need for reinforcing bars.

3.3 CONCRETE BASES

- A. Construct concrete bases of dimensions indicated, but not less than 4 inch larger in both directions than supported unit, and so anchors will be a minimum of 10 bolt diameters from edge of the base.
- B. Use 3000 psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Section 033000 "Cast - in-Place Concrete."
- C. Anchor equipment to concrete base as follows:
 - 1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 2. Install anchor bolts to elevations required for proper attachment to supported equipment.
 - 3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.4 PAINTING

- A. Touchup:
 - 1. Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.
 - a. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils.
- B. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAY AND BOXES FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Type EMT-S raceways and elbows.
2. Type ERMC-S raceways and elbows.
3. Type FMC-S and Type FMC-A raceways.
4. Type LFMC raceways.
5. Type PVC raceways and fittings.
6. Fittings for conduit, tubing, and cable.
7. Threaded metal joint compound.
8. Solvent cements.
9. Surface metal raceways and fittings.
10. Wireways and auxiliary gutters.
11. Metallic outlet boxes, device boxes, rings, and covers.
12. Termination boxes.
13. Cabinets, cutout boxes, junction boxes, pull boxes, and miscellaneous enclosures.
14. Cover plates for device boxes.

B. Related Requirements:

1. Section 260543 "Underground Ducts and Raceways for Electrical Systems" for exterior duct banks, manholes, and underground utility construction.

1.2 ACTION SUBMITTALS**A. Product Data: For the following:**

1. Surface metal raceways.
2. Floor boxes.
3. Cabinets, cutout boxes, and miscellaneous enclosures.

PART 2 - PRODUCTS**2.1 TYPE EMT-S RACEWAYS AND ELBOWS****A. Steel Electrical Metal Tubing (EMT-S) and Elbows:**

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 797 and UL Category Control Number FJMX.
 - 2) Material: Steel.
 - 3) Exterior Coating: Zinc.
 - 4) Interior Coating: Zinc.

- c. Options:
 - 1) Minimum Trade Size: 3/4 inch.
 - 2) Colors: As indicated on Drawings.

2.2 TYPE ERMC-S RACEWAYS, ELBOWS, COUPLINGS, AND NIPPLES

- A. Galvanized-Steel Electrical Rigid Metal Conduit (ERMC-S), Elbows, Couplings, and Nipples:
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 6 and UL Category Control Number DYIX.
 - 2) Exterior Coating: Zinc.
 - 3) Interior Coating: Zinc with organic top coating.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.
 - 2) Colors: As indicated on Drawings.

2.3 TYPE FMC-S AND TYPE FMC-A RACEWAYS

- A. Steel Flexible Metal Conduit (FMC-S):
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standard: UL 1 and UL Category Control Number DXUZ.
 - 2) Material: Steel.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.
 - 2) Colors: As indicated on Drawings.
- B. Aluminum Flexible Metal Conduit (FMC-A):
 - 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standard: UL 1 and UL Category Control Number DXUZ.
 - 2) Material: Aluminum.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.

- 2) Colors: As indicated on Drawings.

2.4 TYPE FMT RACEWAYS

A. Steel Flexible Metallic Tubing (FMT):

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standard: UL 1652 and UL Category Control Number ILJW.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.
 - 2) Colors: As indicated on Drawings.

2.5 TYPE LFMC RACEWAYS

A. Steel Liquid tight Flexible Metal Conduit (LFMC-S):

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standard: UL 360 and UL Category Control Number DXHR.
 - 2) Material: Steel.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.
 - 2) Colors: As indicated on Drawings.

B. Stainless Steel Liquid Tight Flexible Metal Conduit (LFMC-SS):

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standard: UL 360 and UL Category Control Number DXHR.
 - 2) Material: Stainless steel.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.
 - 2) Colors: As indicated on Drawings.

2.6 TYPE PVC RACEWAYS AND FITTINGS

A. Schedule 40 Rigid PVC Conduit (PVC-40) and Fittings:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Schedule 40.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.

B. Schedule 80 Rigid PVC Conduit (PVC-80) and Fittings:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 651 and UL Category Control Number DZYR.
 - 2) Dimensional Specifications: Schedule 80.
 - c. Options:
 - 1) Minimum Trade Size: 3/4 inch.

2.7 FITTINGS FOR CONDUIT, TUBING, AND CABLE

A. Fittings for Type ERM Raceways:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number DWTT.
 - c. Options:
 - 1) Conduit Fittings for Hazardous (Classified) Locations: UL 1203.

B. Fittings for Type EMT Raceways:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number FKAV.
 - 2) Material: Steel.
 - 3) Coupling Method: Setscrew coupling. Setscrew couplings with only single screw per conduit are unacceptable.

C. Fittings for Type FMC Raceways:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number ILNR.

D. Fittings for Type LFMC and Type LFNC Raceways:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514B and UL Category Control Number DXAS.

2.8 ELECTRICALLY CONDUCTIVE CORROSION-RESISTANT COMPOUNDS FOR THREADED CONDUIT

A. Applicable Standards:

1. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and approved by authorities having jurisdiction for application to threaded conduit assemblies.
2. General Characteristics:
 - a. Reference Standards: UL 2419 and UL Category Control Number FOIZ.

2.9 SOLVENT CEMENTS

A. Solvent Cements for Type PVC Raceways and Fittings:

1. Applicable Standards:
 - a. General Characteristics:
 - 1) Reference Standards: As recommended by conduit manufacturer in accordance with UL 514B and UL Category Control Number DWTT.
 - b. Sustainability Characteristics:

2.10 SURFACE METAL RACEWAYS AND FITTINGS

A. Surface Metal Raceways and Fittings with Metal Covers:

1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:

- 1) Reference Standards: UL 5 and UL Category Control Number RJBT.

c. Options:

- 1) Aluminum base with snap-on covers.
- 2) Manufacturer's standard enamel finish in color selected by Design-Builder.
- 3) Wiring Channels: Dual. Multiple channels must be capable of housing a standard 20 to 30 A NEMA device flush within the raceway.

2.11 WIREWAYS AND AUXILIARY GUTTERS

A. Metal Wireways and Auxiliary Gutters:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.

b. General Characteristics:

- 1) Reference Standards: UL 870 and UL Category Control Number ZOYX.
- 2) Fittings and Accessories: Include covers, coupling s, of f sets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
- 3) Finish: Manufacturer's standard enamel finish.

c. Options:

- 1) Degree of Protection: Type 1 for indoor and Type 3R for outdoor unless otherwise indicated.
- 2) Wireway Covers: Screw-cover type for indoor, Flanged-and-gasketed type for outdoor unless otherwise indicated.

2.12 METALLIC OUTLET BOXES, DEVICE BOXES, RINGS, AND COVERS

A. Metallic Outlet Boxes:

1. Description: Box having pry out openings, knockouts, threaded entries, or hubs in either the sides of the back, or both, for entrance of conduit, conduit or cable fittings, or cables, with provisions for mounting outlet box cover, but without provisions for mounting wiring device directly to box.

2. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.

b. General Characteristics:

- 1) Reference Standards: UL 514A and UL Category Control Number QCIT.
- 2) Options:Material: Sheet steel or Cast metal.
- 3) Sheet Metal Depth: Minimum 2 inches.
- 4) Cast-Metal Depth: Minimum 2.4 inch.
- 5) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.

B. Metallic Conduit Bodies:

1. Description: Means for providing access to interior of conduit or tubing system through one or more removable covers at junction or terminal point. In the United States, conduit bodies are listed in accordance with outlet box requirements.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

C. Metallic Device Boxes:

1. Description: Box with provisions for mounting wiring device directly to box.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.
 - c. Options:
 - 1) Material: Sheet steel or Cast metal.
 - 2) Sheet Metal Depth: minimum 2 inches.
 - 3) Cast-Metal Depth: minimum 2.4 inch.
 - 4) Luminaire Outlet Boxes and Covers: Nonadjustable, listed and labeled for attachment of luminaire weighing up to 50 lb.
 - 5) Paddle Fan Outlet Boxes and Covers: Nonadjustable, designed for attachment of paddle fan weighing up to 70 lb.

D. Metallic Extension Rings:

1. Description: Ring intended to extend sides of outlet box or device box to increase box depth, volume, or both.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

E. Metallic Floor Boxes and Floor Box Covers:

1. Description: Box mounted in floor with floor box cover and other components to complete floor box enclosure.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.

b. General Characteristics:

- 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

F. Metallic Raised-Floor Boxes and Floor Box Covers:

1. Description: Box mounted in raised floor with floor box cover and other components to complete floor box enclosure.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

G. Metallic Recessed Access-Floor Boxes and Recessed Floor Box Covers:

1. Description: Floor box with provisions for mounting wiring devices below floor surface and floor box cover with provisions for passage of cords to recessed wiring devices mounted within floor box.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

H. Metallic Concrete Boxes and Covers:

1. Description: Box intended for use in poured concrete.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL 514A and UL Category Control Number QCIT.

2.13 CABINETS, CUTOUBOXES, JUNCTIONBOXES, PULLBOXES, AND MISCELLANEOUS ENCLOSURES

A. Indoor Sheet Metal Cabinets:

1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.

- a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- B. Indoor Sheet Metal Cutout Boxes:
 - 1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- C. Indoor Sheet Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- D. Indoor Cast-Metal Junction and Pull Boxes:
 - 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:

- 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- E. Indoor Sheet Metal Miscellaneous Enclosures:
1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards:
 - a) UL 1773 and UL Category Control Number XCKT.
 - b) Non-Environmental Characteristics: UL 50.
 - c) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 1.
- F. Outdoor Sheet Metal Cabinets:
1. Description: Enclosure provided with frame, mat, or trim in which swinging door or doors are or can be hung.
 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.
- G. Outdoor Sheet Metal Cutout Boxes:
1. Description: Enclosure that has swinging doors or covers secured directly to and telescoping with walls of enclosure.
 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:

- 1) Reference Standards: UL Category Control Number CYIV.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.
- H. Outdoor Sheet Metal Junction and Pull Boxes:
- 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) Degree of Protection: Type 3R.
- I. Outdoor Cast-Metal Junction and Pull Boxes:
- 1. Description: Box with a blank cover that serves the purpose of joining different runs of raceway or cable.
 - 2. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:
 - 1) Reference Standards: UL Category Control Number BGUZ.
 - a) Non-Environmental Characteristics: UL 50.
 - b) Environmental Characteristics: UL 50E.
 - c. Options:
 - 1) degree of Protection: Type 3R.
- J. Outdoor Sheet Metal Miscellaneous Enclosures:
- 1. Applicable Standards:
 - a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
 - b. General Characteristics:

- 1) Reference Standards:
 - a) UL 1773 and UL Category Control Number XCKT.
 - b) Non-Environmental Characteristics: UL 50.
 - c) Environmental Characteristics: UL 50E.

c. Options:

- 1) Degree of Protection: Type 3R.

2.14 COVER PLATES FOR DEVICES BOXES

A. Metallic Cover Plates for Device Boxes:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- c. Options:
 - 1) Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - 2) Wallplate Material: 0.040-inch-thick aluminum, anodized or lacquered to prevent corrosion.

B. Nonmetallic Cover Plates for Device Boxes:

1. Applicable Standards:

- a. Regulatory Requirements: Listed and labeled in accordance with the Chicago Electrical Code and marked for intended location and use.
- b. General Characteristics:
 - 1) Reference Standards: UL 514D and UL Category Control Numbers QCIT and QCMZ.
 - 2) Wallplate-Securing Screws: Metal with head color to match wallplate finish.
- c. Options:
 - 1) Damp and Wet Locations: Listed, labeled, and marked for location and use. Provide gaskets and accessories necessary for compliance with listing.
 - 2) Wallplate Material: 0.060 inch thick high-impact thermoplastic (nylon) with smooth finish and color matching wiring device.
 - 3) Color: Ivory, Gray, Red in accordance with NEMA WD 1 unless indicated on Drawings.

PART 3 - EXECUTION

3.1 SELECTION OF RACEWAYS

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with the Chicago Electrical Code for selection of raceways. Consult Architect for resolution of conflicting requirements.
- B. Outdoors:
 - 1. Exposed Conduit: ERM C.
 - 2. Concealed Conduit, Aboveground: ERM C.
 - 3. Direct-Buried Conduit: PVC-40.
 - 4. Concrete-Encased Conduit in Trench: PVC-40.
 - 5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
- C. Indoors:
 - 1. Hazardous Classified Locations: ERM C.
 - 2. Exposed and Subject to Physical Damage: ERM C. Raceway locations include the following:
 - a. Loading docks.
 - b. Corridors used for traffic of mechanized carts, forklifts, and pallet-handling units.
 - c. Mechanical rooms.
 - 3. Exposed, Not Subject to Physical Damage: EMT.
 - 4. Concealed in Ceilings and Interior Walls and Partitions: EMT.
 - 5. Damp or Wet Locations: ERM C.
 - 6. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC.
- D. Stub-ups to Above Recessed Ceilings: Provide EMT, IMC, or ERM C for raceways.
- E. Raceway Fittings: Select fittings in accordance with NEMA FB 2.10 guidelines.
 - 1. ERM C and IMC: Provide threaded type fittings unless otherwise indicated.

3.2 SELECTION OF BOXES AND ENCLOSURES

- A. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with the Chicago Electrical Code for selection of boxes and enclosures. Consult Architect for resolution of conflicting requirements.
- B. Degree of Protection:
 - 1. Outdoors:
 - a. Type 3R unless otherwise indicated.
 - b. Locations in-Ground or Exposed to Corrosive Agents: Type 4X.
 - c. Locations in-Ground or Exposed to Corrosive Agents Where Mechanism Must Operate When Ice Covered: Type 3SX.
 - 2. Indoors:

- a. Type 1 unless otherwise indicated.
 - b. Locations Exposed to Corrosive Agents: Type 4X.
- C. Exposed Boxes Installed Less Than 6.5 ft. Above Floor:
1. Provide cast-metal boxes.
 2. Provide exposed cover. Flat covers with angled mounting slots or knockouts are prohibited.

3.3 INSTALLATION OF RACEWAYS

A. Installation Standards:

1. Unless more stringent requirements are specified in Contract Documents or manufacturers' written instructions, comply with the Chicago Electrical Code for installation of raceways. Consult Architect for resolution of conflicting requirements.
2. Comply with the Chicago Electrical Code limitations for types of raceways allowed in specific occupancies and number of floors.
3. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for hangers and supports.
4. Comply with NECA NEIS 101 for installation of steel raceways.
5. Comply with NECA NEIS 111 for installation of nonmetallic raceways.
6. Install raceways square to the enclosure and terminate at enclosures without hubs with locknuts on both sides of enclosure wall. Install locknuts hand tight, plus one-quarter turn more.
7. Terminate threaded conduits into threaded hubs or with locknuts on inside and outside of boxes or cabinets. Install bushings on conduits up to 1-1/4-inch trade size and insulated throat metal bushings on 1-1/2-inch trade size and larger conduits terminated with locknuts.
8. Raceway Terminations at Locations Subject to Moisture or Vibration:
 - a. Provide insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.

B. General Requirements for Installation of Raceways:

1. Complete raceway installation before starting conductor installation.
2. Provide stub-ups through floors with coupling threaded inside for plugs, set flush with finished floor. Plug coupling until conduit is extended above floor to final destination or a minimum of 2 ft. above finished floor.
3. Install no more than equivalent of three 90-degree bends in conduit run. Support within 12 inches of changes in direction.
4. Make bends in raceway using large-radius preformed ells except for parallel bends. Field bending must be in accordance with the Chicago Electrical Code minimum radii requirements. Provide only equipment specifically designed for material and size involved.
5. Conceal conduit within finished walls, ceilings, and floors unless otherwise indicated. Install conduits parallel or perpendicular to building lines.
6. Support conduit within 12 inches of enclosures to which attached.
7. Install raceway sealing fittings at accessible locations in accordance with the Chicago Electrical Code and fill them with listed sealing compound. For concealed raceways, install fitting in flush steel box with blank cover plate having finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings in accordance with the

- Chicago Electrical Code.
8. Install devices to seal raceway interiors at accessible locations. Locate seals so no fittings or boxes are between the seal and the following changes of environments. Seal interior of raceways at the following points:
 - a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - b. Where an underground service raceway enters a building or structure.
 - c. Conduit extending from interior to exterior of building.
 - d. Conduit extending into pressurized duct and equipment.
 - e. Conduit extending into pressurized zones that are automatically controlled to maintain different pressure set points.
 - f. Where otherwise required by the Chicago Electrical Code.
 9. Do not install raceways or electrical items on "explosion-relief " walls or rotating equipment.
 10. Do not install conduits within 2 inches of the bottom side of a metal deck roof.
 11. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot - water pipes. Install horizontal raceway runs above water and steam piping.
 12. Cut conduit perpendicular to the length. For conduits 2-inch trade size and larger, use roll cutter or a guide to make cut straight and perpendicular to the length. Ream inside of conduit to remove burrs.
 13. Install pull wires in empty raceways. Provide polypropylene or monofilament plastic line with not less than 200 lb. tensile strength. Leave at least 12 inches of slack at both ends of pull wire. Cap underground raceways designated as spare above grade alongside raceways in use.
- C. Requirements for Installation of Specific Raceway Types:
1. Types ERM C:
 - a. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound that maintains electrical conductivity to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
 2. Types FMC, LFMC, and LFNC:
 - a. Comply with NEMA RV 3. Provide a maximum of 72 inch of flexible conduit for equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 3. Types PVC:
 - a. Do not install Type PVC or Type EPEC conduit where ambient temperature exceeds 122 deg F. Conductor ratings must be limited to 75 deg C except where installed in a trench outside buildings with concrete encasement, where 90 deg C conductors are permitted.
 - b. Comply with manufacturer's written instructions for solvent welding and fittings.
- D. Raceways Embedded in Slabs:
1. Run raceways larger than 1 inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place raceway close to slab support. Secure raceways to reinforcement at maximum 10 ft. intervals.

2. Arrange raceways to cross building expansion joints with expansion fittings at right angles to the joint.
 3. Arrange raceways to ensure that each is surrounded by a minimum of 2 inches of concrete without voids.
 4. Do not embed threadless fittings in concrete unless locations have been specifically approved by Architect.
- E. Stub-ups to Above Recessed Ceilings:
1. Provide EMT or ERMC for raceways.
 2. Provide a conduit bushing or insulated fitting to terminate stub-ups not terminated in hubs or in an enclosure.
- F. Raceway Fittings: Install fittings in accordance with NEMA FB 2.10 guidelines.
1. ERMC-S-PVC: Provide only fittings listed for use with this type of conduit. Patch and seal joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Provide sealant recommended by fitting manufacturer and apply in thickness and number of coats recommended by manufacturer.
 2. EMT: Provide setscrew, steel fittings. Comply with NEMA FB 2.10.
 3. Flexible Conduit: Provide only fittings listed for use with flexible conduit type. Comply with NEMA FB 2.20.
- G. Expansion-Joint Fittings:
1. Install in runs of aboveground PVC that are located where environmental temperature change may exceed 30 deg F and that have straight-run length that exceeds 25 ft. Install in runs of aboveground ERMC and EMT conduit that are located where environmental temperature change may exceed 100 deg F and that have straight-run length that exceeds 100 ft.
 2. Install type and quantity of fittings that accommodate temperature change listed for the following locations:
 - a. Outdoor Locations Not Exposed to Direct Sunlight: 125 deg F temperature change.
 - b. Outdoor Locations Exposed to Direct Sunlight: 155 deg F temperature change.
 - c. Indoor Spaces Connected with Outdoors without Physical Separation: 125 deg F temperature change.
 3. Install fitting(s) that provide expansion and contraction for at least 0.00041 inch per foot of length of straight run per deg F of temperature change for PVC conduits. Install fitting(s) that provide expansion and contraction for at least 0.000078 inch per foot of length of straight run per deg F of temperature change for metal conduits.
 4. Install expansion fittings at locations where conduits cross building or structure expansion joints.
 5. Install expansion-joint fitting with position, mounting, and piston setting selected in accordance with manufacturer's written instructions for conditions at specific location at time of installation. Install conduit supports to allow for expansion movement.
- H. Raceways Penetrating Rooms or Walls with Acoustical Requirements:
1. Seal raceway openings on both sides of rooms or walls with acoustically rated putty or firestopping.

3.4 INSTALLATION OF SURFACE RACEWAYS

- A. Install surface raceways only where indicated on Drawings.
- B. Install surface raceway with a minimum 2-inch radius control at bend points.
- C. Secure surface raceway with screws or other anchor-type devices at intervals not exceeding 48-inch (mm) and with no less than two supports per straight raceway section. Support surface raceway in accordance with manufacturer's written instructions. Tape and glue are unacceptable support methods.

3.5 INSTALLATION OF BOXES AND ENCLOSURES

- A. Provide boxes in wiring and raceway systems wherever required for pulling of wires, making connections, and mounting of devices or fixtures.
- B. Mount boxes at heights indicated on Drawings. If the mounting heights of boxes are not individually indicated, give priority to ADA requirements. Install boxes with height measured to center of box unless otherwise indicated.
- C. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block and install box flush with surface of wall. Prepare block surfaces to provide a flat surface for a raintight connection between box and cover plate or supported equipment and box, whether installed indoors or outdoors.
- D. Horizontally separate boxes mounted on opposite sides of walls, so they are not in the same vertical channel.
- E. Locate boxes so that cover or plate will not span different building finishes.
- F. Support boxes in recessed ceilings independent of ceiling tiles and ceiling grid.
- G. Support boxes of three gangs or more from more than one side by spanning two framing members or mounting on brackets specifically designed for purpose.
- H. Fasten junction and pull boxes to, or support from, building structure. Do not support boxes by conduits.
- I. Set metal floor boxes level and flush with finished floor surface.
- J. Set nonmetallic floor boxes level. Trim after installation to fit flush with finished floor surface.
- K. Do not install aluminum boxes, enclosures, or fittings in contact with concrete or earth.
- L. Do not rely on locknuts to penetrate nonconductive coatings on enclosures. Remove coatings in the locknut area prior to assembling conduit to enclosure to ensure a continuous ground path.
- M. Boxes and Enclosures in Areas or Walls with Acoustical Requirements:
 - 1. Seal openings and knockouts in back and sides of boxes and enclosures with acoustically rated putty.
 - 2. Provide gaskets for wallplates and covers.

3.6 FIRESTOPPING

- A. Install firestopping at penetrations of fire-rated floor and wall assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.7 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

3.8 CLEANING

- A. Boxes: Remove construction dust and debris from device boxes, outlet boxes, and floor-mounted enclosures before installing wallplates, covers, and hoods.

END OF SECTION 26 05 33

SECTION 26 05 43 – UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Rigid nonmetallic duct.
 - 2. Duct accessories.
 - 3. Polymer concrete handholes and boxes with polymer concrete cover.

1.3 DEFINITIONS

- A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
- B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
- C. Duct Bank:
 - 1. Two or more ducts installed in parallel, with or without additional casing materials.
 - 2. Multiple ductbanks.
- D. GRC: Galvanized rigid (steel) conduit.
- E. Traffic ways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include accessories for handholes.
 - 2. Include underground-line warning tape.
- B. Shop Drawings:
 - 1. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
 - a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
 - b. Include duct entry provisions, including locations and duct sizes.
 - c. Include cover design.
 - d. Include grounding details.

PART 2 - PRODUCTS

2.1 RIGID NONMETALLIC DUCT

- A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
- B. Listed and labeled as defined in the Chicago Electrical Code, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 DUCT ACCESSORIES

- A. Duct Spacers: Factory-fabricated, rigid, PVC interlocking spacers; sized for type and size of duct with which used and selected to provide minimum duct spacing indicated while supporting duct during concreting or backfilling.
- B. Underground-Line Warning Tape: Comply with requirements for underground-line warning tape specified in Section 260553 "Identification for Electrical Systems."

2.3 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

- A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
- C. Color: Gray.
- D. Configuration: Units shall be designed for flush burial and have an open bottom unless otherwise indicated.
- E. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
- F. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
- G. Cover Legend: Molded lettering, "ELECTRIC." Insert legend.
- H. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
- I. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.

2.4 SOURCE QUALITY CONTROL

- A. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for

compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.

1. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
2. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Design-Builder if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
- B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Design-Builder.

3.2 UNDERGROUND DUCT APPLICATION

- A. Duct for Electrical Cables More Than 600 V: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.
- B. Duct for Electrical Feeders 600 V and Less: Type EPC-40-PVC RNC, concrete-encased unless otherwise indicated.
- C. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.
- D. Stub-ups: Concrete-encased RNC.

3.3 UNDERGROUND ENCLOSURE APPLICATION

- A. Handholes and Boxes for 600 V and Less:
 1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-20 structural load rating.
 2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Polymer concrete, SCTE 77, Tier 15 structural load rating.
 3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Polymer concrete units, SCTE 77, Tier 8 structural load rating.
 4. Cover design load shall not exceed the design load of the handhole or box.

3.4 EARTHWORK

- A. Excavation and Backfill: Comply with Section 31 23 17 - EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES, but do not use heavy-duty, hydraulic-operated, compaction equipment.

3.5 DUCT AND DUCT-BANK INSTALLATION

- A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
- B. Install duct according to NEMA TCB 2.
- C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
- D. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches, both horizontally and vertically, at other locations unless otherwise indicated.
- E. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.
- F. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition.
- G. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.
- H. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts.
- I. Concrete-Encased Ducts and Duct Bank:
 - 1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 31 23 17 - EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES for pipes less than 6 inches in nominal diameter.
 - 2. Width: Excavate trench 3 inches wider than duct on each side.
 - 3. Depth: Install so top of duct envelope is at least 30 inches below finished grade in areas not subject to deliberate traffic, and at least 36 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
 - 4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
 - 5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie the entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
 - 6. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.

7. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
8. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
9. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
10. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
 - a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions or use other specific measures to prevent expansion-contraction damage.
 - b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4-inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
11. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 03 30 00 – CAST IN PLACE CONCRETE. Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct-installation applications.

J. Direct-Buried Duct and Duct Bank:

1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 31 23 17 - EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Width: Excavate trench 3 inches wider than duct on each side.
3. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
4. Set elevation of bottom of duct bank below frost line.
5. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
6. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than five spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie the entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
7. Install ducts with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
8. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
9. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
 - a. Couple RNC duct to GRC with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a

minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.

- 1) Stub-ups shall be flush with finished floor and minimum 3 inches from conduit side to edge of slab.
- c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
 - 1) Stub-ups shall be flush with finished floor and no less than 3 inches from conduit side to edge of slab.
10. After installing the first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing the last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 312317 "Excavating, Backfilling, and Compacting for Utilities" for installation of backfill materials.
 - a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
 - b. Place minimum 6 inches of engineered fill above concrete encasement of duct.
- K. Underground-Line Warning Tape: Bury nonconducting underground line specified in Section 260553 "Identification for Electrical Systems" no less than 12 inches above all concrete-encased duct and duct banks and approximately 12 inches below grade. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.
- D. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.
- E. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut the wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings

to be used, and seal around penetrations after fittings are installed.

- F. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
 - 1. Concrete: 3000 psi, 28-day strength with a troweled finish.

3.7 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
 - 2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
- B. Correct deficiencies and retest as specified above to demonstrate compliance.
- C. Prepare test and inspection reports.

3.8 CLEANING

- A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
- B. Clean internal surfaces of manholes, including sump.
 - 1. Sweep the floor, removing dirt and debris.
 - 2. Remove foreign material.

END OF SECTION 26 05 43

SECTION 26 05 44 - SLEEVES AND SLEEVE SEALS FOR ELECTRICAL RACEWAYS AND CABLING**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes:
1. Round sleeves.
 2. Rectangular sleeves.
 3. Sleeve seal systems.
 4. Grout.
 5. Foam sealants.

1.2 ACTION SUBMITTALS

- A. Product Data: For each type of product.

PART 2 - PRODUCTS**2.1 ROUND SLEEVES**

- A. Wall Sleeves, Steel:
1. Description: ASTM A53/A53M, Type E, Grade B, Schedule 40, zinc coated, plain ends and integral waterstop.
- B. Sheet Metal Sleeves, Galvanized Steel, Round:
1. Description: Galvanized-steel sheet; thickness not less than 0.0239 inch; round tube closed with welded longitudinal joint, with tabs for screw-fastening the sleeve to the board.

2.2 SLEEVE SEAL SYSTEMS

- A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and raceway or cable or between raceway and cable.
1. Sealing Elements: EPDM rubber interlocking links shaped to fit surface of pipe. Include type and number required for pipe material and size of pipe.
 2. Pressure Plates: Carbon steel.
 3. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements.

2.3 GROUT

- A. Description: Non-shrink; recommended for interior and exterior sealing openings in non- fire-rated walls or floors.
 - 1. Standard: ASTM C1107/C1107M, Grade B, post-hardening and volume-adjusting, dry, hydraulic-cement grout.
 - 2. Design Mix: 5000 psi, 28-day compressive strength.
 - 3. Packaging: Premixed and factory packaged.

2.4 FOAM SEALANTS

- A. Description: Multicomponent, liquid elastomers that, when mixed, expand and cure in place to produce a flexible, non-shrinking foam. Foam expansion must not damage cables or crack penetrated structure.

PART 3 - EXECUTION

3.1 INSTALLATION OF SLEEVES FOR NON-FIRE-RATED ELECTRICAL PENETRATIONS

- A. Sleeves for Conduits Penetrating Above-Grade, Non-Fire-Rated, Concrete and Masonry-Unit Floors and Walls:
 - 1. Interior Penetrations of Non-Fire-Rated Walls and Floors:
 - a. Seal space outside of sleeves with mortar or grout. Pack sealing material solidly between sleeve and wall or floor, so no voids remain. Tool exposed surfaces smooth; protect material while curing.
 - b. Seal annular space between sleeve and raceway or cable, using joint sealant appropriate for size, depth, and location of joint.
 - 2. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 3. Size pipe sleeves to provide 1/4-inch annular clear space between sleeve and raceway or cable, unless sleeve seal system is to be installed.
 - 4. Install sleeves for wall penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of walls. Cut sleeves to length for mounting flush with both surfaces of walls. Deburr after cutting.
 - 5. Install sleeves for floor penetrations. Extend sleeves installed in floors 2 inch above finished floor level. Install sleeves during erection of floors.
- B. Sleeves for Conduits Penetrating Non-Fire-Rated Wall Assemblies:
 - 1. Use circular metal sleeves unless penetration arrangement requires rectangular sleeved opening.
 - 2. Seal space outside of sleeves with approved joint compound for wall assemblies.

- C. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.
- D. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seal systems. Size sleeves to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- E. Underground, Exterior-Wall, and Floor Penetrations:
 - 1. Install steel pipe sleeves with integral waterstops. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing sleeve seal system. Install sleeves during construction of floor or wall.

3.2 INSTALLATION OF RECTANGULAR SLEEVES AND SLEEVE SEALS

- A. Install sleeves in existing walls without compromising structural integrity of walls. Do not cut structural elements without reinforcing the wall to maintain the designed weight bearing and wall stiffness.
- B. Install conduits and cable with no crossings within the sleeve.
- C. Fill opening around conduits and cables with expanding foam without leaving voids.
- D. Provide metal sheet covering at both wall surfaces and finish to match surrounding surfaces. Metal sheet must be same material as sleeve.

3.3 INSTALLATION OF SLEEVE SEAL SYSTEMS

- A. Install sleeve seal systems in sleeves in exterior concrete walls and slabs-on-grade at raceway entries into building.
- B. Install type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION 26 05 44

SECTION 26 05 53 - IDENTIFICATION FOR ELECTRICAL SYSTEMS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Labels.
 - 2. Tapes.
 - 3. Signs.
 - 4. Cable ties.
 - 5. Miscellaneous identification products.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for electrical identification products.
- B. Identification Schedule: For each piece of electrical equipment and electrical system components to be an index of nomenclature for electrical equipment and system components used in identification signs and labels. Use same designations indicated on Drawings.
- C. Delegated-Design Submittal: For arc-flash hazard study.

PART 2 - PRODUCTS**2.1 PERFORMANCE REQUIREMENTS**

- A. Comply with ASME A13.1 and IEEE C2.
- B. Comply with the Chicago Electrical Code.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.

- E. Comply with NFPA 70E and Section 260573.19 "Arc-Flash Hazard Analysis" requirements for arc-flash warning labels.
- F. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

2.2 COLOR AND LEGEND REQUIREMENTS

- A. Color-Coding for Phase- and Voltage-Level Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder, and branch-circuit conductors.
 - 1. Color shall be factory applied or field applied for sizes larger than No. 8 AWG if authorities have jurisdiction permit.
 - 2. Colors for 208/120-V Circuits:
 - a. Phase A: Black.
 - b. Phase B: Red.
 - c. Phase C: Blue.
 - 3. Colors for 480/277-V Circuits:
 - a. Phase A: Brown.
 - b. Phase B: Orange.
 - c. Phase C: Yellow.
 - 4. Color for Neutral: White.
 - 5. Color for Equipment Grounds: Green.
 - 6. Colors for Isolated Grounds: Green with two or more yellow stripes.
- B. Warning Label Colors:
 - 1. Identify system voltage with black letters on an orange background.
- C. Warning labels and signs shall include, but are not limited to, the following legends:
 - 1. Multiple Power Source Warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
 - 2. Workspace Clearance Warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 36 INCHES."
 - 3. Arc Flash and Shock Hazard Warning: Refer to Section 260573.19 for label requirements.
- D. Equipment Identification Labels:
 - 1. Black letters on a white field.

2.3 LABELS

- A. Self-Adhesive Wraparound Labels: Preprinted, 3-mil-thick, vinyl flexible label with acrylic pressure-sensitive adhesive.
 - 1. Self-Lamination: Clear; UV-, weather- and chemical-resistant; self-laminating, protective shield over the legend. Labels sized such that the clear shield overlaps the entire printed legend.
 - 2. Marker for Labels:
 - a. Machine-printed, permanent, waterproof, black ink recommended by printer manufacturer.
- B. Self-Adhesive Labels: Vinyl, thermal, transfer-printed, 3-mil-thick, multicolor, weather- and UV-resistant, pressure-sensitive adhesive labels, configured for intended use and location.
 - 1. Minimum Nominal Size:
 - a. 1-1/2 by 6 inches for raceway and conductors.
 - b. 3-1/2 by 5 inches for equipment.
 - c. As required by authorities having jurisdiction.

2.4 TAPES AND STENCILS

- A. Self-Adhesive Vinyl Tape: Colored, heavy duty, waterproof, fade resistant; not less than 3 mms thick by 1 to 2 inches wide; compounded for outdoor use.
- B. Underground-Line Warning Tape:
 - 1. Tape:
 - a. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - b. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - c. Tape material and ink shall be chemically inert and not subject to degradation when exposed to acids, alkalis, and other destructive substances commonly found in soils.
 - 2. Color and Printing:
 - a. Comply with ANSI Z535.1, ANSI Z535.2, ANSI Z535.3, ANSI Z535 .4, and ANSI Z535.5.
 - b. Inscriptions for Red-Colored Tapes: "ELECTRIC LINE".
 - c. Inscriptions for Orange-Colored Tapes: "TELEPHONE CABLE, CATV CABLE, COMMUNICATIONS CABLE, OPTICAL FIBER CABLE".
 - 3. Tape:

- a. Detectable three-layer laminate, consisting of a printed pigmented polyolefin film, a solid aluminum-foil core, and a clear protective film that allows inspection of the continuity of the conductive core; bright colored, compounded for direct-burial service.
- b. Width: 3 inches.
- c. Overall Thickness: 5 mils.
- d. Foil Core Thickness: 0.35 mil.
- e. Weight: 28 lb./1000 sq. ft.
- f. Tensile according to ASTM D882: 70 lbf and 4600 psi.

2.5 SIGNS

A. Laminated Acrylic or Melamine Plastic Signs:

1. Engraved legend.
2. Thickness:
 - a. For signs up to 20 sq. in., minimum 1/16 inch thick.
 - b. For signs larger than 20 sq. in., 1/8 inch thick.
 - c. Engraved legend with white letters on a dark gray background.
 - d. Punched or drilled for mechanical fasteners with 1/4-inch grommets in corners for mounting.
 - e. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 CABLE TIES

A. General-Purpose Cable Ties: Fungus inert, self-extinguishing, one piece, self-locking, and Type 6/6 nylon.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 12,000 psi.
3. Temperature Range: Minus 40 to plus 185 deg F.
4. Color: Black, except where used for color-coding.

B. Plenum-Rated Cable Ties: Self-extinguishing, UV stabilized, one piece, and self-locking.

1. Minimum Width: 3/16 inch.
2. Tensile Strength at 73 Deg F according to ASTM D638: 7000 psi.
3. UL 94 Flame Rating: 94V-0.
4. Temperature Range: Minus 50 to plus 284 deg F.
5. Color: Black.

2.7 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION**3.1 PREPARATION**

- A. Self-Adhesive Identification Products: Before applying electrical identification products, clean substrates of substances that could impair bond, using materials and methods recommended by manufacturer of identification product.

3.2 INSTALLATION

- A. Verify and coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and operation and maintenance manual. Use consistent designations throughout Project.
- B. Install identifying devices before installing acoustic ceilings and similar concealment.
- C. Verify the identity of each item before installing identification products.
- D. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and operation and maintenance manual.
- E. Apply identification devices to surfaces that require finish after completing finish work.
- F. Install signs with approved legend to facilitate proper identification, operation, and maintenance of electrical systems and connected items.
- G. System Identification for Raceways and Cables under 600 V: Identification shall completely encircle cable or conduit. Place identification of two-color markings in contact, side by side.
 - 1. Secure tight to surface of conductor, cable, or raceway.
 - 2. Secure tight to surface of conductor, cable, or raceway.
- H. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
- I. Elevated Components: Increase sizes of labels, signs, and letters to those appropriate for viewing from the floor.
- J. Accessible Fittings for Raceways: Identify the covers of each junction and pull box of the following systems with the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
- K. Self-Adhesive Wraparound Labels: Secure tight to surface at a location with high visibility and accessibility.

- L. Self-Adhesive Labels:
 - 1. On each item, install unique designation label that is consistent with wiring diagrams, schedules, and operation and maintenance manual.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letter s on 1-1/2-inch-high label; where two lines of text are required, use labels 2 inches high.
- M. Marker Tapes: Secure tight to surface at a location with high visibility and accessibility.
- N. Self-Adhesive Vinyl Tape: Secure tight to surface at a location with high visibility and accessibility.
 - 1. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches where splices or taps are made. Apply the last two turns of tape with no tension to prevent possible unwinding.
- O. Floor Marking Tape: Apply stripes to finished surfaces following manufacturer's written instructions.
- P. UndergroundLine Warning Tape:
 - 1. During backfilling of trenches, install continuous underground-line warning tape directly above cable or raceway at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.
 - 2. Install underground-line warning tape for direct-buried cables and cables in raceways.
- Q. Laminated Acrylic or Melamine Plastic Signs:
 - 1. Attach signs that are not self -adhesive type with mechanical fasteners appropriate to the location and substrate.
 - 2. Unless otherwise indicated, provide a single line of text with 1/2-inch-high letters on 1-1/2-inch-high sign; where two lines of text are required, use labels 2 inches high.
- R. Cable Ties: General purpose, for attaching tags, except as listed below:
 - 1. In Spaces Handling Environmental Air: Plenum rated.

3.3 IDENTIFICATION SCHEDULE

- A. Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment. Install access doors or panels to provide a view of identifying devices.
- B. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, pull points, and locations of high visibility. Identify by system and circuit designation.

- C. Accessible Fittings for Raceways and Cables within Buildings: Identify the covers of each junction and pull box of the following systems with self -adhesive labels containing the wiring system legend and system voltage. System legends shall be as follows:
 - 1. "EMERGENCY POWER."
- D. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use self-adhesive vinyl tape to identify the phase.
 - 1. Locate identification at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
- E. Control-Circuit Conductor Identification: For conductors and cables in pull and junction boxes, manholes, and handholes, use self-adhesive labels with the conductor or cable designation, origin, and destination.
- F. Control-Circuit Conductor Termination Identification: For identification at terminations, provide self-adhesive labels with the conductor designation.
- G. Auxiliary Electrical Systems Conductor Identification: Self-adhesive vinyl tape that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
- H. Locations of Underground Lines: Underground-line warning tape for power, lighting, communication, and control wiring and optical-fiber cable.
- I. Instructional Signs: Self -adhesive labels, including the color code for grounded and ungrounded conductors.
- J. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Self-adhesive labels.
 - 1. Apply to exterior of door, cover, or other access.
 - 2. For equipment with multiple power or control sources, apply to door or cover of equipment, including, but not limited to, the following:
 - a. Power-transfer switches.
 - b. Controls with external control power connections.
- K. Arc Flash Warning Labeling: Self-adhesive labels.
- L. Equipment Identification Labels:
 - 1. Indoor Equipment: Laminated acrylic or melamine plastic sign.
 - 2. Outdoor Equipment: Laminated acrylic or melamine sign.
 - 3. Equipment to Be Labeled:

- a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be in the form of a engraved, laminated acrylic or melamine label.
- b. Enclosures and electrical cabinets.
- c. Switchboards.
- d. Transformers: Label that includes tag designation indicated on Drawings for the transformer, feeder, and panelboards or equipment supplied by the secondary.
- e. Emergency system boxes and enclosures.
- f. Enclosed switches.
- g. Enclosed circuit breakers.
- h. Enclosed controllers.
- i. Variable-speed controllers.
- j. Contactors.
- k. Remote-controlled switches, dimmer modules, and control devices.
- l. UPS equipment.

END OF SECTION 26 05 53

SECTION 26 05 73.13 - SHORT-CIRCUIT STUDIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes a computer-based, fault-current study to determine the minimum interrupting capacity of circuit protective devices.

1.3 DEFINITIONS

- A. Field Adjusting Agency: An independent electrical testing agency with full -time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- F. SCCR: Short-circuit current rating.
- G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data:
 - 1. For computer software program to be used for studies.

2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - a. Short-circuit study input data, including completed computer program input data sheets.
 - b. Short-circuit study and equipment evaluation report; signed, dated, and sealed by a qualified professional engineer.
 - 1) Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.
 - 2) Revised one-line diagram, reflecting field investigation results and results of short-circuit study.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Software Developer.
2. For Power System Analysis Specialist.
3. For Field Adjusting Agency.

B. Product Certificates: For short-circuit study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data:

1. For overcurrent protective devices to include in emergency, operation, and maintenance manuals.
2. The following are from the Short-Circuit Study Report:
 - a. Final one-line diagram.
 - b. Final Short-Circuit Study Report.
 - c. Short-circuit study datafiles.
 - d. Power system data.

1.7 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with the requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.

1. Power System Analysis Software Qualifications: Computer program shall be designed to perform short-circuit studies or have a function, component, or add-on module designed to perform short-circuit studies.
 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- D. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- E. Short-Circuit Study Certification: Short-Circuit Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- F. Field Adjusting Agency Qualifications:
1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 2. A member company of NETA.
 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, utilize products by one of the following:
1. EasyPower, LLC (formerly ESA Inc.).
 2. SKM Systems Analysis, Inc.
- B. Comply with IEEE 399 and IEEE 551.
1. Analytical features of power systems analysis software program shall have capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output.

2.2 SHORT-CIRCUIT STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
1. Protective device designations and ampere ratings.

2. Conductor types, sizes, and lengths.
 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 4. Motor and generator designations and kVA ratings.
 5. Switchgear, switchboard, motor-control center, and panelboard designations and ratings.
 6. Derating factors and environmental conditions.
 7. Any revisions to electrical equipment required by the study.
- D. Comments and recommendations for system improvements or revisions in a written document, separate from one-line diagram.
- E. Protective Device Evaluation:
1. Evaluate equipment and protective devices and compare to available short -circuit currents. Verify that equipment withstand ratings exceed available short-circuit current at equipment installation locations.
 2. Tabulations of circuit breaker, fuse, and other protective device ratings versus calculated short-circuit duties.
 3. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
 4. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in standards to 1/2-cycle symmetrical fault current.
 5. Verify adequacy of phase conductors at maximum three -phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
- F. Short-Circuit Study Input Data:
1. One-line diagram of system being studied.
 2. Power sources available.
 3. Manufacturer, model, and interrupting rating of protective devices.
 4. Conductors.
 5. Transformer data.
- G. Short-Circuit Study Output Reports:
1. Low-Voltage Fault Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. Equivalent impedance.
 2. Momentary Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.

- d. Calculated asymmetrical fault currents:
 - 1) Based on fault-point X/R ratio.
 - 2) Based on calculated symmetrical value multiplied by 1.6.
 - 3) Based on calculated symmetrical value multiplied by 2.7.
3. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each overcurrent device location:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

PART 3 - EXECUTION

3.1 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the study.
 1. Verify completeness of data supplied on one-line diagram. Call any discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
- B. Gather and tabulate the required input data to support the short-circuit study. Comply with requirements in Section 017839 "Project Record Documents" for recording circuit protective device characteristics. Record data on a Record Document copy of one-line diagram. Comply with recommendations in IEEE 551 as to the amount of detail that is required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
 1. Product Data for Project's overcurrent protective devices involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Obtain electrical power utility impedance at the service.
 3. Power sources and ties.
 4. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 5. For reactors, provide manufacturer and model designation, voltage rating, and impedance.

6. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip, SCCR, current rating, and breaker settings.
7. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
8. Busway manufacturer and model designation, current rating, impedance, lengths, and conductor material.
9. Motor horsepower and NEMA MG 1 code letter designation.
10. Conductor sizes, lengths, number, conductor material and conduit material (magnetic or nonmagnetic).
11. Derating factors.

3.2 SHORT-CIRCUIT STUDY

- A. Perform study following the general study procedures contained in IEEE 399.
- B. Calculate short-circuit currents according to IEEE 551.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Begin short-circuit current analysis at the service, extending down to system overcurrent protective devices as follows:
 1. To normal system low-voltage load buses where fault current is 10 kA or less.
- E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- F. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for the fault-current dc decrement to address asymmetrical requirements of interrupting equipment.
- G. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
- H. Include in the report identification of any protective device applied outside its capacity.

END OF SECTION 26 05 73.13

SECTION 26 05 73.16 - COORDINATION STUDIES**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes computer-based, overcurrent protective device coordination studies to determine overcurrent protective devices and to determine overcurrent protective device settings for selective tripping.

1.3 DEFINITIONS

- A. Field Adjusting Agency: An independent electrical testing agency with full -time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- D. Power System Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion of the circuit from the system.
- F. SCCR: Short-circuit current rating.
- G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

A. Product Data:

1. For computer software program to be used for studies.
2. Submit the following after the approval of system protective devices submittals. Submittals shall be in digital form.
 - a. Coordination-study input data, including completed computer program input data sheets.
 - b. Study and equipment evaluation reports.
3. Overcurrent protective device coordination study report; signed, dated, and sealed by a qualified professional engineer.
 - a. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data:

1. For Power Systems Analysis Specialist.
2. For Field Adjusting Agency.

B. Product Certificates: For overcurrent protective device coordination study software, certifying compliance with IEEE 399.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For overcurrent protective devices to include in emergency, operation, and maintenance manuals.

1. The following are from the Coordination Study Report:
 - a. Final one-line diagram.
 - b. Final protective device coordination study.
 - c. Coordination study datafiles.
 - d. List of all protective device settings.
 - e. Time-current coordination curves.
 - f. Power system data.

1.7 QUALITY ASSURANCE

- A. Studies shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with the requirements of standards and guides specified in this Section.

- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications:
 - 1. Computer program shall be designed to perform coordination studies or have a function, component, or add-on module designed to perform coordination studies.
 - 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Field Adjusting Agency Qualifications:
 - 1. Employer of a NETA ETT-Certified Technician Level III responsible for all field adjusting of the Work.
 - 2. A member company of NETA.
 - 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 POWER SYSTEM ANALYSIS SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, utilize products by one of the following:
 - 1. EasyPower, LLC (formerly ESA Inc.).
 - 2. Operation Technology, Inc.
 - 3. SKM Systems Analysis, Inc.
- B. Comply with IEEE 242 and IEEE 399.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.
- D. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.
 - 1. Optional Features:
 - a. Arcing faults.
 - b. Simultaneous faults.

- c. Explicit negative sequence.
- d. Mutual coupling in zero sequence.

2.2 COORDINATION STUDY REPORT CONTENTS

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.
- C. One-line diagram of modeled power system, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, and panelboard designations.
 - 6. Any revisions to electrical equipment required by the study.
 - 7. Study Input Data: As described in "Power System Data" Article.
 - a. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
- D. Protective Device Coordination Study:
 - 1. Report recommended settings of protective devices, ready to be applied in the field. Use manufacturer's data sheets for recording the recommended setting of overcurrent protective devices when available.
 - a. Phase and Ground Relays:
 - 1) Device tag.
 - 2) Relay current transformer ratio and tap, time dial, and instantaneous pickup value.
 - 3) Recommendations on improved relaying systems, if applicable.
 - b. Circuit Breakers:
 - 1) Adjustable pickups and time delays (long time, short time, and ground).
 - 2) Adjustable time-current characteristic.
 - 3) Adjustable instantaneous pickup.
 - 4) Recommendations on improved trip systems, if applicable.
 - c. Fuses: Show current rating, voltage, and class.
- E. Time-Current Coordination Curves: Determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's

upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

1. Device tag and title, one-line diagram with legend identifying the portion of the system covered.
2. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which the device is exposed.
3. Identify the device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
4. Plot the following listed characteristic curves, as applicable:
 - a. Power utility's overcurrent protective device.
 - b. Medium-voltage equipment overcurrent relays.
 - c. Medium- and low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
 - d. Low-voltage equipment circuit-breaker trip devices, including manufacturer's tolerance bands.
 - e. Transformer full-load current, magnetizing inrush current, and ANSI through-fault protection curves.
 - f. Cables and conductors damage curves.
 - g. Ground-fault protective devices.
 - h. Motor-starting characteristics and motor damagepoints.
 - i. Generator short-circuit decrement curve and generator damagepoint.
 - j. The largest feeder circuit breaker in each motor -control center and panelboard.
5. Maintain selectivity for tripping currents caused by overloads.
6. Maintain maximum achievable selectivity for tripping currents caused by overloads on series-rated devices.
7. Provide adequate time margins between device characteristics such that selective operation is achieved.
8. Comments and recommendations for system improvements.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance of the Work. Devices to be coordinated are indicated on Drawings.
 1. Proceed with coordination study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to coordination study may not be used in study.

3.2 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the overcurrent protective device study.

1. Verify completeness of data supplied in one-line diagram on Drawings. Call any discrepancies to Architect's attention.
 2. For equipment included as Work of this Project, use characteristics submitted under provisions of action submittals and information submittals for this Project.
- B. Gather and tabulate all required input data to support the coordination study. List below is a guide. Comply with recommendations in IEEE 551 for the amount of detail required to be acquired in the field. Field data gathering shall be under direct supervision and control of the engineer in charge of performing the study and shall be by the engineer or its representative who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification. Data include, but are not limited to, the following:
1. Product Data for overcurrent protective devices specified in other Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
 2. Electrical power utility impedance at the service.
 3. Power sources and ties.
 4. Short-circuit current at each system bus (three phase and line to ground).
 5. Full-load current of all loads.
 6. Voltage level at each bus.
 7. For transformers, include kVA, primary and secondary voltages, connection type, impedance, X/R ratio, taps measured in percent, and phase shift.
 8. For reactors, provide manufacturer and model designation, voltage rating, and impedance.
 9. For circuit breakers and fuses, provide manufacturer and model designation. List type of breaker, type of trip and available range of settings, SCCR, current rating, and breaker settings.
 10. Generator short-circuit current contribution data, including short-circuit reactance, rated kVA, rated voltage, and X/R ratio.
 11. For relays, provide manufacturer and model designation, current transformer ratios, potential transformer ratios, and relay settings.
 12. Maximum demands from service meters.
 13. Busway manufacturer and model designation, current rating, impedance, lengths, size, and conductor material.
 14. Motor horsepower and NEMA MG 1 code letter designation.
 15. Low-voltage cable sizes, lengths, number, conductor material, and conduit material (magnetic or nonmagnetic).
 16. Medium-voltage cable sizes, lengths, conductor material, cable construction, metallic shield performance parameters, and conduit material (magnetic or nonmagnetic).
 17. Data sheets to supplement electrical distribution system one -line diagram, cross -referenced with tag numbers on diagram, showing the following:
 - a. Special load considerations, including starting inrush currents and frequent starting and stopping.

- b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
- c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
- d. Generator thermal-damage curve.
- e. Ratings, types, and settings of utility company's overcurrent protective devices.
- f. Special overcurrent protective device settings or types stipulated by utility company.
- g. Time-current-characteristic curves of devices indicated to be coordinated.
- h. Manufacturer, frame size, interrupting rating in amperes root mean square (rms) symmetrical, ampere or current sensor rating, long -time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
- i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
- j. Switchgear, switchboards, motor-control centers, and panelboards ampacity, and SCCR in amperes rms symmetrical.
- k. Identify series-rated interrupting devices for a condition where the available fault current is greater than the interrupting rating of downstream equipment. Obtain device data details to allow verification that series application of these devices complies with NFPA 70 and UL 489 requirements.

3.3 COORDINATION STUDY

- A. Comply with IEEE 242 for calculating short-circuit currents and determining coordination time intervals.
- B. Comply with IEEE 399 for general study procedures.
- C. Base study on device characteristics supplied by device manufacturer.
- D. Begin analysis at the service, extending down to system overcurrent protective devices as follows:
 - 1. To normal system low-voltage load buses where fault current is 10 kA or less.
- E. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Study all cases of system-switching configurations and alternate operations that could result in maximum fault conditions.
- F. Transformer Primary Overcurrent Protective Devices:
 - 1. Device shall not operate in response to the following:
 - a. Inrush current when first energized.
 - b. Self-cooled, full-load current or forced-air-cooled, full-load current,

- whichever is specified for that transformer.
 - c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.
 - 2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.
 - G. Motor Protection:
 - 1. Select protection for low-voltage motors according to IEEE 242 and NFPA 70.
 - H. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and protection recommendations in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.
 - I. Include the ac fault-current decay from induction motors, synchronous motors, and asynchronous generators and apply to low- and medium-voltage, three-phase ac systems. Also account for fault-current dc decrement, to address asymmetrical requirements of interrupting equipment.
 - J. Calculate short-circuit momentary and interrupting duties for a three-phase bolted fault and a single line-to-ground fault at each equipment indicated on one-line diagram.
 - 1. For grounded systems, provide a bolted line-to-ground fault-current study for areas as defined for the three-phase bolted fault short-circuit study.
 - K. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short-circuit ratings.
 - 2. Adequacy of switchgear, motor-control centers, and panelboard bus bars to withstand short-circuit stresses.
 - 3. Include in the report identification of any protective device applied outside its capacity.
- ### 3.4 FIELD ADJUSTING
- A. Adjust relay and protective device settings according to recommended settings provided by the coordination study. Field adjustments shall be completed by the engineering service division of the equipment manufacturer under the "Startup and Acceptance Testing" contract portion.
 - B. Make minor modifications to equipment as required to accomplish compliance with short-circuit and protective device coordination studies.
 - C. Testing and adjusting shall be by a full-time employee of the Field Adjusting Agency, who holds NETA ETT-Certified Technician Level III or NICET Electrical Power Testing

Level III certification.

1. Perform each visual and mechanical inspection and electrical test stated in NETA ATS. Certify compliance with test parameters. Perform NETA tests and inspections for all adjustable overcurrent protective devices.

3.5 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in the following:
 1. Acquaint personnel in fundamentals of operating the power system in normal and emergency modes.
 2. Hand-out and explain the coordination study objectives, study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpreting time-current coordination curves.
 3. For Owner's maintenance staff certified as NETA ETT-Certified Technicians Level III or NICET Electrical Power Testing Level III Technicians, teach how to adjust, operate, and maintain overcurrent protective device settings.

END OF SECTION 26 05 73.16

SECTION 26 05 73.19 - ARC-FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes a computer-based, arc-flash study to determine the arc-flash hazard distance and the incident energy to which personnel could be exposed during work on or near electrical equipment.

1.3 DEFINITIONS

- A. Field Adjusting Agency: An independent electrical testing agency with full -time employees and the capability to adjust devices and conduct testing indicated and that is a member company of NETA.
- B. One-Line Diagram: A diagram that shows, by means of single lines and graphic symbols, the course of an electric circuit or system of circuits and the component devices or parts used therein.
- C. Power System Analysis Software Developer: An entity that commercially develops, maintains, and distributes computer software used for power system studies.
- D. Power Systems Analysis Specialist: Professional engineer in charge of performing the study and documenting recommendations, licensed in the state where Project is located.
- E. Protective Device: A device that senses when an abnormal current flow exists and then removes the affected portion from the system.
- F. SCCR: Short-circuit current rating.
- G. Service: The conductors and equipment for delivering electric energy from the serving utility to the wiring system of the premises served.
- H. Single-Line Diagram: See "One-Line Diagram."

1.4 ACTION SUBMITTALS

- A. Product Data: For computer software program to be used for studies.
- B. Study Submittals: Submit the following submittals after the approval of system protective devices submittals. Submittals shall be in digital form:
 - 1. Arc-flash study input data, including completed computer program input data sheets.
 - 2. Arc-flash study report; signed, dated, and sealed by Power Systems Analysis Specialist.
 - 3. Submit study report for action prior to receiving final approval of distribution equipment submittals. If formal completion of studies will cause delay in equipment manufacturing, obtain approval from Architect for preliminary submittal of sufficient study data to ensure that selection of devices and associated characteristics is satisfactory.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data:
 - 1. For Power Systems Analysis Software Developer.
 - 2. For Power System Analysis Specialist.
 - 3. For Field Adjusting Agency.
- B. Product Certificates: For arc-flash hazard analysis software, certifying compliance with IEEE 1584 and NFPA 70E.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data:
 - 1. Provide maintenance procedures in equipment manuals according to requirements in NFPA 70E.
 - 2. Operation and Maintenance Procedures: In addition to items specified in Section 017823 "Operation and Maintenance Data," provide maintenance procedures for use by Owner's personnel that comply with requirements in NFPA 70E.

1.7 QUALITY ASSURANCE

- A. Study shall be performed using commercially developed and distributed software designed specifically for power system analysis.
- B. Software algorithms shall comply with requirements of standards and guides specified in this Section.
- C. Manual calculations are unacceptable.
- D. Power System Analysis Software Qualifications: An entity that owns and markets

computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Computer program shall be designed to perform arc-flash analysis or have a function, component, or add-on module designed to perform arc-flash analysis.
 2. Computer program shall be developed under the charge of a licensed professional engineer who holds IEEE Computer Society's Certified Software Development Professional certification.
- E. Power Systems Analysis Specialist Qualifications: Professional engineer in charge of performing the arc-flash study, analyzing the arc flash, and documenting recommendations, licensed in the state where Project is located. All elements of the study shall be performed under the direct supervision and control of this professional engineer.
- F. Arc-Flash Study Certification: Arc-Flash Study Report shall be signed and sealed by Power Systems Analysis Specialist.
- G. Field Adjusting Agency Qualifications:
1. Employer of a NETA ETT-Certified Technician Level III or NICET Electrical Power Testing Level III certification responsible for all field adjusting of the Work.
 2. A member company of NETA.
 3. Acceptable to authorities having jurisdiction.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE DEVELOPERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. EasyPower, LLC (formerly ESA Inc.).
 2. Operation Technology, Inc.
 3. SKM Systems Analysis, Inc.
- B. Comply with IEEE 1584 and NFPA 70E.
- C. Analytical features of device coordination study computer software program shall have the capability to calculate "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

2.2 ARC-FLASH STUDY REPORT CONTENT

- A. Executive summary of study findings.
- B. Study descriptions, purpose, basis, and scope. Include case descriptions, definition of terms, and guide for interpretation of results.

- C. One-line diagram, showing the following:
 - 1. Protective device designations and ampere ratings.
 - 2. Conductor types, sizes, and lengths.
 - 3. Transformer kilovolt ampere (kVA) and voltage ratings, including derating factors and environmental conditions.
 - 4. Motor and generator designations and kVA ratings.
 - 5. Switchgear, switchboard, motor-control center, panelboard designations, and ratings.

- D. Study Input Data: As described in "Power System Data" Article.

- E. Short-Circuit Study Output Data: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."

- F. Protective Device Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

- G. Arc-Flash Study Output Reports:
 - 1. Interrupting Duty Report: Three-phase and unbalanced fault calculations, showing the following for each equipment location included in the report:
 - a. Voltage.
 - b. Calculated symmetrical fault-current magnitude and angle.
 - c. Fault-point X/R ratio.
 - d. No AC Decrement (NACD) ratio.
 - e. Equivalent impedance.
 - f. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a symmetrical basis.
 - g. Multiplying factors for 2-, 3-, 5-, and 8-cycle circuit breakers rated on a total basis.

- H. Incident Energy and Flash Protection Boundary Calculations:
 - 1. Arcing fault magnitude.
 - 2. Protective device clearing time.
 - 3. Duration of arc.
 - 4. Arc-flash boundary.
 - 5. Restricted approach boundary.
 - 6. Limited approach boundary.

 - 7. Working distance.
 - 8. Incident energy.
 - 9. Hazard risk category.
 - 10. Recommendations for arc-flash energy reduction.

- I. Fault study input data, case descriptions, and fault-current calculations including a definition of terms and guide for interpretation of computer printout.

2.3 ARC-FLASH WARNING LABELS

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems" for self-adhesive equipment labels. Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.
- B. Label shall have an orange header with the wording, "WARNING, ARC -FLASH HAZARD," and shall include the following information taken directly from the arc -f lash hazard analysis:
 - 1. Location designation.
 - 2. Nominal voltage.
 - 3. Protection boundaries.
 - a. Arc-flash boundary.
 - b. Restricted approach boundary.
 - c. Limited approach boundary.
 - 4. Arc flash PPE category.
 - 5. Required minimum arc rating of PPE in Cal/cm squared.
 - 6. Available incident energy.
 - 7. Working distance.
 - 8. Engineering report number, revision number, and issue date.
- C. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine Project overcurrent protective device submittals. Proceed with arc -flash study only after relevant equipment submittals have been assembled. Overcurrent protective devices that have not been submitted and approved prior to arc-flash study may not be used in study.

3.2 ARC-FLASH HAZARD ANALYSIS

- A. Comply with NFPA 70E and its Annex D for hazard analysis study.
- B. Preparatory Studies: Perform the Short-Circuit and Protective Device Coordination studies prior to starting the Arc-Flash Hazard Analysis.
 - 1. Short-Circuit Study Output: As specified in "Short-Circuit Study Output Reports" Paragraph in "Short-Circuit Study Report Contents" Article in Section 260573.13 "Short-Circuit Studies."
 - 2. Coordination Study Report Contents: As specified in "Coordination Study Report Contents" Article in Section 260573.16 "Coordination Studies."

- C. Calculate maximum and minimum contributions of fault-current size.
 - 1. Maximum calculation shall assume a maximum contribution from the utility and shall assume motors to be operating under full-load conditions.
 - 2. Calculate arc-flash energy at 85 percent of maximum short-circuit current according to IEEE 1584 recommendations.
 - 3. Calculate arc-flash energy with the utility contribution at a minimum and assume no motor contribution.
- D. Calculate the arc-flash protection boundary and incident energy at locations in electrical distribution system where personnel could perform work on energized parts.
- E. Include low-voltage equipment locations, except equipment rated 240 V ac or less fed from transformers less than 125 kVA.
- F. Calculate the limited, restricted, and prohibited approach boundaries for each location.
- G. Incident energy calculations shall consider the accumulation of energy over time when performing arc-flash calculations on buses with multiple sources. Iterative calculations shall take into account the changing current contributions, as the sources are interrupted or decremented with time. Fault contribution from motors and generators shall be decremented as follows:
 - 1. Fault contribution from induction motors shall not be considered beyond three to five cycles.
 - 2. Fault contribution from synchronous motors and generators shall be decayed to match the actual decrement of each as closely as possible (for example, contributions from permanent magnet generators will typically decay from 10 per unit to three per unit after 10 cycles).
- H. Arc-flash energy shall generally be reported for the maximum of line or load side of a circuit breaker. However, arc-flash computation shall be performed and reported for both line and load side of a circuit breaker as follows:
 - 1. When the circuit breaker is in a separate enclosure.
 - 2. When the line terminals of the circuit breaker are separate from the work location.
- I. Base arc-flash calculations on actual overcurrent protective device clearing time. Cap maximum clearing time at two seconds based on IEEE 1584, Section B.1.2.

3.3 POWER SYSTEM DATA

- A. Obtain all data necessary for conduct of the arc-flash hazard analysis.
 - 1. Verify completeness of data supplied on one-line diagram on Drawings and under "Preparatory Studies" Paragraph in "Arc-Flash Hazard Analysis" Article. Call discrepancies to Architect's attention.
 - 2. For new equipment, use characteristics from approved submittals under

provisions of action submittals and information submittals for this Project.

3.4 LABELING

- A. Apply arc-flash label on the front cover of each section of the equipment for each equipment included in the study. Base arc-flash label data on highest values calculated at each location.
- B. Each piece of equipment listed below shall have an arc-flash label applied to it:
 - 1. Low-voltage switchboard.
 - 2. Panelboard and safety switch over 250 V.
 - 3. Applicable panelboard and safety switch under 250 V.
 - 4. Control panel.
- C. Note on record Drawings the location of equipment where the personnel could be exposed to arc-flash hazard during their work.
 - 1. Indicate arc-flash energy.
 - 2. Indicate protection level required.

3.5 APPLICATION OF WARNING LABELS

- A. Install arc-flash warning labels under the direct supervision and control of Power System Analysis Specialist.

3.6 DEMONSTRATION

- A. Engage Power Systems Analysis Specialist to train Owner's maintenance personnel in potential arc-flash hazards associated with working on energized equipment and the significance of arc-flash warning labels.

END OF SECTION 26 05 73.19

SECTION 26 08 00 - COMMISSIONING OF ELECTRICAL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes commissioning process requirements for ELECTRICAL systems, assemblies, and equipment.
- B. Provide documentation and testing of these systems, as well as training of the Owner's operation and maintenance personnel. Work with the Commissioning Authority and in cooperation with other members of the commissioning team to ensure compliance.
- C. Refer to Section 01 91 13 GENERAL COMMISSIONING REQUIREMENTS for commissioning requirements.
- D. Related Sections:
 - 1. Division 01 Section "General Commissioning Requirements" for commissioning process requirements.
 - 2. Division 23 Sections related to Testing, Adjusting and Balancing (TAB).
 - 3. Division 23 Sections related to Building Direct Digital Control (DDC) System.

1.3 COMMISSIONING

- A. This section governs the commissioning of Electrical systems.
- B. The following systems and equipment shall be commissioned, where applicable.
 - 1. Switchgear/Switchboards
 - 2. Disconnect Switches
 - 3. Circuit Breakers
 - 4. Motor Controllers
 - 5. Automatic Transfer Switches
 - 6. Emergency Power Generators and Distribution Systems
 - 7. Lighting and Lighting Controls
 - 8. Fire Alarm System/Equipment
 - 9. Motors

10. Electric Distribution Power Monitoring System

- C. Refer to Division 01. Section 01 91 13, "General Commissioning Requirements" for the Work related to commissioning of these systems.

PART 2 - PRODUCTS: NOT USED

PART 3 - EXECUTION: NOT USED

END OF SECTION

SECTION 26 09 13 - ELECTRICAL POWER MONITORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
 - 1. Multifunction energy meters.
 - 2. Power monitoring software.
 - 3. Monitoring of power distribution equipment.
 - 4. System operator interfaces.
 - 5. Raceways and boxes.
 - 6. Wires and cables.

1.2 DEFINITIONS

- A. Active Power: The average power consumed by a unit. Also known as "real power."
- B. Analog: A continuously varying signal value, such as current, flow, pressure, or temperature.
- C. Apparent (Phasor) Power: " $S = VI$ " where "S" is the apparent power, "V" is the RMS value of the voltage, and "I" is the RMS value of the current.
- D. Firmware: Software (programs or data) that has been written onto read-only memory (ROM). Firmware is a combination of software and hardware. Storage media with ROMs that have data or programs recorded on them are firmware.
- E. L-G: Line to ground.
- F. L-L: Line to line.
- G. L-N: Line to neutral.
- H. MODBUS TCP/IP: An open protocol for exchange of process data.
- I. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.
- J. N-G: Neutral to ground.
- K. Power Factor: The ratio of active power to apparent power, sometimes expressed in percentage.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for power monitoring and control.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For power monitoring equipment.
1. Include plans, elevations, sections, and attachment details.
 2. Include details of equipment assemblies. Indicate dimensions, method of field assembly, components, and location and size of each field connection.
 - a. Attach copies of approved Product Data submittals for products (such as switchboards, switchgear, and motor-control centers) that describe the following:
 - 1) Location of the meters and gateways, and routing of the connecting wiring.
 - 2) Details of power monitoring and control features to illustrate coordination among related equipment and power monitoring and control.
 3. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.
 4. Network naming and numbering scheme.
 5. Include diagrams for power, signal, and control wiring. Coordinate nomenclature and presentation with a block diagram.
 6. Specifications for workstations.
 7. UPS sizing calculations for workstation.
 8. Surge Suppressors: Data for each device used and where applied.

1.4 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.
- B. Design Data:
1. Manufacturer's system installation and setup guides, with data forms to plan and record options and setup decisions.
 - a. Project Record Drawings of as-built versions of submittal Shop Drawings provided in electronic PDF format on compact disk or portable storage device with a USB interface.
 - b. Testing and commissioning reports and checklists of completed final versions of reports, checklists, and trend logs.
 - c. As-built versions of submittal Product Data.
 - d. Names, addresses, e-mail addresses, and 24-hour telephone numbers of Installer and service representatives for the system and products.
 - e. Operator's manual with procedures for operating control systems including logging on and off, handling alarms, producing point reports, trending data, overriding computer control, and changing set points and variables.
 - f. Programming manuals with description of programming language and syntax, of statements for algorithms and calculations used, of point database creation and modification, of program creation and modification, and of editor use.
 - g. Engineering, installation, and maintenance manuals that explain how to do the following:

- 1) Design and install new points, panels, and other hardware.
 - 2) Perform preventive maintenance and calibration.
 - 3) Debug hardware problems.
 - 4) Repair or replace hardware.
- h. Documentation of programs created using custom programming language including set points, tuning parameters, and object database.
 - i. Backup copy of graphic files, programs, and database on compact disk or portable storage device with a USB interface.
 - j. Complete original-issue documentation, installation, and maintenance information for furnished third-party hardware including computer equipment and sensors.
 - k. Complete original-issue copies of furnished software, including operating systems, custom programming language, workstation software, and graphics software on compact disk or portable storage device with a USB interface.
 - l. Recommended preventive maintenance procedures for system components, including schedule of tasks such as inspection, cleaning, and calibration; time between tasks; and task descriptions.
 - m. Owner training materials.

1.5 COORDINATION

- A. Coordinate features of distribution equipment and power monitoring and control components to form an integrated interconnection of compatible components.
 1. Match components and interconnections for optimum performance of specified functions.
- B. Coordinate Work of this Section with those in Sections specifying distribution components that are monitored or controlled by power monitoring and control equipment.

PART 2 - PRODUCTS

2.1 SYSTEM DESCRIPTION

- A. Microprocessor-based advanced energy metering of electrical power distribution system(s) that includes the following:
 1. Meters must be permanently installed, record at intervals of 15 minutes or less, and transmit data to a remote location.
 2. Electricity meters must record both consumption and demand. Whole-building electricity meters shall record the power factor.
 3. The data collection system must use a local area network, building automation system, wireless network, or comparable communication infrastructure
 4. The system must be capable of storing all meter data for at least 36 months.
 5. The data must be remotely accessible.
 6. All meters in the system must be capable of reporting hourly, daily, monthly, and annual energy use.
- B. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with UL 61010-1 and marked for intended location and application.
- C. Meet the requirements of LEED v4 Advanced Energy Metering credit.

2.2 PERFORMANCE REQUIREMENTS

A. Multi-Point Metering (MPM) requirements.

1. ANSI C12.20 0.5 accuracy class for sub-metering of loads with 125A, 250A and 400 A solid core current sensors with voltage clamping circuits.
2. The MPM metering modules shall meet ANSI C12.20 0.5 accuracy class.
3. The metering system shall be modular in construction with capacity for up to 60 current channels configurable for 20 three phase, 30 two pole or 60 one pole loads or combination thereof.
4. The MPM design shall permit the use of solid core 100mA sensors, split core 333mV sensors and 5A current transformers on the same MPM.
5. MPM shall support up to 80 channels of pulse metering of other utilities such as Water, Gas, Steam and chilled water.
6. Load Profile intervals shall be configurable as 15, 30 or 60 minutes or controllable from a Demand Synch input.
7. Demand Interval shall be configurable as 15, 30 or 60 minutes.
8. Interval-by-interval data storage of demand readings shall be programmable from 1-60 minutes.
9. Sufficient memory for a minimum of 3 years of 15-minute interval data

B. MPM Configuration

1. MPM shall include a configuration port compatible with a temporary laptop connection such as a USB interface.
2. The MPM shall be field configurable for combinations of 1, 2 or 3 pole sub-meters with the use of intuitive graphical configuration software.

C. Communications Capabilities

1. The MPM shall support two RS-485 MODBUS communications ports to facilitate simultaneous communications to a local HMI display and to a communications gateway.
2. The MPM shall support Ethernet communications including Modbus TCP, BACnet/IP, HTTPS, SFTP, SNMP, SMTP and NTP

D. WEB Enabled Capabilities

1. Embedded configurable WEB server shall support individual operator usernames and passwords.
2. Web pages shall support HTTPS to protect usernames, passwords, and metering data from being transmitted in the clear on communications packets.
3. Energy and Power comparisons between user selectable time periods
4. Three years of 15-minute historical data shall be stored in .csv file formats on an SFTP directory in the embedded device.
5. Circuit dashboards shall support importing of customer one-line or plan view graphic images and configurable MPM hotspot links on the graphic linked to MPM data.
6. Dashboards shall be configurable to support user preferred dashboard views.

E. Metering Data

1. Whole Building Data - The MPM shall report the present value of metering data representing a whole building. Readings for the whole building meter shall include:
 - a. Meter Name (32 Characters)
 - b. Watts, vars and VA per phase and system
 - c. Per phase Volts L-N and Volts L-L

- d. Frequency
 - e. System Power Factor
 - f. kWh, forward and reverse
 - g. kvarh, Q1, Q2, Q3 and Q4
 - h. kVAh imported (Q1,Q4) and exported (Q2,Q3)
 - i. Block interval demand (1-60 minutes programmable)
 - j. Peak interval demand with Date/Time of peak
 - k. Minimum and Maximum readings including date and time of min/max shall be reported for:
 - 1) Watts, vars and VA per phase and system, Per phase Volts L-N and Volts L-L, Frequency and System Power Factor
2. Sub-meter readings - MPM shall report aggregated power and energy readings for combinations of channels configured as three phase, two pole and single pole sub-meters. Readings for the Sub-meters shall include:
 - a. Present RMS readings for Watts, Vars and VA (total)
 - b. W and kWh
 - c. var and kvarh
 - d. kVAh
 - e. Block interval demand (1-60 minutes programmable)
 3. Pulse Input Module – MPM reports for up to 80 Pulse input channels.
- F. Historical Data
1. MPM shall store interval-based Load Profile readings in non-volatile memory which can be retrieved by MPM configuration software or accessed by the Energy Portal Module.
 2. Stored data for the Main System and Submeters.
 3. Stored data for up to 81 configured Pulse Input channel.

2.3 MICROPROCESSOR-BASED METERING EQUIPMENT

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:
1. Eaton. (Power Xpert – Basis of Design)
 2. Schneider Electric USA, Inc. (Power Logic)
- B. Power Xpert Branch Circuit Monitor: Where shown on the drawings, supply a UL listed microprocessor-based Branch Circuit Monitoring System (PXBCM), or approved equal having the specified features, this system shall consist of meter base, and meter module(s) as described below.
1. Capable of metering four-wire wye, three-wire wye, three-wire delta, and single-phase power systems.
 2. The Branch Circuit Monitor shall measure the following operational data for up to 84 branch load circuits.
 - a. Forward and Reverse kWh
 - b. Watts, VA, Amps, Power Factor
 - c. Present and Peak demand readings for Amps, Forward and Reverse Watts
 - d. Maximum Watts, VA, Amps
 3. Branch Circuit monitor shall support upgradeable firmware via communications.
 4. The Branch Circuit Monitor shall have the following ratings:
 - a. Elevation: 0 – 9843 ft (0 – 3000M)
 - b. Ambient temperature range: -4°F – +158°F
 - c. Storage temperature range: -40°F - +185°F
 - d. Humidity: 5% – 95% non-condensing

- e. PXBCM as a component shall have a NEMA 1 rating. When installed in an enclosure it shall have the same rating as its enclosure.
- f. UL 61010-1 3rd edition
- 5. PXBCM Meter Base
 - a. Each PXBCM-MB Meter Base shall support connection of up to 4 Meter Modules in either an MMS Strip or MME External configuration monitoring a total of up to 100 single-phase two-wire AC loads, 48 single-phase three-wire AC loads or 32 three-phase four-wire AC loads or combinations not to exceed 25 poles per meter module.
 - b. The PXBCM-MB shall be equipped with 4-meter module ports. Each port shall provide control power and communications to either a PXBCM-MMS Meter Module Strip or a PXBCM-MME Meter Module External with a maximum cable length of 28ft between each Meter Base and each Meter Module.
 - c. Each PXBCM-MB shall support connection to up to 4 PXBCM-MMS Meter Module Strip or 4 PXBCM-MME Meter Module External, or a combination of up to 4 total PXBCM-MMS and PXBCM-MME each meter module with independent single or three phase voltage metering circuits with inputs up to 277V L-N and 480V L-L.
 - d. PXBCM-MB Power Supply shall be rated for 100-277VAC L-N +/-10% CAT III, 47-63 Hz, 6W.
 - e. The PXBCM-MB embedded WEB server shall support device configuration for to up to 4 PXBCM-MMS Meter Module Strip or 4 PXBCM-MME Meter Module External, or a combination of up to 4 total PXBCM-MMS and PXBCM-MME and display of up to 100 points of metering data. It shall be possible to save device configuration information to a file for archiving and for uploading to PXBCM.
 - f. The PXBCM-MB shall support connection to a pre-configured HMI via RS-485 serial port. The HMI shall not require configuration.
 - g. The PXBCM-MB shall be equipped with LEDs to indicate communications activity and Device/Alarm Status. An LED shall also indicate if Ethernet is configured for DHCP (automatically assigned IP address) or Fixed IP (manually assigned IP address). The PXBCM-MB shall be equipped with 2 rotary switches to assign Modbus Slave ID 1-99.
 - h. The PXBCM-MB shall be equipped with security mode switches to enable the device to operate in a secure mode to prevent tampering with device configuration and resets over comms.
 - i. The PXBCM Meter Base shall automatically sense the type of PXBCM Meter Module connected to each of its 4-meter module ports.
 - j. The Configuration wizard shall support naming and configuration of up to 100 virtual meters by assigning 1-3 channels of current to 1, 2 or 3 pole meters. Virtual meters shall aggregate the channel data assigned to each virtual meter and report the aggregated virtual meter values for:
 - 1) Forward and Reverse Energy
 - 2) Watts, VA, Average Amps and Power Factor
 - 3) Average and Peak demand for Watts and VA
- 6. PXBCM-MMS Meter Module Strip
 - a. PXBCM-MMS Meter Module Strips shall be available in configurations to mount on either the left or right of a panelboard and contain 9, 15, or 21 CTs. Four additional 333mV connections shall be provided on each PXBCM-MMS for Auxiliary 333mV CT connections which can be used to monitor the panel mains or branch circuits. The MMS shall include both load current and voltage metering circuits providing meter data to the Meter Base.
 - b. The PXBCM Meter Module Strip shall be available with either 9 CT's, 15 CT's or 21 CT's per assembly for factory assembly into Panelboards with 18, 30 or 42 poles. PXBCM MMS CT's shall have been rated for up to 100A continuous current monitoring and designed to mount in an Eaton PRL-1a, PRS-2a or PRL-3e Panelboard with 1 inch breaker pole spacing.

- c. The PXBCM Meter Module Strip shall support direct connection of one set of 3 phase nominal metering voltage inputs up to 277V L-N and 480V L-L voltages and shall be rated as CatIII.
 - d. Power and Energy metering shall be performed based on the voltage assignment for each 100A strip mounted CT and 333mV Aux CT current input as configured using the embedded WEB server.
 - e. PXBCM MMS Accuracy of kWh metering on branch circuits shall be rated for ANSI C12.20 0.5 accuracy class as a system, including 100A rated strip mounted solid core current transformers. kWh accuracy for 333mV input auxiliary circuits shall satisfy ANSI C12.20 0.5 class excluding external 333mV sensor performance.
 - f. The PXBCM-MMS shall be UL approved for mounting to the panelboard interior with no interference. Strip placement shall line up 1 inch center CT's with breaker poles and not impede the normal routing of branch circuit conductors in the panel enclosure.
 - g. The PXBCM-MMS shall connect to the PXBCM MB using factory supplied cables.
7. PXBCM-MME Meter Module External
- a. The PXBCM-MME provides the same metering functionality as the PXBCM-MMS but is used for retrofit or non-uniform/high-mix load applications where the PXBCM-MMS strip mounted 100A CT's cannot be applied.
 - b. The PXBCM Meter Module external shall support 25 channels of current using external 333mV current sensors connected to terminal strips on the PXBCM-MME.
 - c. The PXBCM Meter Module External shall support direct connection of one set of 3 phase nominal metering voltage inputs up to 277V L-N and 480V L-L voltages and shall be rated as CatIII.
 - d. Power and Energy metering shall be performed based on the voltage assignment for each 333mV current sensor input as configured using the embedded WEB server.
 - e. PXBCM MMS Accuracy of kWh metering on 333mV input circuits shall satisfy ANSI C12.20 0.5 class excluding external 333mV sensor performance.

2.4 PC OPERATING SYSTEM SOFTWARE

- A. Description: System software must monitor, analyze, display, control, and save the parameters and features available at the connected meter.
- B. Software: Configured to run on a portable laptop computer, a single PC, or a tablet computer, with capability for accessing a single meter at a time, at the location of the meter. System is not connected to LAN.
- C. Minimum Requirements:
 - 1. Real-time multitasking and multiuser [32-] [or] [64-]bit operating system that allows execution of multiple real-time programs and custom program development.
 - 2. Operating system must be capable of operating Microsoft Windows applications.
 - 3. Scheduling software must schedule centrally based time and event, temporary, and exception day programs.

2.5 RACEWAYS AND BOXES

- A. Comply with requirements in Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power wiring and Chicago Electrical Code Class 1 remote-control and signaling circuits.

2.6 WIRES AND CABLES

- A. Electrical Power Wiring: Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 1. Copper conductors are Type THHN/THWN-2.
- B. Control Wiring: Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
 - 1. Balanced Twisted Pair Cable: 100 ohm, four-pair Category 5e.
 - 2. Workstation Outlets: Four-port-connector assemblies mounted in single or multigang faceplate. Coordinate color and labels with Section 262726 "Wiring Devices."
 - 3. TIA-485 Cable: Paired, two pairs, twisted, No. 22 AWG, stranded (7x30) tinned-copper conductors.
 - 4. Control-Voltage Control Cable: Multiple conductor, color-coded, No. 20 AWG copper, minimum.
 - a. Sheath: PVC; except in plenum-type spaces, use sheath listed for plenums.
 - b. Ordinary Switching Circuits: Three conductors unless otherwise indicated.
 - c. Switching Circuits with Pilot Lights or Locator Feature: Five conductors unless otherwise indicated.
- C. TIA-232 Cable:
 - 1. PVC-Jacketed, TIA-232 Cable: Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, polypropylene insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; PVC jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - a. Type CM.
 - b. Flame Resistance: UL 1581, vertical tray.
 - 2. Plenum-Type, TIA-232 Cable: Paired, two pairs, No. 22 AWG, stranded (7x30) tinned copper conductors, plastic insulation, and individual aluminum foil-polyester tape shielded pairs with 100 percent shield coverage; plastic jacket. Pairs are cabled on common axis with No. 24 AWG, stranded (7x32) tinned copper drain wire.
 - a. Type CMP.
 - b. Flame Resistance: NFPA 262, flame test.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine pathway elements intended for cables. Check raceways, cable trays, and other elements for compliance with space allocations, installation tolerances, hazards to cable installation, and other conditions affecting performance of the Work.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF POWER MONITORING AND CONTROL SYSTEMS

- A. Wiring Method: Install cables in raceways and cable trays except within consoles, cabinets, desks, and counters. Conceal raceway and cables except in unfinished spaces.
- B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- C. Wiring and Cabling Installation:
 - 1. Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power wiring.
 - 2. Comply with Section 260523 "Control-Voltage Electrical Power Cables" for control wiring.
- D. Raceways Installation:
 - 1. Comply with Section 260533 "Raceway and Boxes for Electrical Systems" for electrical power wiring and NFPA 70 Class 1 remote-control and signaling circuits.
- E. Identification Installation:
 - 1. Comply with Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for electrical power wiring.

3.3 NETWORK NAMING AND NUMBERING

- A. Coordinate with Owner and provide unique naming and addressing for networks and devices.

3.4 GROUNDING

- A. For data communication wiring, comply with BICSI N1.
- B. For control-voltage wiring and cabling, comply with requirements in Section 260526 "Grounding and Bonding for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 2. Visually inspect balanced twisted pair cabling and optical-fiber cable jacket materials for UL or third-party certification markings. Inspect cabling terminations to confirm color-coding for pin assignments and inspect cabling connections to confirm compliance with TIA-568-C.1.
 - 3. Visually inspect cable placement, cable termination, grounding and bonding, equipment, and patchcords, and labeling of components.
 - 4. Test balanced twisted pair cabling for direct-current loop resistance, shorts, opens, intermittent faults, and polarity between conductors. Test operation of shorting bars in connection blocks. Test cables after termination, but not after cross-connection.
 - a. Test instruments must meet or exceed applicable requirements in TIA-568-C.2. Perform tests with a tester that complies with performance requirements in its "Test Instruments (Normative)" Annex, complying with measurement accuracy

specified in its "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturers for channel or link test configuration.

- b. Document data for each measurement. Print data for submittals in a summary report that is formatted using Table 10.1 in BICSI TDMM as a guide or transfer the data from the instrument to the computer, save as text files, print, and submit.

5. Power Monitoring System Tests.

a. Test Analog Signals:

- 1) Check analog voltage signals using a precision voltage meter at zero, 50, and 100 percent.
- 2) Check analog current signals using a precision current meter at zero, 50, and 100 percent.

B. Nonconforming Work:

1. Wiring and cabling will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

3.6 MAINTENANCE SERVICE

- A. Beginning at Substantial Completion, maintenance service must include 12 months' full maintenance by manufacturer's authorized service representative. Include quarterly preventive maintenance, repair or replacement of defective components, cleaning, and adjusting as required for proper system operation. Parts and supplies must be manufacturer's authorized replacement parts and supplies.

3.7 TRAINING

A. Attendee Training Manuals:

1. Provide each attendee with a color hard copy of training materials and visual presentations.
2. Hard-copy materials must be organized in a three-ring binder with table of contents and individual divider tabs marked for each logical grouping of subject matter. Organize material to provide space for attendees to take handwritten notes within training manuals.
3. In addition to hard-copy materials included in training manual, provide each binder with a sleeve or pocket that includes a DVD or flash drive with PDF copy of hard-copy materials.

B. On-Site Training:

1. Owner will provide conditioned classroom or workspace with ample desks or tables, chairs, power, and data connectivity for instructor and each attendee.
2. Instructor must provide training materials, projector, and other audiovisual equipment used in training.
3. Provide as much of training located on-site as deemed feasible and practical by Owner.
4. On-site training must include regular walk-through tours, as required, to observe each unique product type installed with hands-on review of operation, calibration, and service requirements.
5. The workstation provided with the system must be used in training. If workstation is not indicated, provide a temporary workstation to convey training content.

- C. At Completion of Training: Staff familiar with the system installed are capable of demonstrating operation of the system during final review.

END OF SECTION 26 09 13

SECTION 26 09 43 - DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Distributed Digital Lighting Control System: System includes
 1. Digital Lighting and Plug Load Controls
 2. Relay Panels
 3. Emergency Lighting Control.

1.2 RELATED SECTIONS

- A. Section 26 51 19 – LED Interior Lighting.
- B. Section 26 52 13 - Emergency and Exit Lighting.

1.3 REFERENCES

- A. Chicago Electrical Code
- B. NEMA - National Electrical Manufacturers Association
- C. FCC emission standards
- D. UL - Underwriters Laboratories, Inc. Listings
- E. UL 2043 - Standard for Fire Test for Heat and Visible Smoke Release for Discrete Products Installed in Air-Handling Spaces.
- F. UL 20 - General Use Switches, Plug Load Controls
- G. UL 924 - Standard for Emergency Lighting and Power Equipment

1.4 DESIGN / PERFORMANCE REQUIREMENTS

- A. Digital Lighting Management System shall accommodate the square-footage coverage requirements for each area controlled, utilizing room controllers, digital occupancy sensors, switches, daylighting sensors and accessories that suit the required lighting and electrical system parameters.
- B. System shall conform to requirements of the Chicago Electrical Code.
- C. System shall comply with FCC emission standards specified in part 15, sub-part J for commercial and residential application.
- D. System shall be listed under UL sections 916 and/or 508.

1.5 SUBMITTALS

- A. Product Data: Manufacturer's data sheets on each product to be used, including:
 1. Catalog sheets and specifications.
 2. Ratings, configurations, standard wiring diagrams, dimensions, colors, service

- condition requirements, and installed features.
- 3. Storage and handling requirements and recommendations.
- 4. Installation instructions.
- B. Shop Drawings: Wiring diagrams for the various components of the System specified including:
 - 1. Composite wiring and/or schematic diagram of each control circuit as proposed to be installed.
 - 2. Show location of all devices, including at minimum sensors, load controllers, and switches/dimmers for each area on reflected ceiling plans.
 - 3. Provide room/area details including products and sequence of operation for each room or area. Illustrate typical acceptable room/area connection topologies.
 - 4. Network riser diagram including floor and building level details. Include network cable specification. Illustrate points of connection to integrated systems. Coordinate integration with mechanical and/or other trades.
- C. Manufacturer's Certificates: Certify products meet or exceed specified requirements.
- D. Closeout Submittals:
 - 1. Project Record Documents: Record actual installed locations and settings for lighting control devices.
 - 2. Operation and Maintenance Manual:
 - a. Include approved Shop Drawings and Product Data.
 - b. Include Sequence of Operation, identifying operation for each room or space.
 - c. Include manufacturer's maintenance information.
 - d. Operation and Maintenance Data: Include detailed information on device programming and setup.
 - e. Include startup and test reports.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing of centralized and distributed lighting control systems with a minimum of 10 years documented experience.
- B. Installer Qualifications: Company certified by the manufacturer and specializing in installation of networked lighting control products with minimum three years documented experience.
- C. System Components: Demonstrate that individual components have undergone quality control and testing prior to shipping.

1.7 PRE-INSTALLATION MEETINGS

- A. Convene minimum two weeks prior to commencing Work of this section. Meeting to be attended by Contractor, Architect, system installer, factory authorized manufacturer's representative, and representative of all trades related to the system installation.
- B. Review installation procedures and coordination required with related Work and the following:
 - 1. Confirm the location and mounting of all devices, with special attention to placement of switches, dimmers, and any sensors.
 - 2. Review the specifications for low voltage control wiring and termination.
 - 3. Discuss the functionality and configuration of all products, including sequences of operation, per design requirements.
 - 4. Discuss requirements for integration with other trades.

- C. Inspect and make notes of job conditions prior to installation:
 - 1. Record minutes of the conference and provide copies to all parties present.
 - 2. Identify all outstanding issues in writing designating the responsible party for follow-up action and the timetable for completion.
 - 3. Installation shall not begin until all outstanding issues are resolved to the satisfaction of the Architect.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.9 PROJECT CONDITIONS

- A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.
- B. Do not install equipment until following conditions can be maintained in spaces to receive equipment:
 - 1. Ambient temperature: 32 to 104 degrees F (0 to 40 degrees C).
 - 2. Relative humidity: Maximum 90 percent, non-condensing.

1.10 WARRANTY

- A. Manufacturer shall provide a 5-year limited warranty on products within this installation, except where otherwise noted, and consisting of a one for one device replacement.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: Legrand WattStopper Digital Lighting Management System

2.2 DISTRIBUTED DIGITAL LIGHTING CONTROL SYSTEM

- A. System General: Provide Wattstopper Digital Lighting Management System (DLM) complete with all necessary enclosures, wiring, and system components to ensure a complete and properly functioning system as indicated on the Drawings and specified herein. If a conflict is identified between the Drawing and this Specification, contact the Architect for clarification prior to proceeding.
 - 1. Space Control Requirements: Provide occupancy/vacancy sensors with Manual- or Partial-ON functionality as indicated in all spaces except toilet rooms, storerooms, library stacks, or other applications where hands-free operation is desirable and Automatic-ON occupancy sensors are more appropriate. Provide Manual-ON occupancy/vacancy sensors for any enclosed office, conference room, meeting room, open plan system and training room. For spaces with multiple occupants, or where line-of-sight may be obscured, provide ceiling- or corner-mounted sensors and Manual-ON switches.
 - 2. Task Lighting / Plug Loads: Provide automatic shut off of non-essential plug loads and task lighting in spaces as required by the applicable energy code. Provide Automatic-ON of plug loads whenever spaces are occupied. For spaces with multiple occupants a single shut off consistent with the overhead lighting may be used for the area.
 - 3. Daylit Areas: Provide daylight-responsive automatic control in all spaces (conditioned or unconditioned) where daylight contribution is available as defined by relevant local

building energy code:

- a. All luminaires within code-defined daylight zones shall be controlled separately from luminaires outside of daylight zones.
 - b. Daytime setpoints for total ambient illumination (combined daylight and electric light) levels that initiate dimming shall be programmed in compliance with relevant local building energy codes.
 - c. Multiple-level switched daylight harvesting controls may be utilized for areas marked on drawings.
 - d. Provide smooth and continuous daylight dimming for areas marked on drawings. Daylighting control system may be designed to turn off electric lighting when daylight is at or above required lighting levels, only if system functions to turn lamps back on at dimmed level, rather than turning full-on prior to dimming.
4. Conference, meeting, training, auditoriums, and multipurpose rooms shall have controls that allow for independent control of each local control zone. Rooms larger than 300 square feet shall instead have at least four preset lighting scenes unless otherwise specified. Occupancy / vacancy sensors shall be provided to turn off all lighting in the space. Spaces with up to four moveable walls shall include controls that can be reconfigured when the room is partitioned.
- B. Equipment Required: Lighting Control and Automation system as defined under this section covers the following equipment.
1. Digital Lighting Management (DLM) local network: Free topology, plug-in wiring system (Cat 5e) for power and data to room devices.
 2. Digital Room Controllers: Self-configuring, digitally addressable one, two or three relay plenum-rated controllers for on/off control. Selected models include 0-10 volt or line voltage forward phase control dimming outputs and integral current monitoring capabilities.
 3. Digital Plug Load Controllers: Self-configuring, digitally addressable, single relay, plenum-rated application-specific controllers. Selected models include integral current monitoring capabilities.
 4. Digital Occupancy Sensors: Self-configuring, digitally addressable, calibrated occupancy sensors with LCD display and two-way active infrared (IR) communications.
 5. Digital Switches: Self-configuring, digitally addressable pushbutton on/off, dimming, and scene switches with two-way active infrared (IR) communications.
 6. Digital Daylighting Sensors: Single-zone closed loop, multi-zone open loop and single-zone dual-loop daylighting sensors with two-way active infrared (IR) communications for daylight harvesting using switching, bi-level, tri-level or dimming control.
 7. Configuration Tools: Handheld remote for room configuration and relay panel programming provides two-way infrared (IR) communications to digital devices and allows complete configuration and reconfiguration of the device / room from up to 30 feet away.
 8. Digital Lighting Management (DLM) segment network: Linear topology, BACnet MS/TP network (1.5 twisted pair, shielded) to connect multiple DLM local networks for centralized control.
 9. Network Bridge: Provides BACnet MS/TP-compliant digital networked communication between rooms, panels and the Segment Manager or building automation system (BAS) and automatically creates BACnet objects representative of connected devices.
 10. Segment Manager: BACnet MS/TP-based controller with web browser-based user interface for system control, scheduling, power monitoring, room device parameter administration and reporting.
 11. Programming and Configuration Software: Optional PC-native application capable of

accessing DLM control parameters within a room, for the local network, via a USB adapter, or globally, for many segment networks simultaneously, via BACnet/IP communication.

12. Digital Lighting Management Relay Panel and Zone Controller: Provides up to 8, 24, or 48 mechanically latching relays. Relays include a manual override and a single push-on connector for easy installation or removal from the panel. Panel accepts program changes from handheld configuration tool for date and time, location, holidays, event scheduling, button binding and group programming. Provides BACnet MS/TP-compliant digital networked communication between other lighting controls and/or building automation system (BAS). Zero relay Zone Controller primarily supports Digital Fixture Controller applications.
13. Emergency Lighting Control Unit (ELCU): Allows a standard lighting control device to control emergency lighting in conjunction with normal lighting in any area within a building.

C. Local Network LMRJ-Series: DLM local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.

1. Features of the DLM local network include:
 - a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy-efficient sequence of operation based upon the device attached.
 - b. Simple replacement of any device in the local DLM network with a standard off the shelf unit without requiring significant commissioning, configuration or setup.
 - c. Push n' Learn configuration to change the automatic configuration, including binding and load parameters without tools, using only the buttons on the digital devices in the local network.
 - d. Two-way infrared communications for control by handheld remotes, and configuration by a handheld tool including adjusting load parameters, sensor configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.
2. Digital room devices connect to the local network using pre-terminated Cat 5e cables with RJ-45 connectors, which provide both data and power to room devices. Systems that utilize RJ-45 patch cords but do not provide serial communication data from individual end devices are not acceptable.
3. If manufacturer's pre-terminated Cat5e cables are not used for the installation each cable must be individually tested and observed by authorized service representative following installation.

2.3 DIGITAL LOAD CONTROLLERS (ROOM, PLUG LOAD AND FIXTURE CONTROLLERS)

- A. Digital Load Controllers: Digital controllers for lighting zones, fixtures and/or plug loads automatically bind room loads to the connected control devices in the space without commissioning or the use of any tools. Provide controllers to match the room lighting and plug load control requirements. Controllers are simple to install, and do not have dip switches/potentiometers, or require special configuration for standard Plug n' Go applications. Control units include the following features.
1. Automatic room configuration to the most energy-efficient sequence of operation based upon the devices in the room.
 2. Simple replacement using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf device.
 3. Multiple room controllers connected together in a local network must automatically arbitrate with each other, without requiring any configuration or setup, so that

- individual load numbers are assigned starting with load 1 to a maximum of 64, assigned based on each controller's device ID's from highest to lowest.
4. Device Status LEDs to indicate:
 - a. Data transmission
 - b. Device has power
 - c. Status for each load
 - d. Configuration status
 5. Quick installation features including:
 - a. Standard junction box mounting
 - b. Quick low voltage connections using standard RJ-45 patch cable
 6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
 - a. Turn on to 100 percent
 - b. Turn off
 - c. Turn on to last level
 7. Each load be configurable to operate in the following sequences based on occupancy:
 - a. Auto-on/Auto-off (Follow on and off)
 - b. Manual-on/Auto-off (Follow off only)
 8. Polarity of each load output shall be reversible, via digital configuration, so that on is off and off is on.
 9. BACnet object information shall be available for the following objects:
 - a. Load status
 - b. Schedule state, normal or after-hours
 - c. Demand Response enable and disable
 - d. Room occupancy status
 - e. Total room lighting and plug loads watts
 - f. Electrical current
 - g. Total watts per controller
 - h. Total room watts/sqft.
 - i. Force on/off all loads
 10. UL 2043 plenum rated
 11. Manual override and LED indication for each load
 12. Zero cross circuitry for each load
 13. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself. Memory shall have an expected life of no less than 10 years.
 14. Dimming Room Controllers shall share the following features:
 - a. Each load shall have an independently configurable preset on level for Normal Hours and After Hours events to allow different dimmed levels to be established at the start of both Normal Hours and After Hours events.
 - b. Fade rates for dimming loads shall be specific to bound switch buttons, and the load shall maintain a default value for any bound buttons that do not specify a unique value.
 - c. The following dimming attributes may be changed or selected using a wireless configuration tool:
 - 1) Establish preset level for each load from 0-100 percent
 - 2) Set high and low trim for each load
 - 3) Initiate lamp burn in for each load of either 0, 12 or 100 hours
 - d. Override button for each load provides the following functions:
 - 1) Press and release for on/off control
 - 2) Press and hold for dimming control
 - e. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match

- the true dynamic range of the connected ballast or driver. LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
- f. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100 percent dimming range defined by the minimum and maximum calibration trim.
 - g. Calibration and trim levels must be set per output channel. Devices that set calibration or trim levels per controller (as opposed to per load) are not acceptable.
 - h. All configuration shall be digital. Devices that set calibration or trim levels per output channel via trim pots or dip-switches are not acceptable.
- B. On/Off Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 20A total load
 2. One or two relay configuration
 3. Simple 150 mA switching power supply (Only 4 100 series devices on a Cat 5e local network)
 4. Three RJ-45 DLM local network ports with integral strain relief and dust cover
 5. WattStopper product numbers: LMRC-101, LMRC-102
- C. On/Off/0-10V Dimming KO Mount Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable rated for 10A total load
 2. Optional real time current and voltage monitoring (with - M Monitoring option).
 3. One or two relay configurations
 4. Smart 150 mA switching power supply
 5. Two RJ-45 DLM local network ports. Provide molded strain relief ring
 6. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting
 7. Units capable of providing both Class 1 or Class 2 wiring for the 0-10V output
 8. WattStopper product numbers: LMRC-111, LMRC-111-M, LMRC-112, or LMRC-112-M.
- D. On/Off/0-10V Dimming Enhanced Room Controllers shall include:
1. Dual voltage (120/277 VAC, 60 Hz) capable or 347 VAC, 60 Hz. 120/277 volt models rated for 20A total load; 347 volt models rated for 15A total load
 2. Built in real time current monitoring
 3. One, two or three relay configurations
 4. Smart 250 mA switching power supply
 5. Four RJ-45 DLM local network ports. Provide integral strain relief
 6. One dimming output per relay
 - a. 0-10V Dimming - Where indicated, one 0-10 volt analog output per relay for control of compatible ballasts and LED drivers. The 0-10 volt output shall automatically open upon loss of power to the Room Controller to assure full light output from the controlled lighting (LMRC-110 series and 210 series).
 7. WattStopper product numbers: LMRC-211, LRMC-212, LRMC-213.
- E. Plug Load Controllers shall include:
1. 120 VAC, 60 Hz rated for 20A total load. Controller carries application-specific UL 20 rating for receptacle control.
 2. One relay configuration with additional connection for unswitched load

3. Configurable additive time delay to extend plug load time delay beyond occupancy sensor time delay (e.g. a 10-minute additive delay in a space with a 20-minute occupancy sensor delay ensures that plug loads turn off 30 minutes after the space is vacated).
4. Factory default operation is Auto-on/Auto-off, based on occupancy
5. Real time current monitoring of both switched and un-switched load (LMPL-201 only)
6. Switching power supply
 - a. Simple 150mA - Only 4 100 series devices on a Cat 5e local network (LMPL-101)
 - b. Smart 250mA (LMPL-201)
7. RJ-45 DLM local network ports
 - a. Three RJ-45 ports (LMPL-101)
 - b. Four RJ-45 ports (LMPL-201)
8. Provide a wireless transmitter that can be connected to any Cat 5e network of the lighting controls that will communicate the room's occupancy state to receptacles mounted in the area with integral relays. Binding of the transmitter to the receptacles shall be accomplished by pressing a test button on the transmitter, and then a test button on the receptacle.
9. WattStopper product numbers:
 - a. Plug Load Controllers: LMPL-101, LMPL-201.
 - b. Wireless Transceiver and Receptacles: WRC-TX-LM, WRC-15-1/2, WRC-20-1/2

2.4 DIGITAL WALL OR CEILING MOUNTED OCCUPANCY SENSOR

- A. Digital Occupancy Sensors shall provide graphic LCD display for digital calibration and electronic documentation. Features include the following:
 1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity, 0-100 percent in 10 percent increments
 - b. Time delay, 1-30 minutes in 1-minute increments
 - c. Test mode, Five second time delay
 - d. Detection technology, PIR, Ultrasonic or Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 2. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 3. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically within a configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - e. Ultrasonic and Passive Infrared
 - f. Ultrasonic or Passive Infrared
 - g. Ultrasonic only
 - h. Passive Infrared only
 - i. Independently configurable sensitivity settings for passive infrared and ultrasonic technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.

4. One or two RJ-45 port(s) for connection to DLM local network.
 5. Two-way infrared (IR) transceiver to allow remote programming through handheld commissioning tool and control by remote personal controls.
 6. Device Status LEDs, which may be disabled for selected applications, including:
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 7. Assignment of occupancy sensor to a specific load within the room without wiring or special tools.
 8. Manual override of controlled loads.
 9. All digital parameter data programmed into an individual occupancy sensor shall be retained in non-volatile FLASH memory within the sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
1. Detection state
 2. Occupancy sensor time delay
 3. Occupancy sensor sensitivity, PIR and Ultrasonic
- C. Units shall not have any dip switches or potentiometers for field settings
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- E. WattStopper product numbers: LMPX, LMDX, LMPC, LMUC, LMDC

2.5 DIGITAL WALLSWITCH OCCUPANCY SENSORS

- A. Digital Occupancy Sensors shall provide scrolling LCD display for digital calibration and electronic documentation. Features include the following:
1. Digital calibration and pushbutton configuration for the following variables:
 - a. Sensitivity: 0-100 percent in 10 percent increments
 - b. Time delay: 1-30 minutes in 1-minute increments
 - c. Test mode: Five second time delay
 - d. Detection technology: PIR, Dual Technology activation and/or re-activation.
 - e. Walk-through mode
 - f. Load parameters including Auto/Manual-ON, blink warning, and daylight enable/disable when photosensors are included in the DLM local network.
 2. Programmable control functionality including:
 - a. Each sensor may be programmed to control specific loads within a local network.
 - b. Sensor shall be capable of activating one of 16 user-definable lighting scenes.
 - c. Adjustable retrigger time period for manual-on loads. Load will retrigger (turn on) automatically during the configurable period of time (default 10 seconds) after turning off.
 - d. On dual technology sensors, independently configurable trigger modes are available for both Normal (NH) and After Hours (AH) time periods. The retrigger mode can be programmed to use the following technologies:
 - 1) Ultrasonic and Passive Infrared
 - 2) Ultrasonic or Passive Infrared
 - 3) Ultrasonic only
 - 4) Passive Infrared only
 3. Independently configurable sensitivity settings for passive infrared and ultrasonic

- technologies (on dual technology sensors) for both Normal (NH) and After Hour (AH) time periods.
4. Two RJ-45 ports for connection to DLM local network.
 5. Two-way infrared (IR) transceiver to allow remote programming through handheld configuration tool and control by remote personal controls.
 6. Device Status LEDs including
 - a. PIR detection
 - b. Ultrasonic detection
 - c. Configuration mode
 - d. Load binding
 7. Assignment of any occupancy sensor to a specific load within the room without wiring or special tools.
 8. Assignment of local buttons to specific loads within the room without wiring or special tools
 9. Manual override of controlled loads
 10. All digital parameter data programmed into an individual wall switch sensor shall be retained in non-volatile FLASH memory within the wall switch sensor itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
1. Detection state
 2. Occupancy sensor time delay
 3. Occupancy sensor sensitivity, PIR and Ultrasonic
 4. Button state
 5. Switch lock control
 6. Switch lock status
- C. Units shall not have any dip switches or potentiometers for field settings.
- D. Multiple occupancy sensors may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration will be required.
- E. Two-button wall switch occupancy sensors, when connected to a single relay dimming room or fixture controller, shall operate in the following sequence as a factory default:
1. Left button
 - a. Press and release - Turn load on
 - b. Press and hold - Raise dimming load
 2. Right button
 - a. Press and release - Turn load off
 - b. Press and hold - Lower dimming load
- F. Low voltage momentary pushbuttons shall include the following features:
1. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 2. The following button attributes may be changed or selected using a wireless configuration tool:
 - a. Load and Scene button function may be reconfigured for individual buttons (from Load to Scene, and vice versa).
 - b. Individual button function may be configured to Toggle, On only or Off only.
 - c. Individual scenes may be locked to prevent unauthorized change.
 - d. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.

- e. Ramp rate may be adjusted for each dimmer switch.
- f. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
- g. WattStopper part numbers: LMPW, LMDW. Available in white, light almond, ivory, grey, red and black; compatible with wall plates with decorator opening.

2.6 DIGITAL WALL SWITCHES

- A. Low voltage momentary pushbutton switches in 1, 2, 3, 4, 5 and 8 button configuration. Wall switches shall include the following features:
 - 1. Two-way infrared (IR) transceiver for use with personal and configuration remote controls.
 - 2. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall.
 - 3. Configuration LED on each switch that blinks to indicate data transmission.
 - 4. Load/Scene Status LED on each switch button with the following characteristics:
 - a. Bi-level LED
 - b. Dim locator level indicates power to switch
 - c. Bright status level indicates that load or scene is active
 - d. Dimming switches shall include seven bi-level LEDs to indicate load levels using 14 steps.
 - 5. Programmable control functionality including:
 - a. Button priority may be configured to any BACnet priority level, from 1-16, corresponding to networked operation allowing local actions to utilize life safety priority
 - b. Scene patterns may be saved to any button other than dimming rockers. Once set, buttons may be digitally locked to prevent overwriting of the preset levels.
 - 6. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself. Memory shall have an expected life of no less than 10 years.
- B. BACnet object information shall be available for the following objects:
 - 1. Button state
 - 2. Switch lock control
 - 3. Switch lock status
- C. Two RJ-45 ports for connection to DLM local network.
- D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology DLM local network. No additional configuration shall be required to achieve multi-way switching.
- E. Load and Scene button function may be reconfigured for individual buttons from Load to Scene, and vice versa.
 - 1. Individual button function may be configured to Toggle, On only or Off only.
 - 2. Individual scenes may be locked to prevent unauthorized change.
 - 3. Fade Up and Fade Down times for individual scenes may be adjusted from 0 seconds to 18 hours.
 - 4. Ramp rate may be adjusted for each dimmer switch.
 - 5. Switch buttons may be bound to any load on any load controller or relay panel and are not load type dependent; each button may be bound to multiple loads.
 - 6. WattStopper product numbers: LMSW-101, LMSW-102, LMSW-103, LMSW-104, LMSW-105, LMSW-108, LMDM-101. Available in white, light almond, ivory, grey, red

and black; compatible with wall plates with decorator opening.

2.7 DIGITAL DAYLIGHTING SENSORS

- A. Digital daylighting sensors shall work with load controllers and relay panels to provide automatic switching, bi-level, or tri-level or dimming daylight harvesting capabilities for any load type connected to the controller or panel. Daylighting sensors shall be interchangeable without the need for rewiring.
1. Closed loop sensors measure the ambient light in the space and control a single lighting zone.
 2. Open loop sensors measure incoming daylight in the space and are capable of controlling up to three lighting zones.
 3. Dual loop sensors measure both ambient and incoming daylight in the space to ensure that proper light levels are maintained as changes to reflective materials are made in a single zone
- B. Digital daylighting sensors shall include the following features:
1. Sensor's internal photodiode shall only measure lightwaves within the visible spectrum. The photodiode's spectral response curve shall closely match the entire photopic curve. Photodiode shall not measure energy in either the ultraviolet or infrared spectrums. Photocell shall have a sensitivity of less than 5 percent for any wavelengths less than 400 nanometers or greater than 700 nanometers.
 2. Sensor light level range shall be from 1-6,553 foot-candles (fc).
 3. Capability of ON/OFF, bi-level or tri-level switching, or dimming, for each controlled zone, depending on the selection of load controller(s) and load binding to controller(s).
 4. For switching daylight harvesting, the photosensor shall provide a field-selectable deadband, or a separation, between the "ON Setpoint" and the "OFF Setpoint" that will prevent the lights from cycling excessively after they turn off.
 5. For dimming daylight harvesting, the photosensor shall provide the option, when the daylight contribution is sufficient, of turning lights off or dimming lights to a field-selectable minimum level.
 6. Photosensors shall have a digital, independently configurable fade rate for both increasing and decreasing light level in units of percent per second.
 7. Photosensors shall provide adjustable cut-off time. Cut-off time is defined by the number of selected minutes the load is at the minimum output before the load turns off. Selectable range between 0-240 minutes including option to never cut-off.
 8. Optional wall switch override shall allow occupants to reduce lighting level to increase energy savings or, if permitted by system administrator, raise lighting levels for a selectable period of time or cycle of occupancy.
 9. Integral infrared (IR) transceiver for configuration and/or commissioning with a handheld configuration tool, to transmit detected light level to wireless configuration tool, and for communication with personal remote controls.
 10. Configuration LED status light on device that blinks to indicate data transmission.
 11. Status LED indicates test mode, override mode and load binding.
 12. Recessed switch on device to turn controlled load(s) ON and OFF.
 13. BACnet object information shall be available for the following daylighting sensor objects, based on the specific photocell's settings:
 - a. Light level
 - b. Day and night setpoints
 - c. Off time delay
 - d. On and off setpoints
 - e. Up to three zone setpoints
 - f. Operating mode - on/off, bi-level, tri-level or dimming

14. One RJ-45 port for connection to DLM local network.
 15. A choice of accessories to accommodate multiple mounting methods and building materials. Photosensors may be mounted on a ceiling tile, skylight light well, suspended lighting fixture or backbox. Standard tube photosensors accommodate mounting materials from 0-0.62 inch thick (LMLS-400, LMLS-500). Extended tube photosensors accommodate mounting materials from 0.62 to 1.25 inches thick (LMLS-400-L, LMLS-500-L). Mounting brackets are compatible with J boxes (LMLS-MB1) and wall mounting (LMLS-MB2). LMLS-600 photosensor to be mounted on included bracket below skylight well.
 16. Any load or group of loads in the room can be assigned to a daylighting zone
 17. Each load within a daylighting zone can be individually enabled or disabled for discrete control (load independence).
 18. All digital parameter data programmed into a photosensor shall be retained in non-volatile FLASH memory within the photosensor itself. Memory shall have an expected life of no less than 10 years.
- C. Closed loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 100-degree angle, cutting off the unwanted light from bright sources outside of this cone.
 2. Automatic self-calibration, initiated from the photosensor, a wireless configuration tool or a PC with appropriate software.
 3. Automatically establishes application-specific setpoints following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of loads.
 4. WattStopper Product Number: LMLS-400, LMLS-400-L.
- D. Open loop digital photosensors shall include the following additional features:
1. An internal photodiode that measures light in a 60-degree angle (cutting off the unwanted light from the interior of the room).
 2. Automatically establishes application-specific setpoints following manual calibration using a wireless configuration tool or a PC with appropriate software. For switching operation, an adequate deadband between the ON and OFF setpoints for each zone shall prevent the lights from cycling; for dimming operation, a proportional control algorithm shall maintain the design lighting level in each zone.
 3. Each of the three discrete daylight zones can include any non-overlapping group of loads in the room.
 4. WattStopper Product Number: LMLS-500, LMLS-500-L.
- E. Dual loop digital photosensors shall include the following additional features:
1. Close loop portion of dual loop device must have an internal photodiode that measures light in a 100 degree angle, cutting off the unwanted light from sources outside of this con
 2. Open loop portion of dual loop device must have an internal photodiode that can measure light in a 60 degree angle, cutting off the unwanted light from the interior of the room.
 3. Automatically establishes application-specific set-points following self-calibration. For switching operation, an adequate deadband between the ON and OFF setpoints shall prevent the lights from cycling; for dimming operation a sliding setpoint control algorithm with separate Day and Night setpoints shall prevent abrupt ramping of load.
 4. Device must reference closed loop photosensor information as a base line reference. The device must be able to analyze the open loop photosensor information to determine if an adjustment in light levels is required.

5. Device must be able to automatically commission setpoints each night to provide adjustments to electrical lighting based on changes in overall lighting in the space due to changes in reflectance within the space or changes to daylight contribution based on seasonal changes.
6. Device must include extendable mounting arm to properly position sensor within a skylight well.
7. WattStopper product number LMLS-600

2.8 DIGITAL PARTITION CONTROLS

- A. Partition controls shall enable manual or automatic coordination of lighting controls in flexible spaces with up to four movable walls by reconfiguring the connected digital switches and occupancy sensors.
- B. Coordinate contact closure interface for automatic control via input from limit switches on movable walls specified in Section 10 22 43 - Sliding Partitions.
 1. Operates on Class 2 power supplied by DLM local network.
 2. Includes 24VDC output and four input terminals for maintained third party contract closure inputs.
 3. Input max. sink/source current: 1-5mA
 4. Logic input signal voltage High: > 18VDC
 5. Logic input signal voltage Low: < 2VDC
 6. Four status LEDs under hinged cover indicate if walls are open or closed; supports LMPS-104 as remote status indicator.
 7. Two RJ-45 ports for connection to DLM local network.
 8. WattStopper partnumber: LMIO-102

2.9 HANDHELD CONFIGURATION TOOLS

- A. Provide a wireless configuration tool to facilitate customization of DLM local networks using two-way infrared communications, and/or PC software that connects to each local network via a USB interface.
- B. Features and functionality of the wireless configuration tool shall include but not be limited to:
 1. Two-way infrared (IR) communication with DLM IR-enabled devices within a range of approximately 30 feet.
 2. High visibility organic LED (OLED) display, pushbutton user interface and menu-driven operation.
 3. Must be able to read and modify parameters for load controllers and relay panels, occupancy sensors, wall switches, daylighting sensors, network bridges, and identify DLM devices by type and serial number.
 4. Save up to eight occupancy sensor setting profiles, and apply profiles to selected sensors.
 5. Temporarily adjust light level of any load(s) on the local network, and incorporate those levels in scene setting. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 6. Adjust or fine-tune daylighting settings established during auto-configuration, and input light level data to complete configuration of open loop daylighting controls.
 7. Set room mode for testing of Normal Hours (NH) and After Hours (AH) parameter settings.
 8. Verify status of building level network devices.
- C. WattStopper Product Numbers: Handheld LMCT-100

2.10 DLM SEGMENT NETWORK

- A. Provide a segment network using linear topology, BACnet-based MS/TP subnet to connect LMCP relay panels for centralized control.
1. Each connected DLM local network shall include a single network bridge (LMBC-300), and the network bridge is the only room-based device that is connected to the segment network.
 2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.
 3. Segment network utilizes 1.5 twisted pair, shielded, cable supplied by the lighting control manufacturer. Maximum cable run for each segment is 4,000 feet. Conductor-to-conductor capacitance of the twisted pair shall be less than 30 pf/ft and have a characteristic impedance of 120 Ohms.
 4. Network wire jackets are available in high visibility green, white, or black.
 5. Substitution of manufacturer-supplied cable is not permitted and may void the warranty, if non-approved cable is installed, and if terminations are not completed according to manufacturer's specific requirements.
 6. Network signal integrity requires that each conductor and ground wire be correctly terminated at every connected device.
 7. Segment networks shall be capable of connecting to any of the following: BACnet-compliant BAS (provided by others) directly via MS/TP, or BACnet/IP via an NB-ROUTER or LMSM Unit. Systems whose room-connected network infrastructure require gateway devices to provide BACnet data to a BAS are unacceptable.
- B. WattStopper Product Number: LM-MSTP, LM-MSTP-W, LM-MSTP-B, LM-MSTP-DB

2.11 NETWORK BRIDGE

- A. Network bridge module connects a DLM local network to a BACnet-compliant segment network for communication between rooms, relay panels and a segment manager or BAS. Each local network shall include a network bridge component to provide a connection to the local network room devices. Network bridge shall use industry standard BACnet MS/TP network communication and an optically isolated EIA/TIA RS-485 transceiver.
1. Network bridge shall be provided as a separate module connected on the local network through an available RJ-45 port.
 2. Provide Plug n' Go operation to automatically discover room devices connected to the local network and make all device parameters visible to the segment manager via the segment network. No commissioning shall be required for set up of the network bridge on the local network.
 3. Network bridge shall automatically create standard BACnet objects for selected DLM devices to allow any BACnet-compliant BAS to include lighting control and power monitoring features as provided by the DLM devices on each local network. BACnet objects will be created for the addition or replacement of any given DLM device for the installed life of the system. Products requiring that an application-specific point database be loaded to create or map BACnet objects are not acceptable. Systems not capable of providing BACnet data for control devices via a dedicated BACnet Device ID and physical MS/TP termination per room are not acceptable. Standard BACnet objects shall be provided as follows:
 - a. Read/write the normal or after hours schedule state for the room
 - b. Read the detection state of each occupancy sensor
 - c. Read the aggregate occupancy state of the room
 - d. Read/write the On/Off state of loads
 - e. Read/write the dimmed light level of loads

- f. Read the button states of switches
- g. Read total current in amps, and total power in watts through the load controller
- h. Read/write occupancy sensor time delay, PIR sensitivity and ultrasonic sensitivity settings
- i. Activate a preset scene for the room
- j. Read/write daylight sensor fade time and day and night setpoints
- k. Read the current light level, in foot-candles, from interior and exterior photosensors and photocells
- l. Set daylight sensor operating mode
- m. Read/write wall switch lockstatus
- n. Read watts per square foot for the entire controlled room
- o. Write maximum light level per load for demand response mode
- p. Read/write activation of demand response mode for the room
- q. Activate/restore demand response mode for the room

B. WattStopper product numbers:LMBC-300

2.12 LMCP LIGHTING CONTROL PANELS AND LMZC ZONE CONTROLLER

A. Hardware: Provide LMCP lighting control panels in the locations and capacities as indicated on the Drawing and schedules. Each panel shall be of modular construction and consist of the following components:

1. Enclosure/Tub shall be NEMA 1, sized to accept an interior with 1 - 8 relays, 1 - 24 relays and 6 four-pole contactors, or 1 - 48 relays and 6 four-pole contactors.
2. Cover shall be configured for surface or flush wall mounting of the panel as indicated on the plans. LMCP panel cover shall have a hinged and lockable door with restricted access to line voltage section of the panel.
3. Interior assembly shall be supplied as a factory assembled component specifically designed and listed for field installation. Interior construction shall provide total isolation of high voltage (Class 1) wiring from low voltage (Class 2) wiring within the assembled panel. Interior assembly shall include intelligence boards, power supply, DIN rails for mounting optional Class 2 control devices, and individually replaceable latching type relays. Panel interiors shall include the following features:
 - a. 0-10v dimming outputs.
 - b. Removable, plug-in terminal blocks with connections for all low voltage terminations.
 - c. Individual terminal block, override pushbutton, and LED status light for each relay.
 - d. Direct wired switch inputs associated with each relay shall support 2-wire momentary switches only.
 - e. Digital inputs (four RJ-45 jacks) shall support 1-, 2-, 3-, 4-, and 8-button digital switches; digital IO modules capable of receiving 0-5V or 0-10V analog photocell inputs; digital IO modules capable of receiving momentary or maintained contact closure inputs or analog sensor inputs; digital daylighting sensors; and digital occupancy sensors. Inputs are divided into two separate digital networks, each capable of supplying 250mA to connected devices.
 - f. True relay state shall be indicated by the on-board LED and shall be available to external control devices and systems via BACnet.
 - g. Automatically sequenced operation of relays to reduce impact on the electrical distribution system when large loads are controlled simultaneously.
 - h. Group and pattern control of relays shall be provided through a simple keypad interface from a handheld IR programmer. Any set of relays can be associated with a group for direct on/off control or pattern (scene) control via a simple

- programming sequence using the relay override pushbuttons and LED displays for groups 1-8 or a handheld IR programmer for groups 1-99.
- i. Relay group status for shall be provided through LED indicators for groups 1-8 and via BACnet for groups 1-99. A solid LED indicates that the last group action called for an ON state and relays in the group are on or in a mixed state.
4. Single-pole latching relays with modular plug-in design. Relays shall provide the following ratings and features:
 - a. Electrical:
 - 1) 30 amp ballast at 277V
 - 2) 20amp tungsten at 120V
 - 3) 1.5 HP motor at 120V
 - 4) 14,000 amp short circuit current rating (SCCR) at 347V
 - 5) Relays shall be specifically UL 20 listed for control of plug-loads
 - b. Mechanical:
 - 1) Replaceable, 1/2-inch KO mounting with removable Class 2 wire harness.
 - 2) Actuator on relay housing provides manual override and visual status indication, accessible from Class 2 section of panel.
 - 3) Dual line and load terminals each support two #14 - #12 solid or stranded conductors.
 - 4) Tested to 300,000 mechanical on/off cycles.
 5. Isolated low voltage contacts provide for true relay status feedback and pilot light indication.
 6. Power supply shall be a multi-voltage transformer assembly with rated power to supply all electronics, occupancy sensors, switches, pilot lights, and photocells as necessary to meet the project requirements. Power supply to have internal over-current protection with automatic reset and metal oxide varistor protection.
 7. Where indicated, lighting control panels designated for control of emergency lighting shall be provided with factory installed provision for automatic bypass of relays controlling emergency circuits upon loss of normal power. Panels shall be properly listed and labeled for use on emergency lighting circuits and shall meet the requirements of UL924 and the Chicago Electrical Code - Article 700.
 8. Integral system clock shall provide scheduling capabilities for panel-only projects without DLM segment networks or BAS control.
 - a. Each panel shall include digital clock capability able to issue system wide automation commands to up to 11 other panels for a total of 12 networked lighting control panels. Clock shall provide capability for up to 254 independent schedule events per panel for each of the ninety-nine system wide channel groups.
 - b. Clock capability of each panel shall support the time-based energy saving requirements of applicable local energy codes.
 - c. Clock module shall provide astronomic capabilities, time delays, blink warning, daylight savings, and holiday functions and will include a battery backup for clock function and program retention in non-volatile FLASH memory. Clocks that require multiple events to meet local code lighting shut off requirements shall not be allowed.
 - d. Clock capability of each panel shall operate on a basis of ON/OFF or Normal Hours/After Hours messages to automation groups that implement pre-configured control scenarios. Scenarios shall include:
 - 1) Scheduled ON / OFF
 - 2) Manual ON / Scheduled OFF
 - 3) Astro ON / OFF (or Photo ON / OFF)
 - 4) Astro and Schedule ON / OFF (or Photo and Schedule ON / OFF)

- e. User interface shall be a portable IR handheld remote control capable of programming any panel in the system (LMCT-100)
 - f. Clock capability of each panel shall employ non-volatile memory and shall retain user programming and time for a minimum of 10 years.
 - g. Schedules programmed into the clock of any one panel shall be capable of executing panel local schedule or Dark/Light (photocell or Astro) events for that panel in the event that global network communication is lost. Lighting control panels that are not capable of executing events independently of the global network shall not be acceptable.
9. Lighting control panel can operate as a stand-alone system, or can support schedule, group, and photocell control functions, as configured in a Segment Manager controller, via a segment network connection.
10. Lighting control panel shall support digital communications to facilitate the extension of control to include interoperation with building automation systems and other intelligent field devices. Digital communications shall be RS485 MS/TP-based using the BACnet protocol.
- a. Panel shall have provision for an individual BACnet device ID and shall support the full 222 range (0 - 4,193,304). The device ID description property shall be writable via the network to allow unique identification of the lighting control panel on the network.
 - b. Panel shall support MS/TP MAC addresses in the range of 0 - 127 and baud rates of 9600k, 38400k, 76800k, and 115.2k bits per second.
 - c. Lighting control relays shall be controllable as binary output objects in the instance range of 1 - 64. The state of each relay shall be readable and writable by the BAS via the object's present value property.
 - d. Lighting control relays shall report their true on/off state as binary input objects in the instance range of 1 - 64.
 - e. The 99 group Normal Hours/After Hours control objects associated with the panel shall be represented by binary value objects in the instance range of 201 - 299. The occupancy state of each channel group shall be readable and writable by the BAS via the object present value property. Commanding 1 to a channel group will put all relays associated with the channel into the normal hours mode. Commanding 0 or NULL shall put the relays into the after hours mode.
 - f. Setup and commissioning of panel shall not require manufacturer-specific software or a computer. All configuration of the lighting control panel shall be performed using standard BACnet objects or via the handheld IR programming remote. Provide BACnet objects for panel setup and control as follows:
 - 1) Binary output objects in the instance range of 1 - 64 (one per relay) for on/off control of relays.
 - 2) Binary value objects in the instance range of 1 - 99 (one per channel) for normal hours/after hours schedule control.
 - 3) Binary input objects in the instance range of 1 - 64 (one per relay) for reading true on/off state of the relays.
 - 4) Analog value objects in the instance range of 101 - 199 (one per channel group) shall assign a blink warn time value to each channel. A value of 5 shall activate the blink warning feature for the channel and set a 5-minute grace-time period. A value of 250 shall activate the sweep feature for the channel and enable the use of sweep type automatic wall switches.
 - g. Description property for all objects shall be writable via the network and shall be saved in non-volatile memory within the panel.
 - h. BO and BV 1 - 99 objects shall support BACnet priority array with a relinquish

- default of off and after hours respectively. Prioritized writes to the channel BV objects shall propagate prioritized control to each member relay in a way analogous to the BACnet Channel object described in addendum aa. (<http://www.bacnet.org/Addenda/Add-135-2010aa.pdf>)
- i. Panel-aggregate control of relay Force Off at priority 2 shall be available via a single BV5 object. Force On at priority 1 shall be available via a single BV4 object.
 - j. Lockout of all digital switch buttons connected to a given panel shall be command-able via a single BV2 object. The lock status of any connected switch station shall be represented as BV101-196.
11. In addition to the LMCP Relay Panels, an LMZC Zone Controller panel shall be available for zero-relay applications. The panel is designed for applications where LMFC-011 Fixture Controllers or other distributed load controllers are used to switch and/or dim the controlled loads. Key similarities to and differences from the LMCP panel design shall include:
- a. Use the same intelligence board as the LMCP relay panel.
 - b. Shall not include relay driver boards or relays.
 - c. Have a removable interior section to facilitate installation, and a Tub/Cover. Cover is for surface mounting applications only.
 - d. Tub shall have two interior KOs to allow installation of LMPB-100 Power Boosters. Each installed Power Booster can provide an additional 150 mA for either of the two available DLM local networks provided by the LMZC.
 - e. All programming and networking (whether DLM Local Network and/or Segment Network) capabilities in the LMZC Zone Controller shall be similar to capabilities for LMCP relay panels, except for functions designed for panel-mounted HDR relays.
12. To aid in project start up, if LMFC Fixture Controllers are connected to an LMZC Zone Controller, Plug n' Go automatic configuration will establish a unique sequence of operation so that all LMFC-controlled fixtures will turn on to 50 percent output when any digital occupancy sensor detects motion.
13. WattStopper Product Number: Relay Panels: LMCP8, LMCP24 or LMCP48, Zone Controller: LMZC-301.
- B. User Interface: Each lighting control panel system shall be supplied with at least one handheld configuration tool (LMCT-100). As a remote programming interface the configuration tool shall allow setup, configuration, and diagnostics of the panel without the need for software or connection of a computer. User interface shall have the following panel-specific functions as a minimum:
1. Set network parameters including panel device ID, MS/TP MAC address, baud rate and max master range.
 2. Relay Group creation of up to 99 groups. Group creation shall result in programming of all seven key relay parameters for member relays. The seven parameters are as follows: After-hours Override Time Delay, Normal Hours Override Time Delay, Action on Transition to Normal Hours, Action on Transition to After Hours, Sensor Action During Normal Hours, Sensor Action During After Hours, Blink-Warn Time for After Hours.
 3. Program up to 254 separate scheduled events. Events shall occur on seven-day intervals with each day selectable as active or inactive and shall be configurable as to whether the event is active on holidays. Holidays are also defined through the User Interface.
 4. Program up to 32 separate Dark/Light events. Events shall have a selectable source as either calculated Astro with delay, or a digital IO module with an integral 0-5V or 0-10V analog photocell. Dark/Light events shall occur on seven-day intervals with each

- day selectable as active or inactive and shall be configurable as to whether the event is active on holidays.
5. Button binding of digital switches to groups shall be accessible via the handheld IR remote and accomplished from the digital switch station.
 6. Programming of panel location information shall be accomplished by the handheld IR remote and include at a minimum LAT, LON, DST zone, and an approximate city/state location.
 7. WattStopper Product Number: LMCT-100

2.13 SEGMENT MANAGER

- A. For networked applications, the Digital Lighting Management system shall include at least one segment manager to manage network communication. It shall be capable of serving up a graphical user interface via a standard web browser utilizing either unencrypted TCP/IP traffic via a configurable port (default is 80) or 256-bit AES encrypted SSL TCP/IP traffic via a configurable port (default is 443).
- B. Each segment manager shall have integral support for at least three segment networks. Segment networks may alternately be connected to the segment manager via external BACnet-to-IP interface routers and switches, using standard Ethernet structured wiring. Each router shall accommodate one segment network. Provide the quantity of routers and switches as shown on the Drawings.
- C. Operational features of the Segment Manager shall include the following:
 1. Connection to PC or LAN via standard Ethernet TCP/IP via standard Ethernet TCP/IP with the option to use SSL encrypted connections for all traffic.
 2. Easy to learn and use graphical user interface, compatible with Internet Explorer 8, or equal browser. The Segment Manager shall not require installation of any lighting control software on an end-user PC.
 3. Log in security capable of restricting some users to view-only or other limited operations.
 4. Segment Manager shall provide two main sets of interface screens - those used to initially configure the unit (referred to as the config screens), and a those used to allow users to dynamic monitor the performance of their system and provide a centralized scheduling interface. Capabilities using the Config Screens shall include:
 - a. Automatic discovery of DLM devices and relay panels on the segment network(s). Commissioning beyond activation of the discovery function shall not be required to provide communication, monitoring or control of all local networks and lighting control panels.
 - b. Allow information for all discovered DLM devices to be imported into the Segment Manager via a single XML based site file from the WattStopper LMCS Software, significantly reducing the time needed to make a system usable by the end user. Importable information can include text descriptions of every DLM component and individual loads, and automatic creation of room location information and overall structure of DLM network. Info entered into LMCS should not have to be re-entered manually via keystrokes into the Segment Manager
 - c. After discovery, all rooms and panels shall be presented in a standard navigation tree format. Selecting a device from the tree will allow the device settings and operational parameters to be viewed and changed by the user.
 - d. Ability to view and modify DLM device operational parameters. It shall be possible to set device parameters independently for normal hours and after hours operation including sensor time delays and sensitivities, and load response to sensor including Manual-On or Auto-On.

- e. Provide capabilities for integration with a BAS via BACnet protocol. At a minimum, the following points shall be available to the BAS via BACnet IP connection to the segment manager: room occupancy state; room schedule mode; room switch lock control; individual occupancy sensor state; room lighting power; room plug-load power; load ON/OFF state; load dimming level; panel channel schedule state; panel relay state; and Segment Manager Group schedule state control. Any of above items shall be capable of being moved into an "Export Table" that will provide any integrator with only the data they need, and by using the Export Table effectively create a firewall between the integrator's request for info and the overall system performance.
5. Capabilities using the Segment Manager's Dashboard Screens shall include:
 - a. A dynamic "tile" based interface that allows easy viewing of each individual room's lighting and plug load power consumption, and lighting and plug load power density (power consumption information requires Enhanced DLM Room and Plug Load Controllers with integral current transducers such as LMRC-21x). Tiles will be automatically organized according to location so a single tile for the building summarizes all information for tiles beneath it on every floor, in every area, in every room. Tiles use three color coded energy target parameters, allowing an owner to quickly identify rooms that are not performing efficiently. Tiles for rooms with occupancy sensors shall include an icon to indicate whether that room is occupied. Tiles shall be clickable, and when clicked the underlying hierarchical level of tiles shall become visible. Tile interface shall be accessible via mouse, or touch screen devices. Tiles shall be created automatically by the segment manager, based on the information found during the device discovery and/or information included in a file imported in from LMCS (such as tagged descriptions for each room) without any custom programming.
 - b. Ability to set up schedules for DLM local networks (rooms) and panels. Schedules shall be capable of controlling individual rooms with either on/off or normal hours/after hours set controlled zones or areas to either a normal hours or after hours mode of operation. Support for annual schedules, holiday schedules and unique date-bound schedules, as well as astro On or astro Off events with offsets. Schedules shall be viable graphically as time bars in a screen set up to automatically show scheduled events by day, week or month.
 - c. For fixtures that are accessible via the Segment Network, and have CCT capability as specified under paragraph Digital Wall Switch and Timer For Correlated Color Temperature, the Segment Manager will provide schedule functionality similar to the CCT Wall Timer, allowing all CCT fixtures across the entire facility to be scheduled together.
 - d. Ability to provide a simple time vs. power graph based on information stored in each Segment Manager's memory (typically two to three days' data).
 6. If shown on the Drawings, Segment Managers shall be integrated into a larger control network by the addition of a Network Supervisor package. The Supervisor is a server level computer running a version of the Segment Manager interface software with dedicated communication and networking capability, able to pull information automatically from each individual Segment Manager in the network. By using a Supervisor, information for individual Segment Managers can be accessed and stored on the Supervisor's hard drive, eliminating the risk of data being overwritten after a few days because of Segment Manager memory limits.
 7. Segment Manager shall allow access and control of the overall system database via Native Niagara AX FOX connectivity. Systems that must utilize a Tridium Niagara controller in addition to the programming, scheduling and configuration server are not acceptable.

- D. Segment Manager v2.2 and later shall support multiple DLM rooms as follows:
 - 1. Support up to 120 network bridges and 750 digital in-room devices (LMSM-3E).
 - 2. Support up to 200 network bridges and 1,100 digital in room devices, connected via network routers and switches (LMSM-6E).
- E. WattStopper Product Numbers: LMSM-3E, LMSM-6E, LM-SUPERVISOR, NB-ROUTER, NB-SWITCH, NB-SWITCH-8, NB-SWITCH-16.

2.14 PROGRAMMING, CONFIGURATION AND DOCUMENTATION SOFTWARE

- A. PC-native application for optional programming of detailed technician-level parameter information for all DLM products, including all parameters not accessible via BACnet and the handled IR configuration tool. Software must be capable of accessing room-level parameter information locally within the room when connected via the optional LMCI-100 USB programming adapter, or globally for many segment networks simultaneously utilizing standard BACnet/IP communication.
- B. Additional parameters exposed through this method include but are not limited to:
 - 1. Occupancy sensor detection LED disable for performance and other aesthetic spaces where blinking LEDs present a distraction.
 - 2. Six occupancy sensor action behaviors for each controlled load, separately configurable for normal hours and after-hours modes. Modes include: No Action, Follow Off Only, Follow On Only, Follow On and Off, Follow On Only with Override Time Delay, Follow Off Only with Blink Warn Grace Time, Follow On and Off with Blink Warn Grace Time.
 - 3. Separate fade time adjustments per load for both normal and after hours from 0 - 4 hours.
 - 4. Configurable occupancy sensor re-trigger grace period from 0 - 4 minutes separate for both normal hours and after hours.
 - 5. Separate normal hours and after hours per-load button mode with modes including: Do nothing, on only, off only, on and off.
 - 6. Load control polarity reversal so that on events turn loads off and vice versa.
 - 7. Per-load DR (demand response) shed level in units of percent.
 - 8. Load output pulse mode in increments of 1 second.
 - 9. Fade trip point for each load for normal hours and after hours that establishes the dimmer command level at which a switched load closes its relay to allow for staggered On of switched loads in response to a dimmer.
- C. Generation of reports at the whole file, partial file, or room level. Reports include but are not limited to:
 - 1. Device list report: All devices in a project listed by type.
 - 2. Load binding report: All load controller bindings showing interaction with sensors, switches, and daylighting.
 - 3. BACnet points report: Per room Device ID report of the valid BACnet points for a given site's BOM.
 - 4. Room summary report: Device manifest for each room, aggregated by common BOM, showing basic sequence of operations.
 - 5. Device parameter report: Per-room lists of all configured parameters accessible via handheld IR programmer for use with O&M documentation.
 - 6. Scene report: All project scene pattern values not left at defaults (i.e. 1 = all loads 100 percent, 2 = all loads 75 percent, 3 = all loads 50 percent, 4 = all loads 25 percent, 5-16 = same as scene 1).
 - 7. Occupancy sensor report: Basic settings including time delay and sensitivities for all

occupancy sensors.

- D. Network-wide programming of parameter data in a spreadsheet-like programming environment including but not limited to the following operations:
 1. Set, copy/paste an entire project site of sensor time delays.
 2. Set, copy/paste an entire project site of sensor sensitivity settings.
 3. Search based on room name and text labels.
 4. Filter by product type (i.e. LMRC-212) to allow parameter set by product.
 5. Filter by parameter value to search for product with specific configurations.
- E. Network-wide firmware upgrading remotely via the BACnet/IP network.
 1. Mass firmware update of entire rooms.
 2. Mass firmware update of specifically selected rooms or areas.
 3. Mass firmware upgrade of specific products
- F. WattStopper Product Number: LMCS-100, LMCI-100

2.15 EMERGENCY LIGHTING CONTROL DEVICES

- A. Emergency Lighting Control Unit - A UL 924 listed device that monitors a switched circuit providing normal lighting to an area. The unit provides normal ON/OFF control of emergency lighting along with the normal lighting. Upon normal power failure the emergency lighting circuit will close, forcing the emergency lighting ON until normal power is restored. Features include:
 1. 120/277 volts, 50/60 Hz, 20 amp ballast rating
 2. Push to test button
 3. Auxiliary contact for remote test or fire alarm system interface
- B. WattStopper Product Numbers: ELCU-100, ELCU-200.

PART 3 EXECUTION

3.1 PREPARATION

- A. Do not begin installation until measurements have been verified and work areas have been properly prepared.
- B. If preparation is the responsibility of another installer, notify Design-Builder of unsatisfactory preparation before proceeding.
- C. Verify that the required pre-installation meeting specified in Part 1 of this specification has been completed, recorded meeting minutes have been distributed and all outstanding issues noted have been resolved prior to the start of installation.

3.2 INSTALLATION

- A. Install system in accordance with the approved system shop drawings and manufacturer's instructions.
- B. Install all room/area devices using manufacturer's factory-tested Cat 5e cable with pre-terminated RJ-45 connectors.
 1. If pre-terminated cable is not used for room/area wiring, each field-terminated cable shall be tested following installation and testing results submitted to the Manufacturer's Representative for approval prior to proceeding with the Work.
 2. If fixtures have internal DLM Control Modules, ensure that they are also connected with Cat 5e cable.

3. Install all room-to-room network devices using manufacturer-supplied LM-MSTP network wire or wireless devices. Network wire substitution is not permitted and may result in loss of product warranty.
 4. Low voltage wiring topology must comply with manufacturer's specifications.
 5. Route network wiring as indicated on the Drawings as closely as possible. Document final wiring location, routing and topology on as built drawings.
- C. All line voltage connections shall be tagged to indicate circuit and switched legs.
 - D. Test all devices to ensure proper communication.
 - E. Calibrate all sensor time delays and sensitivity to guarantee proper detection of occupants and energy savings. Adjust time delay so that controlled area remains lighted while occupied.
 - F. Provide written or computer-generated documentation on the configuration of the system including room by room description including:
 1. Sensor parameters, time delays, sensitivities, and daylighting setpoints.
 2. Sequence of operation, (e.g. manual ON, Auto OFF. etc.)
 3. Load Parameters (e.g. blink warning, etc.)
 - G. Post start-up tuning - Adjust sensor time delays and sensitivities to meet the Owner's requirements 30 days from beneficial occupancy. Provide a detailed report to the Architect / Owner of post start-up activity.
 - H. Tighten all panel Class I conductors from both circuit breaker and to loads to torque ratings as marked on enclosure UL label.
 - I. All Class II cabling shall enter enclosures from within low-voltage wiring areas and shall remain within those areas. No Class I conductors shall enter a low-voltage area.
 - J. Run separate neutrals for any phase dimmed branch load circuit. Different types of dimming loads shall have separate neutral.
 - K. Verify all non-panel-based lighting loads to be free from short circuits prior to connection to room controllers.
 - L. Remote Access for Network Systems: If "REMOTE ACCESS AND ENHANCED WARRANTY FOR NETWORKED SYSTEMS" is specified in Part 1 of this specification, ensure Segment Manager enclosure is installed in a location with good to excellent cellular phone coverage based on building orientation and geographic location, and mount magnetic antenna for the modem. For cases where alternate mounting locations are not available and a stronger cellular signal is needed, the manufacturer shall offer additional antenna options to improve signal quality. Verify final mounting location with Engineer and Owner prior to proceeding with the Work.

3.3 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing. Notify Architect and Manufacturer in writing a minimum of 3 weeks prior to system start-up and testing.
- B. Tests and Inspections: Manufacturer's service representative shall perform the following inspections and prepare reports.

1. Verify Class I and II wiring connections are terminated properly by validating system performance.
 2. Set IP addresses and other network settings of system front end hardware per facilities IT instructions.
 3. Verify / complete task programming for all switches, dimmers, time clocks, and sensors.
 4. Verify that the control of each space complies with the Sequence of Operation.
 5. Correct any system issues and retest.
- C. Provide a report in table format with drawings, or using a software file that can be opened in the manufacturer's system software including each room or space that has lighting control installed. Indicate the following:
1. Date of test or inspection.
 2. Loads per space, or Fixture Address identification.
 3. Quantity and Type of each device installed
 4. Reports providing each device's settings.
- 3.4 DEMONSTRATION AND TRAINING
- A. Before Substantial Completion, arrange and provide a one-day Owner instruction period to designated Owner personnel. Set-up, starting of the lighting control system and Owner instruction includes:
1. Confirmation of entire system operation and communication to each device.
 2. Confirmation of operation of individual relays, switches, and sensors.
 3. Confirmation of system Programming, photocell settings, override settings, etc.
 4. Provide training to cover installation, programming, operation, and troubleshooting of the lighting control system.
- 3.5 PRODUCT SUPPORT AND SERVICE
- A. Factory telephone support shall be available at no cost to the Owner following acceptance. Factory assistance shall consist of assistance in solving application issues pertaining to the control equipment.

END OF SECTION 26 09 43

SECTION 26 22 13 - LOW-VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes distribution, dry-type transformers with a nominal primary and secondary rating of 600 V and less, with capacities up to 1500 kVA.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 - 1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type and size of transformer.
 - 2. Include rated nameplate data, capacities, weights, dimensions, minimum clearances, installed devices and features, and performance for each type and size of transformer.
- B. Shop Drawings:
 - 1. Detail equipment assemblies and indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.

1.4 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For transformers to include in emergency, operation, and maintenance manuals.

1.5 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Accredited by NETA.
 - 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Inspection: On receipt, inspect for and note any shipping damage to packaging and transformer.
 - 1. If manufacturer packaging is removed for inspection, and transformer will be stored after

inspection, re-package transformer using original or new packaging materials that provide protection equivalent to manufacturer's packaging.

- B. Storage: Store in a warm, dry, and temperature-stable location in original shipping packaging.
- C. Temporary Heating: Apply temporary heat according to manufacturer's written instructions within the enclosure of each ventilated-type unit, throughout periods during which equipment is not energized and when transformer is not in a space that is continuously under normal control of temperature and humidity.
- D. Handling: Follow manufacturer's instructions for lifting and transporting transformers.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. ABB, Electrification Products Division.
 - 2. Eaton.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; Schneider Electric USA.
- B. Source Limitations: Obtain each transformer type from single source from single manufacturer.

2.2 GENERAL TRANSFORMER REQUIREMENTS

- A. Description: Factory-assembled and -tested, air-cooled units for 60-Hz service.
- B. Comply with NFPA 70.
 - 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and use.
- C. Transformers Rated 15 kVA and Larger:
 - 1. Comply with 10 CFR 431 (DOE 2016) efficiency levels.
 - 2. Marked as compliant with DOE 2016 efficiency levels by an NRTL.

2.3 DISTRIBUTION TRANSFORMERS

- A. Comply with the Chicago Electrical Code.
- B. Cores: Electrical grade, non-aging silicon steel with high permeability and low hysteresis losses.
 - 1. One leg per phase.
 - 2. Grounded to enclosure.
- C. Coils: Continuous windings without splices except for taps.

1. Coil Material: Aluminum.
 2. Internal Coil Connections: Brazed or pressure type.
 3. Terminal Connections: Welded.
- D. Enclosure: Ventilated.
1. NEMA 250, Type 1: Core and coil shall be encapsulated within resin compound to seal out moisture and air.
 2. KVA Ratings: Based on convection cooling only and not relying on auxiliary fans.
 3. Wiring Compartment: Sized for conduit entry and wiring installation.
 4. Finish: Comply with NEMA 250.
 - a. Finish Color: Gray weather-resistant enamel.
- E. Taps for Transformers 3 kVA and Smaller: None.
- F. Taps for Transformers 7.5 to 24 kVA: One 5 percent tap above and one 5 percent tap below normal full capacity.
- G. Taps for Transformers 25 kVA and Larger: Two 2.5 percent taps above and two 2.5 percent taps below normal full capacity.
- H. Insulation Class, Smaller Than 30 kVA: 180 deg C, UL-component-recognized insulation system with a maximum of 115 deg C rise above 40 deg C ambient temperature.
- I. Insulation Class, 30 kVA and Larger: 220 deg C, UL-component-recognized insulation system with a maximum of 150 deg C rise above 40 deg C ambient temperature.
- J. Grounding: Provide ground-bar kit or a ground bar installed on the inside of the transformer enclosure.
- K. Wall Brackets: Manufacturer's standard brackets.

2.4 IDENTIFICATION

- A. Nameplates: Engraved, laminated-acrylic or melamine plastic signs for each distribution transformer, mounted with corrosion-resistant screws. Nameplates and label products are specified in Section 260553 "Identification for Electrical Systems."
- B. Nameplates: Self-adhesive label for each distribution transformer. Self-adhesive labels are specified in Section 260553 "Identification for Electrical Systems."

2.5 SOURCE QUALITY CONTROL

- A. Test and inspect transformers according to IEEE C57.12.01 and IEEE C57.12.91.
 1. Resistance measurements of all windings at rated voltage connections and at all tap connections.
 2. Ratio tests at rated voltage connections and at all tap connections.
 3. Phase relation and polarity tests at rated voltage connections.
 4. No load losses, and excitation current and rated voltage at rated voltage connections.
 5. Impedance and load losses at rated current and rated frequency at rated voltage connections.

6. Applied and induced tensile tests.
7. Regulation and efficiency at rated load and voltage.
8. Insulation-Resistance Tests:
 - a. High-voltage to ground.
 - b. Low-voltage to ground.
 - c. High-voltage to low-voltage.
9. Temperature tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine conditions for compliance with enclosure- and ambient-temperature requirements for each transformer.
- B. Verify that field measurements are as needed to maintain working clearances required by NFPA 70 and manufacturer's written instructions.
- C. Examine walls, floors, roofs, and concrete bases for suitable mounting conditions where transformers will be installed.
- D. Verify that ground connections are in place and requirements in Section 260526 "Grounding and Bonding for Electrical Systems" have been met.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install wall-mounted transformers level and plumb with wall brackets fabricated by transformer manufacturer.
 1. Coordinate installation of wall-mounted and structure-hanging supports with actual transformer provided.
- B. Construct concrete bases according to Section 033000 "Cast-in-Place Concrete" and anchor floor-mounted transformers according to manufacturer's written instructions and requirements in Section 260529 "Hangers and Supports for Electrical Systems."
 1. Coordinate size and location of concrete bases with actual transformer provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.
- C. Secure transformer to concrete base according to manufacturer's written instructions.
- D. Secure covers to enclosure and tighten all bolts to manufacturer-recommended torques to reduce noise generation.
- E. Remove shipping bolts, blocking, and wedges.

3.3 CONNECTIONS

- A. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
- B. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
- C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A-486B.
- D. Provide flexible connections at all conduit and conductor terminations and supports to eliminate sound and vibration transmission to the building structure.

3.4 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.
- B. Small (Up to 167-kVA Single-Phase or 500-kVA Three-Phase) Dry-Type Transformer Field Tests:
 - 1. Visual and Mechanical Inspection.
 - a. Inspect physical and mechanical condition.
 - b. Inspect anchorage, alignment, and grounding.
 - c. Verify that resilient mounts are free and that any shipping brackets have been removed.
 - d. Verify the unit is clean.
 - e. Perform specific inspections and mechanical tests recommended by manufacturer.
 - f. Verify that as-left tap connections are as specified.
 - g. Verify the presence of surge arresters and that their ratings are as specified.
 - 2. Electrical Tests:
 - a. Measure resistance at each winding, tap, and bolted connection.
 - b. Perform insulation-resistance tests winding -to-winding and each winding-to-ground. Apply voltage according to manufacturer's published data. In the absence of manufacturer's published data, comply with NETA ATS, Table 100.5. Calculate polarization index: the value of the index shall not be less than 1.0.
 - c. Perform turns-ratio tests at all tap positions. Test results shall not deviate by more than one-half percent from either the adjacent coils or the calculated ratio. If test fails, replace the transformer.
 - d. Verify correct secondary voltage, phase-to-phase and phase-to-neutral, after energization and prior to loading.
- C. Remove and replace units that do not pass tests or inspections and retest as specified above.
- D. Test Labeling: On completion of satisfactory testing of each unit, attach a dated and signed "Satisfactory Test" label to tested component.

3.5 ADJUSTING

- A. Record transformer secondary voltage at each unit for at least 48 hours of typical occupancy period. Adjust transformer taps to provide optimum voltage conditions at secondary terminals. Optimum is defined as not exceeding nameplate voltage plus 5 percent and not being lower than nameplate voltage minus 3 percent at maximum load conditions. Submit recording and tap settings as test results.
- B. Output Settings Report: Prepare a written report recording output voltages and tap settings.

3.6 CLEANING

- A. Vacuum dirt and debris; do not use compressed air to assist in cleaning.

END OF SECTION 26 22 13

tar

SECTION 26 24 13 - SWITCHBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Service and distribution switchboards rated 600 V and less.
2. Surge protection devices.
3. Disconnecting and overcurrent protective devices.
4. Instrumentation.
5. Control power.
6. Accessory components and features.
7. Identification.

B. Related Requirements

1. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.
2. Section 260913 "Electrical Power Monitoring" for advanced power monitoring requirements.

1.3 ACTION SUBMITTALS

- A. Product Data: For each switchboard, overcurrent protective device, surge protection device, ground-fault protector, accessory, and component.

1. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.

- B. Shop Drawings: For each switchboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details, including required clearances and service space around equipment. Show tabulations of installed devices, equipment features, and ratings.
2. Detail enclosure types for types other than NEMA 250, Type 1.
3. Detail bus configuration, current, and voltage ratings.
4. Detail short-circuit current rating of switchboards and overcurrent protective devices.
5. Include descriptive documentation of optional barriers specified for electrical insulation and isolation.
6. Detail utility company's metering provisions with indication of approval by utility company.

7. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
8. Include schematic and wiring diagrams for power, signal, and control wiring.

C. Delegated Design Submittal:

1. For arc-flash hazard analysis.
2. For arc-flash labels.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.5 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For switchboards and components to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Routine maintenance requirements for switchboards and all installed components.
 - b. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - c. Time-current coordination curves for each type and rating of overcurrent protective device included in switchboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Potential Transformer Fuses: Equal to 10 percent of quantity installed for each size and type but no fewer than two of each size and type.
2. Control-Power Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than two of each size and type.
3. Fuses and Fusible Devices for Fused Circuit Breakers: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
4. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.
5. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type but no fewer than three of each size and type.

6. Indicating Lights: Equal to 10 percent of quantity installed for each size and type but no less than one of each size and type.

1.7 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers qualified as defined in NEMA PB 2.1 and trained in electrical safety as required by the Chicago Electrical CodeE.
- B. Testing Agency Qualifications: Accredited by NETA.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Deliver switchboards in sections or lengths that can be moved past obstructions in delivery path.
- B. Handle and prepare switchboards for installation according to NEMA PB 2.1.

1.9 FIELD CONDITIONS

- A. Installation Pathway: Remove and replace access fencing, doors, lift-out panels, and structures to provide pathway for moving switchboards into place.
- B. Environmental Limitations:
 1. Do not deliver or install switchboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above switchboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

1.10 COORDINATION

- A. Coordinate layout and installation of switchboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified with concrete.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace switchboard enclosures, bus work, overcurrent protective devices, accessories, and factory installed interconnection wiring that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Three years from date of Substantial Completion.
- B. Manufacturer's Warranty: Manufacturer agrees to repair or replace surge protection devices that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SWITCHBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. ABB, Electrification Products Division.
 - 2. Eaton.
 - 3. Siemens Industry, Inc., Energy Management Division.
 - 4. Square D; Schneider Electric USA.
- B. Source Limitations: Obtain switchboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code, by a qualified testing agency, and marked for intended location and application.
- D. Comply with NEMAPB 2.
- E. Comply with the Chicago Electrical Code.
- F. Comply with UL 891.
- G. Front-Connected, Front-Accessible Switchboards:
 - 1. Main Devices: Fixed, individually mounted.
 - 2. Branch Devices: Panel mounted.
 - 3. Sections front and rear aligned.
- H. Nominal System Voltage: 480Y/277 V.
- I. Main-Bus Continuous: See Drawings.
- J. Indoor Enclosures: Steel, NEMA 250, Type 1.
- K. Enclosure Finish for Indoor Units: Factory-applied finish in manufacturer's standard gray finish over a rust-inhibiting primer on treated metal surface.
- L. Barriers: Between adjacent switchboard sections.

- M. Insulation and isolation for main bus of main section and main and vertical buses of feeder sections.
- N. Service Entrance Rating: Switchboards intended for use as service entrance equipment shall contain from one to six service disconnecting means with overcurrent protection, a neutral bus with disconnecting link, a grounding electrode conductor terminal, and a main bonding jumper.
- O. Bus Transition and Incoming Pull Sections: Matched and aligned with basic switchboard.
- P. Hinged Front Panels: Allow access to circuit breaker, metering, accessory, and blank compartments.
- Q. Buses and Connections: Three phase, four wire unless otherwise indicated.
 - 1. Provide phase bus arrangement A, B, C from front to back, top to bottom, and left to right when viewed from the front of the switchboard.
 - 2. Phase- and Neutral-Bus Material: Hard-drawn copper of 98 percent conductivity.
 - 3. Copper feeder circuit-breaker line connections.
 - 4. Ground Bus: Minimum-size required by UL 891, hard-drawn copper of 98 percent conductivity, equipped with mechanical connectors for feeder and branch-circuit ground conductors.
 - 5. Main-Phase Buses and Equipment-Ground Buses: Uniform capacity for entire length of switchboard's main and distribution sections. Provide for future extensions from both ends.
 - 6. Disconnect Links:
 - a. Isolate neutral bus from incoming neutral conductors.
 - b. Bond neutral bus to equipment-ground bus for switchboards utilized as service equipment or separately derived systems.
 - 7. Neutral Buses: 100 percent of the ampacity of phase buses unless otherwise indicated, equipped with compression connectors for outgoing circuit neutral cables. Brace bus extensions for busway feeder neutral bus.
- R. Future Devices: Equip compartments with mounting brackets, supports, bus connections, and appurtenances at full rating of circuit-breaker compartment.

2.2 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Electronic trip circuit breakers with rms sensing; field-replaceable rating plug or field-replicable electronic trip; and the following field-adjustable settings:
 - a. Instantaneous trip.
 - b. Long- and short-time pickup levels.
 - c. Long- and short-time adjustments.
 - d. Ground-fault pickup level, time delay, and I^2t response.

4. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mAtrip).
5. Ground-Fault Equipment Protection (GFEP) Circuit Breakers: Class B ground-fault protection (30-mAtrip).
6. MCCB Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor material.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.

2.3 INSTRUMENTATION

- A. Where indicated on Drawings, switchboards shall be equipped with integral multi-point metering (MPM) system for metering of all loads fed from the assembly.
 1. Install MPM in switchboard at the factory.
 2. Pre-wire current sensors and interface modules to MPM.
- B. Pre-wire metering voltages and control power connections.
- C. Multifunction Digital-Metering Monitor: Microprocessor-based unit suitable for three- or four-wire systems and with the following features:
 1. Switch-selectable digital display of the following values with maximum accuracy tolerances as indicated:
 - a. Phase Currents, Each Phase: Plus or minus 0.5 percent.
 - b. Phase-to-Phase Voltages, Three Phase: Plus or minus 0.5 percent.
 - c. Phase-to-Neutral Voltages, Three Phase: Plus or minus 0.5 percent.
 - d. Megawatts: Plus or minus 1 percent.
 - e. Megavars: Plus or minus 1 percent.
 - f. Power Factor: Plus or minus 1 percent.
 - g. Frequency: Plus or minus 0.1 percent.
 - h. Accumulated Energy, Megawatt Hours: Plus or minus 1 percent; accumulated values unaffected by power outages up to 72 hours.
 - i. Megawatt Demand: Plus or minus 1 percent; demand interval programmable from five to 60 minutes.
 2. Mounting: Display and control unit flush or semi-flush mounted in instrument compartment door.

2.4 CONTROL POWER

- A. Control Circuits: 120-V ac, supplied through secondary disconnecting devices from control- power transformer.
- B. Control-Power Fuses: Primary and secondary fuses for current-limiting and overload protection of transformer and fuses for protection of control circuits.
- C. Control Wiring: Factory installed, with bundling, lacing, and protection included. Provide flexible conductors for No. 8 AWG and smaller, for conductors across hinges, and for conductors for interconnections between shipping units.

2.5 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.
- B. Mounting Accessories: For anchors, mounting channels, bolts, washers, and other mounting accessories, comply with manufacturer's instructions.

2.6 IDENTIFICATION

- A. Service Equipment Label: NRTL labeled for use as service equipment for switchboards with one or more service disconnecting and overcurrent protective devices.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store switchboards according to NEMA PB 2.1.
 - 1. Lift or move panelboards with spreader bars and manufacturer-supplied lifting straps following manufacturer's instructions.
 - 2. Use rollers, slings, or other manufacturer-approved methods if lifting straps are not furnished.
 - 3. Protect from moisture, dust, dirt, and debris during storage and installation.
 - 4. Install temporary heating during storage per manufacturer's instructions.
- B. Examine switchboards before installation. Reject switchboards that are moisture damaged or physically damaged.
- C. Examine elements and surfaces to receive switchboards for compliance with installation tolerances and other conditions affecting performance of the Work or that affect the performance of the equipment.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install switchboards and accessories according to NEMA PB 2.1.
- B. Equipment Mounting: Install switchboards on concrete base, 4-inch nominal thickness. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install conduits entering underneath the switchboard, entering under the vertical section where the conductors will terminate. Install with couplings flush with the concrete base. Extend 2 inches above concrete base after switchboard is anchored in place.
 - 2. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 3. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

4. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 5. Install anchor bolts to elevations required for proper attachment to switchboards.
 6. Anchor switchboard to building structure at the top of the switchboard if required or recommended by the manufacturer.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, straps and brackets, and temporary blocking of moving parts from switchboard units and components.
- D. Operating Instructions: Frame and mount the printed basic operating instructions for switchboards, including control and key interlocking sequences and emergency procedures. Fabricate frame of finished wood or metal and cover instructions with clear acrylic plastic. Mount on front of switchboards.
- E. Install filler plates in unused spaces of panel-mounted sections.
- F. Install overcurrent protective devices, surge protection devices, and instrumentation.
1. Set field-adjustable switches and circuit-breaker trip ranges.
- G. Comply with NECA 1.

3.3 CONNECTIONS

- A. Bond conduits entering underneath the switchboard to the equipment ground bus with a bonding conductor sized per the Chicago Electrical Code.
- B. Support and secure conductors within the switchboard according to the Chicago Electrical Code.
- C. Extend insulated equipment grounding cable to busway ground connection and support cable at intervals in vertical run.

3.4 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- B. Switchboard Nameplates: Label each switchboard compartment with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- C. Device Nameplates: Label each disconnecting and overcurrent protective device and each meter and control device mounted in compartment doors with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections with the assistance of a factory-authorized service representative.

- B. Tests and Inspections:
 - 1. Acceptance Testing:
 - a. Test insulation resistance for each switchboard bus, component, connecting supply, feeder, and control circuit. Open control and metering circuits within the switchboard and remove neutral connection to surge protection and other electronic devices prior to insulation test. Reconnect after test.
 - b. Test continuity of each circuit.
 - 2. Test ground-fault protection of equipment for service equipment per the Chicago Electrical Code.
 - 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 - 4. Correct malfunctioning units on-site where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 5. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- C. Switchboard will be considered defective if it does not pass tests and inspections.
- D. Prepare test and inspection reports, including a certified report that identifies switchboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.6 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

3.7 PROTECTION

- A. Temporary Heating: Apply temporary heat, to maintain temperature according to manufacturer's written instructions, until switchboard is ready to be energized and placed into service.

3.8 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain switchboards, overcurrent protective devices, instrumentation, and accessories.

END OF SECTION 26 24 13

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.
3. Fused coordination panelboards.

B. Related Requirements

1. Section 260573.19 "Arc-Flash Hazard Analysis" for arc-flash analysis and arc-flash label requirements.
2. Section 260913 "Electrical Power Monitoring" for advanced power monitoring requirements.

1.3 DEFINITIONS

- A. ATS: Acceptance testing specification.
- B. GFCI: Ground-fault circuit interrupter.
- C. GFEP: Ground-fault equipment protection.
- D. HID: High-intensity discharge.
- E. MCCB: Molded-case circuit breaker.
- F. SPD: Surge protective device.
- G. VPR: Voltage protection rating.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of panelboard.

1. Include materials, switching and overcurrent protective devices, SPDs, accessories, and components indicated.
2. Include dimensions and manufacturers' technical data on features, performance,

electrical characteristics, ratings, and finishes.

- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details.
 - 2. Show tabulations of installed devices with nameplates, conductor termination sizes, equipment features, and ratings.
 - 3. Detail enclosure types including mounting and anchorage, environmental protection, knockouts, corner treatments, covers and doors, gaskets, hinges, and locks.
 - 4. Detail bus configuration, current, and voltage ratings.
 - 5. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For testing agency.
- B. Panelboard Schedules: For installation in panelboards.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
 - 2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Keys: Two spares for each type of panelboard cabinet lock.
 - 2. Fuses for Fused Switches: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 3. Fuses for Fused Power-Circuit Devices: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

1.8 QUALITY ASSURANCE

- A. Manufacturer Qualifications: ISO 9001 or ISO 9002 certified.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Remove loose packing and flammable materials from inside panelboards; install temporary

electric heating (250 W per panelboard) to prevent condensation.

- B. Handle and prepare panelboards for installation according to NEMA PB 1.

1.10 FIELD CONDITIONS

- A. Environmental Limitations:

1. Do not deliver or install panelboards until spaces are enclosed and weathertight, wet work in spaces is complete and dry, work above panelboards is complete, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
2. Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - a. Ambient Temperature: Not exceeding 23 deg F to plus 104 deg F.
 - b. Altitude: Not exceeding 6600 feet.

1.11 WARRANTY

- A. Manufacturer's Warranty: Manufacturer agrees to repair or replace panelboards that fail in materials or workmanship within specified warranty period.
 1. Panelboard Warranty Period: 18 months from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PANELBOARDS AND LOAD CENTERS COMMON REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code, by a qualified testing agency, and marked for intended location and application.
- B. Comply with NEMA PB 1.
- C. Comply with the Chicago Electrical Code.
- D. Enclosures: Surface-mounted, dead-front cabinets.
 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 2. Height: 84 inches maximum.
 3. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box. Trims shall cover all live parts and shall have no exposed hardware.
 4. Finishes:
 - a. Panels and Trim: Steel and galvanized steel, factory finished immediately after

- cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
- b. Back Boxes: Galvanized steel.
- E. Incoming Mains:
- 1. Location: Top.
 - 2. Main Breaker: Main lug interiors up to 400 amperes shall be field convertible to main breaker.
- F. Phase, Neutral, and Ground Buses:
- 1. Material: Tin-plated aluminum.
 - a. Plating shall run entire length of bus.
 - b. Bus shall be fully rated the entire length.
 - 2. Interiors shall be factory assembled into a unit. Replacing switching and protective devices shall not disturb adjacent units or require removing the main bus connectors.
 - 3. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
 - 4. Full-Sized Neutral: Equipped with full-capacity bonding strap for service entrance applications. Mount electrically isolated from enclosure. Do not mount neutral bus in gutter.
- G. Conductor Connectors: Suitable for use with conductor material and sizes.
- 1. Terminations shall allow use of 75 deg C rated conductors without derating.
 - 2. Size: Lugs suitable for indicated conductor sizes, with additional gutter space, if required, for larger conductors.
 - 3. Main and Neutral Lugs: Mechanical type, with a lug on the neutral bar for each pole in the panelboard.
 - 4. Ground Lugs and Bus-Configured Terminators: Mechanical type, with a lug on the bar for each pole in the panelboard.
 - 5. Feed-Through Lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
 - 6. Subfeed (Double) Lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.
- H. NRTL Label: Panelboards or load centers shall be labeled by an NRTL acceptable to authority having jurisdiction for use as service equipment with one or more main service disconnecting and overcurrent protective devices. Panelboards or load centers shall have meter enclosures, wiring, connections, and other provisions for utility metering. Coordinate with utility company for exact requirements.
- I. Future Devices: Panelboards or load centers shall have mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- 1. Percentage of Future Space Capacity: 10 percent.
- J. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Assembly listed by an NRTL for 100 percent interrupting capacity.
- 1. Panelboards and overcurrent protective devices rated 240 V or less shall have short-circuit ratings as shown on Drawings, but not less than 10,000 A rms symmetrical.

2. Panelboards and overcurrent protective devices rated above 240 V and less than 600 V shall have short-circuit ratings as shown on Drawings, but not less than 14,000 A rms symmetrical.
- K. Where indicated on Drawings, panelboards shall be equipped with integral multi-point metering (MPM) system for metering of all loads fed from the assembly.
1. Install MPM in panelboard at the factory.
 2. Pre-wire current sensors and interface modules to MPM.
 3. Pre-wire metering voltages and control power connections.

2.2 POWER PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
 2. Eaton.
 3. Mersen USA.
 4. Siemens Industry, Inc., Energy Management Division.
 5. Square D; Schneider Electric USA.
- B. Panelboards: NEMA PB 1, distribution type.
- C. Doors: Secured with vault-type latch with tumbler lock; keyed alike.
1. For doors more than 36 inches high, provide two latches, keyed alike.
- D. Mains: Circuit breaker, Fused switch, Lugs only. See Drawings for type of Main.
- E. Branch Overcurrent Protective Devices: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- F. Branch Overcurrent Protective Devices for emergency systems: Fused switches.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
 2. Eaton.
 3. Mersen USA.
 4. Siemens Industry, Inc., Energy Management Division.
 5. Square D; Schneider Electric USA.
- B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- C. Mains: Circuit breaker and Lugs only. See Drawings for type of Main.
- D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers or Plug-in circuit breakers where individual positive-locking device requires mechanical release for removal.
- E. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

- F. Doors: Door-in-door construction with concealed hinges; secured with multipoint latch with tumbler lock; keyed alike. Outer door shall permit full access to the panel interior. Inner door shall permit access to breaker operating handles and labeling, but current carrying terminals and bus shall remain concealed.

2.4 FUSED COORDINATION PANELBOARDS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. Eaton.
 - 2. Mersen USA.
- B. Ratings
 - 1. Panelboards shall be fully rated for use in systems up to 600VAC with available short circuit current of 200kA RMS symmetrical.
 - 2. Panelboards shall be labeled with a UL short-circuit rating.
- C. Branch Overcurrent Protective Devices: Bolt-on combination circuit breaker/fuse holder, interlocked to prevent fuse from being removed while energized. Suitable for use with Class J and Class CC fuses.

2.5 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. MCCB: Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers:
 - a. Inverse time-current element for low-level overloads.
 - b. Instantaneous magnetic trip element for short circuits.
 - c. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Electronic Trip Circuit Breakers:
 - a. RMS sensing.
 - b. Field-replaceable rating plug or electronic trip.
 - c. Digital display of settings, trip targets, and indicated metering displays.
 - d. Multi-button keypad to access programmable functions and monitored data.
 - e. Ten-event, trip-history log. Each trip event shall be recorded with type, phase, and magnitude of fault that caused the trip.
 - f. Integral test jack for connection to portable test set or laptop computer.
 - g. Field-Adjustable Settings:
 - 1) Instantaneous trip.
 - 2) Long- and short-time pickup levels.
 - 3) Long- and short-time adjustments.
 - 4) Ground-fault pickup level, time delay, and I squared T response.
 - 3. GFCI Circuit Breakers: Single- and double-pole configurations with Class A ground-fault protection (6-mA trip).
 - 4. GFEP Circuit Breakers: Class B ground-fault protection (30-mA trip).
 - 5. MCCB Features and Accessories:

- a. Standard frame sizes, trip ratings, and number of poles.
- b. Breaker handle indicates tripped status.
- c. UL listed for reverse connection without restrictive line or load ratings.
- d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
- e. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and HID lighting circuits.
- f. Rating Plugs: Three-pole breakers with ampere ratings greater than 150 amperes shall have interchangeable rating plugs or electronic adjustable trip units.
- g. Multipole units enclosed in a single housing with a single handle or factory assembled to operate as a single unit.
- h. Handle Padlocking Device: Fixed attachment, for locking circuit-breaker handle in on or off position.
- i. Handle Clamp: Loose attachment, for holding circuit-breaker handle in on position.

2.6 IDENTIFICATION

- A. Panelboard Label: Manufacturer's name and trademark, voltage, amperage, number of phases, and number of poles shall be located on the interior of the panelboard door.
- B. Breaker Labels: Faceplate shall list current rating, UL and IEC certification standards, and AIC rating.
- C. Circuit Directory: Computer-generated circuit directory mounted inside panelboard door with transparent plastic protective cover.
 1. Circuit directory shall identify specific purpose with detail sufficient to distinguish it from all other circuits.

2.7 ACCESSORY COMPONENTS AND FEATURES

- A. Accessory Set: Include tools and miscellaneous items required for overcurrent protective device test, inspection, maintenance, and operation.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify actual conditions with field measurements prior to ordering panelboards to verify that equipment fits in allocated space in, and comply with, minimum required clearances specified in the Chicago Electrical Code.
- B. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- C. Examine panelboards before installation. Reject panelboards that are damaged, rusted, or have been subjected to water saturation.
- D. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Comply with NECA 1.
- C. Install panelboards and accessories according to NEMA PB 1.1.
- D. Equipment Mounting:
 - 1. Attach panelboard to the vertical finished or structural surface behind the panelboard.
- E. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- F. Mount panelboard cabinet plumb and rigid without distortion of box.
- G. Mount surface-mounted panelboards to steel slotted supports 5/8 inch in depth. Orient steel slotted supports vertically.
- H. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
 - 2. Tighten bolted connections and circuit breaker connections using calibrated torque wrench or torque screwdriver per manufacturer's written instructions.
- I. Make grounding connections and bond neutral for services and separately derived systems to ground. Make connections to grounding electrodes, separate grounds for isolated ground bars, and connections to separate ground bars.
- J. Install filler plates in unused spaces.

3.3 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; install warning signs complying with requirements in Section 260553 "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads; incorporate Owner's final room designations. Obtain approval before installing. Handwritten directories are not acceptable. Install directory inside panelboard door.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in power panelboards with a nameplate complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- C. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- D. Tests and Inspections:
 - 1. Perform each visual and mechanical inspection and electrical test for low-voltage air circuit breakers stated in NETA ATS, Paragraph 7.6 Circuit Breakers. Do not perform optional tests. Certify compliance with test parameters.
 - 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
- E. Panelboards will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results, with comparisons of the two scans. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.5 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."
- C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes. Prior to making circuit changes to achieve load balancing, inform Architect of effect on phase color coding.
 - 1. Measure loads during period of normal facility operations.
 - 2. Perform circuit changes to achieve load balancing outside normal facility operation schedule or at times directed by the Architect. Avoid disrupting services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
 - 3. After changing circuits to achieve load balancing, recheck loads during normal facility operations. Record load readings before and after changing circuits to achieve load balancing.
 - 4. Tolerance: Maximum difference between phase loads, within a panelboard, shall not

exceed 20 percent.

END OF SECTION 26 24 16

SECTION 26 27 13 - ELECTRICITY METERING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section includes work to accommodate utility company revenue meters, and Owner's electricity meters used to manage the electrical power system.

1.3 ACTION SUBMITTALS

- A. Product Data:
 - 1. For metering infrastructure components.

1.4 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL.

1.5 COORDINATION

- A. Electrical Service Connections:
 - 1. Coordinate with utility companies and utility-furnished components.
 - a. Comply with requirements of utility providing electrical power services.
 - b. Coordinate installation and connection of utilities and services, including provision for electricity-metering components.

PART 2 - PRODUCTS**2.1 SYSTEM DESCRIPTION**

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- B. Comply with UL 916.

2.2 UTILITY METERING INFRASTRUCTURE

- A. Install metering accessories furnished by the utility company, complying with its requirements.
- B. Current-Transformer Cabinets: Comply with requirements of electrical-power utility company.
- C. Meter Sockets:
 - 1. Comply with requirements of electrical-power utility company.
 - 2. Meter Sockets: Steady-state and short-circuit current ratings shall meet indicated circuit ratings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with equipment installation requirements in NECA 1.
- B. Install meters furnished by utility company. Install raceways and equipment according to utility company's written instructions. Provide empty conduits for metering leads and extend grounding connections as required by utility company.
- C. Wiring Method:
 - 1. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables."
 - 2. Minimum conduit size shall be 3/4 inch.

END OF SECTION 26 27 13

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Standard-grade receptacles, 125 V, 20 A.
 - 2. GFCI receptacles, 125 V, 20 A.
 - 3. Twist-locking receptacles.
 - 4. Cord and plug sets.
 - 5. Toggle switches, 120/277 V, 20 A.
 - 6. Wall plates.

1.3 DEFINITIONS

- A. AFCI: Arc-fault circuit interrupter.
- B. BAS: Building automation system.
- C. EMI: Electromagnetic interference.
- D. GFCI: Ground-fault circuit interrupter.
- E. Pigtail: Short lead used to connect a device to a branch-circuit conductor.
- F. RFI: Radio-frequency interference.
- G. SPD: Surge protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 GENERAL WIRING-DEVICE REQUIREMENTS

- A. Wiring Devices, Components, and Accessories: Listed and labeled as defined in the Chicago Electrical Code, by a qualified testing agency, and marked for intended location and use.
- B. Comply with the Chicago Electrical Code.
- C. RoHS compliant.
- D. Comply with NEMA WD 1.
- E. Devices for Owner-Furnished Equipment:
 - 1. Receptacles: Match plug configurations.
 - 2. Cord and Plug Sets: Match equipment requirements.
- F. Device Color:
 - 1. Wiring Devices Connected to Normal Power System: Ivory unless otherwise indicated or required by the Chicago Electrical Code or device listing.
 - 2. Wiring Devices Connected to Emergency Electrical System: Red.
- G. Wall Plate Color: For plastic covers, match device color.
- H. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from single manufacturer.

2.2 STANDARD-GRADE RECEPTACLES, 125 V, 20 A

- A. Duplex Receptacles, 125 V, 20 A:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
 - 2. Description: Two pole, three wire, and self-grounding.
 - 3. Configuration: NEMA WD 6, Configuration 5-20R.
 - 4. Standards: Comply with UL 498 and FS W-C-596.
- B. Tamper-Resistant Duplex Receptacles, 125 V, 20 A:

1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498 and FS W-C-596.
 4. Marking: Listed and labeled as complying with the Chicago Electrical Code, "Tamper-Resistant Receptacles" Article.
- C. Weather-Resistant Duplex Receptacle, 125 V, 20 A:
1. Description: Two pole, three wire, and self-grounding. Integral shutters that operate only when a plug is inserted in the receptacle. Square face.
 2. Configuration: NEMA WD 6, Configuration 5-20R.
 3. Standards: Comply with UL 498.
 4. Marking: Listed and labeled as complying with the Chicago Electrical Code, "Receptacles in Damp or Wet Locations" Article.
- 2.3 GFCI RECEPTACLES, 125 V, 20 A
- A. Duplex GFCI Receptacles, 125 V, 20 A:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
 2. Description: Integral GFCI with "Test" and "Reset" buttons and LED indicator light. Two pole, three wire, and self-grounding.
 3. Configuration: NEMA WD 6, Configuration 5-20R.
 4. Type: Feed through.
 5. Standards: Comply with UL 498, UL 943 Class A, and FS W-C-596.
- 2.4 TWIST-LOCKING RECEPTACLES
- A. Twist-Lock, Single Receptacles, 125 V, 20 A:
1. Configuration: NEMA WD 6, Configuration L5-20R.
 2. Standards: Comply with UL 498.
- B. Twist-Lock, Single Receptacles, 250 V, 20 A:
1. Configuration: NEMA WD 6, Configuration L6-20R.
 2. Standards: Comply with UL 498.
- C. Twist-Lock, Single Receptacles, 208/120 V, 3 Phase, 20A
1. Configuration: NEMA WD 6, Configuration L21-20R.
 2. Standards: Comply with UL 498.
- 2.5 CORD AND PLUG SETS

- A. Match voltage and current ratings and number of conductors to requirements of equipment being connected.
- B. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and ampacity of at least 130 percent of the equipment rating.
- C. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.6 TOGGLE SWITCHES, 120/277 V, 20 A

- A. Single-Pole Switches, 120/277 V, 20 A:
 - 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. Arrow Hart, Wiring Devices; Eaton, Electrical Sector.
 - b. Leviton Manufacturing Co., Inc.
 - c. Pass & Seymour; Legrand North America, LLC.
 - d. Wiring Device-Kellems; Hubbell Incorporated, Commercial and Industrial.
 - 2. Standards: Comply with UL 20 and FS W-S-896.
- B. Two-Pole Switches, 120/277 V, 20A:
 - 1. Comply with UL 20 and FS W-S-896.
- C. Three-Way Switches, 120/277 V, 20 A:
 - 1. Comply with UL 20 and FS W-S-896.
- D. Four-Way Switches, 120/277 V, 20 A:
 - 1. Standards: Comply with UL 20 and FS W-S-896.

2.7 WALL PLATES

- A. Single Source: Obtain wall plates from same manufacturer of wiring devices.
- B. Single and combination types shall match corresponding wiring devices.
 - 1. Plate-Securing Screws: Metal with head color to match plate finish.
 - 2. Material for Finished Spaces: Smooth, high-impact thermoplastic.
 - 3. Material for Unfinished Spaces: Galvanized steel.
 - 4. Material for Damp Locations: Thermoplastic with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.
- C. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with Type 3R, weather-resistant thermoplastic with lockable cover.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Comply with NECA 1, including mounting heights listed in that standard, unless otherwise indicated.
- B. Coordination with Other Trades:
 - 1. Protect installed devices and their boxes. Do not place wall finish materials over device boxes, and do not cut holes for boxes with routers that are guided by riding against outside of boxes.
 - 2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
 - 3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
 - 4. Install wiring devices after all wall preparation, including painting, is complete.
- C. Conductors:
 - 1. Do not strip insulation from conductors until right before they are spliced or terminated on devices.
 - 2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
 - 3. The length of free conductors at outlets for devices shall comply with the Chicago Electrical Code, Article 300, without pigtails.
 - 4. Existing Conductors:
 - a. Cut back and pigtail or replace all damaged conductors.
 - b. Straighten conductors that remain and remove corrosion and foreign matter.
 - c. Pigtailing existing conductors is permitted, provided the outlet box is large enough.
- D. Device Installation:
 - 1. Replace devices that have been in temporary use during construction and that were installed before building finishing operations were complete.
 - 2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
 - 3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
 - 4. Connect devices to branch circuits using pigtails that are not less than 6 inches in length.
 - 5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, two-thirds to three-fourths of the way around terminal screw.
 - 6. Use a torque screwdriver when a torque is recommended or required by manufacturer.
 - 7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
 - 8. Tighten unused terminal screws on the device.
 - 9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device-mounting screws in yokes, allowing metal-to-metal contact.
- E. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.
- F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multigang wall plates.
- G. Adjust locations of floor service outlets and service poles to suit arrangement of partitions and

furnishings.

3.2 GFCI RECEPTACLES

- A. Install non-feed-through GFCI receptacles where protection of downstream receptacles is not required.

3.3 IDENTIFICATION

- A. Comply with Section 260553 "Identification for Electrical Systems."
- B. Identify each receptacle with panelboard identification and circuit number. Use hot, stamped, or engraved machine printing with black-filled lettering on face of plate, and durable wire markers or tags inside outlet boxes.
- C. Essential Electrical System: Mark receptacles supplied from the essential electrical system to allow easy identification using a self-adhesive label.

3.4 FIELD QUALITY CONTROL

- A. Tests for Receptacles:
 - 1. Line Voltage: Acceptable range is 105 to 132 V.
 - 2. Percent Voltage Drop under 15-A Load: A value of 6 percent or higher is unacceptable.
 - 3. Ground Impedance: Values of up to 2 ohms are acceptable.
 - 4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
 - 5. Using the test plug, verify that the device and its outlet box are securely mounted.
 - 6. Tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault-current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.
- B. Wiring device will be considered defective if it does not pass tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Cartridge fuses rated 600 V ac and less for use in the following:
 - a. Control circuits.
 - b. Panelboards.
 - c. Switchboards.
 - d. Enclosed controllers.
 - e. Enclosed switches.

1.3 ACTION SUBMITTALS

- A. Product Data: For each type of product. Include construction details, material descriptions, dimensions of individual components and profiles. Include the following for each fuse type indicated:
 1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics, and ratings.
 2. Current-limitation curves for fuses with current-limiting characteristics.
 3. Coordination charts and tables and related data.

1.4 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the

following:

1. Bussmann; Eaton, Electrical Sector.
 2. Littelfuse, Inc.
 3. Mersen USA.
- B. Source Limitations: Obtain fuses, for use within a specific product or circuit, from single source from single manufacturer.

2.2 CARTRIDGE FUSES

- A. Characteristics: NEMA FU 1, current-limiting, nonrenewable cartridge fuses with voltage ratings consistent with circuit voltages.
1. Type RK-1: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 2. Type RK-5: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
 3. Type CC: 600-V, zero- to 30-A rating, 200 kAIC, time delay.
 4. Type J: 600-V, zero- to 600-A rating, 200 kAIC, time delay.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- C. Comply with NEMA FU 1 for cartridge fuses.
- D. Comply with NFPA 70.
- E. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size and with system short-circuit current levels.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine fuses before installation. Reject fuses that are moisture damaged or physically damaged.
- B. Examine holders to receive fuses for compliance with installation tolerances and other conditions affecting performance, such as rejection features.
- C. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.
- D. Evaluate ambient temperatures to determine if fuse rating adjustment factors must be applied to fuse ratings.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

- A. Cartridge Fuses:

1. Feeders: Class RK1, time delay.
2. Motor Branch Circuits: Class RK1, time delay.
3. Power Electronics Circuits: Class J, highspeed.
4. Other Branch Circuits: Class J, time delay.
5. Control Transformer Circuits: Class CC, time delay, control transformer duty.

3.3 INSTALLATION

- A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

- A. Install labels complying with requirements for identification specified in Section 260553 "Identification for Electrical Systems" and indicating fuse replacement information inside of door of each fused switch and adjacent to each fuse block, socket, and holder.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Fusible switches.
 - 2. Non-fusible switches.
 - 3. Shunt trip switches.
 - 4. Molded-case circuit breakers (MCCBs).
 - 5. Enclosures.

1.3 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, doublethrow.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include nameplate ratings, dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Shop Drawings: For enclosed switches and circuit breakers.
 - 1. Include plans, elevations, sections, details, and attachments to other work.
 - 2. Include wiring diagrams for power, signal, and control wiring.

1.5 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For qualified testing agency.

- B. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals.
 - 1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Fuses: Equal to 10 percent of quantity installed for each size and type, but no fewer than three of each size and type.
 - 2. Fuse Pullers: Two for each size and type.

1.8 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.

1.9 WARRANTY

- A. Manufacturer's Warranty: Manufacturer and Installer agree to repair or replace components that fail in materials or workmanship within specified warranty period.
 - 1. Warranty Period: One year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS

- A. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single manufacturer.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by an NRTL, and marked for intended location and application.

- C. Comply with NFPA 70.

2.2 FUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

- B. Type HD, Heavy Duty:

1. Single throw.
2. Three pole.
3. 600-V ac.
4. 1200 A and smaller.
5. UL 98 and NEMA KS 1, horsepower rated, with clips or bolt pads to accommodate specified fuses.
6. Lockable handle with capability to accept three padlocks and interlocked with cover in closed position.

- C. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
4. Hookstick Handle: Allows use of a hookstick to operate the handle.
5. Lugs: Mechanical type, suitable for number, size, and conductor material.
6. Service-Rated Switches: Labeled for use as service equipment.

2.3 NONFUSIBLE SWITCHES

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

- B. Type HD, Heavy Duty, Three Pole, Single Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

- C. Type HD, Heavy Duty, Three Pole, Double Throw, 600-V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
3. Hookstick Handle: Allows use of a hookstick to operate the handle.
4. Lugs: Mechanical type, suitable for number, size, and conductor material.
5. Service-Rated Switches: Labeled for use as service equipment.

2.4 SHUNT TRIP SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Bussmann; Eaton, Electrical Sector.
2. Littelfuse, Inc.
3. Mersen USA.

B. General Requirements: Comply with ASME A17.1, UL 50, and UL 98, with Class J fuse block and 200-kA interrupting and short-circuit current rating.

C. Type HD, Heavy-Duty, Three Pole, Single-Throw Fusible Switch: 600-V ac, 100 A; UL 98 and NEMA KS 1; integral shunt trip mechanism; horsepower rated, with clips or bolt pads to accommodate specified fuses; lockable handle with capability to accept three padlocks; interlocked with cover in closed position.

D. Control Circuit: 120-V ac; obtained from integral control power transformer, with primary and secondary fuses, with a control power of enough capacity to operate shunt trip, pilot, indicating and control devices.

E. Accessories:

1. Mechanically interlocked auxiliary contacts that change state when switch is opened and closed.
2. Form C alarm contacts that change state when switch is tripped.
3. Three-pole, double-throw, fire-safety and alarm relay; 24-V dc coil voltage.
4. Three-pole, double-throw, fire-alarm voltage monitoring relay complying with NFPA 72.
5. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
6. Class R Fuse Kit: Provides rejection of other fuse types when Class R fuses are specified.
7. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.5 MOLDED-CASE CIRCUITBREAKERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ABB, Electrification Products Division.
2. Eaton.
3. Siemens Industry, Inc., Energy Management Division.
4. Square D; Schneider Electric USA.

- B. Circuit breakers shall be constructed using glass-reinforced insulating material. Current carrying components shall be completely isolated from the handle and the accessory mounting area.
- C. Circuit breakers shall have a toggle operating mechanism with common tripping of all poles, which provides quick-make, quick-break contact action. The circuit-breaker handle shall be over center, be trip free, and reside in a tripped position between on and off to provide local trip indication. Circuit-breaker escutcheon shall be clearly marked on and off in addition to providing international I/O markings. Equip circuit breaker with a push-to-trip button, located on the face of the circuit breaker to mechanically operate the circuit -breaker tripping mechanism for maintenance and testing purposes.
- D. The maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker. Circuit breakers shall be 100percent rated.
- E. MCCBs shall be equipped with a device for locking in the isolated position.
- F. Lugs shall be suitable for 194 deg F rated wire, sized according to the 167 deg F temperature rating in the Chicago Electrical Code.
- G. Standard: Comply with UL 489 with interrupting capacity to comply with available fault currents.
- H. Thermal-Magnetic Circuit Breakers: Inverse time-current thermal element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- I. Adjustable, Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
- J. Electronic Trip Circuit Breakers: Field-replaceable rating plug, rms sensing, with the following field-adjustable settings:
 - 1. Instantaneous trip.
 - 2. Long- and short-time pickup levels.
 - 3. Long- and short-time time adjustments.
 - 4. Ground-fault pickup level, time delay, and I-squared t response.
- K. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller and let-through ratings less than NEMA FU 1, RK-5.
- L. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker and trip activation on fuse opening or on opening of fuse compartment door.
- M. Ground-Fault Circuit-Interrupter (GFCI) Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mAtrip).
- N. Ground-Fault Equipment-Protection (GFEP) Circuit Breakers: With Class B ground-fault protection (30-mAtrip).
- O. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.

3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.
4. Ground-Fault Protection: Comply with UL 1053; integrally mounted, self-powered type with mechanical ground-fault indicator; relay with adjustable pickup and time-delay settings, push-to-test feature, internal memory, and shunt trip unit; and three-phase, zero-sequence current transformer/sensor.
5. Shunt Trip: Trip coil energized from separate circuit, with coil-clearing contact.
6. Undervoltage Trip: Set to operate at 35 to 75 percent of rated voltage without intentional time delay.
7. Auxiliary Contacts: Two SPDT switches with "a" and "b" contacts; "a" contacts mimic circuit-breaker contacts, "b" contacts operate in reverse of circuit-breaker contacts.
8. Alarm Switch: One NC contact that operates only when circuit breaker has tripped.
9. Key Interlock Kit: Externally mounted to prohibit circuit-breaker operation; key shall be removable only when circuit breaker is in off position.
10. Accessory Control Power Voltage: Integrally mounted, self-powered.

2.6 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: UL 489, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
- B. Enclosure Finish: The enclosure shall be finished with gray baked enamel paint, electrodeposited on cleaned, phosphatized steel (NEMA 250 Type 1) gray baked enamel paint, electrodeposited on cleaned, phosphatized galvanized steel (NEMA 250 Types 3R, 12), or a brush finish on Type 304 stainless steel (NEMA 250 Type 4-4X stainless steel).
- C. Conduit Entry: NEMA 250 Types 4, 4X, and 12 enclosures shall contain no knockouts. NEMA 250 Types 7 and 9 enclosures shall be provided with threaded conduit openings in both endwalls.
- D. Operating Mechanism: The circuit-breaker operating handle shall be directly operable through the front cover of the enclosure (NEMA 250 Type 1). The cover interlock mechanism shall have an externally operated override. The override shall not permanently disable the interlock mechanism, which shall return to the locked position once the override is released. The tool used to override the cover interlock mechanism shall not be required to enter the enclosure in order to override the interlock.
- E. Enclosures designated as NEMA 250 Type 4, 4X stainless steel, 12, or 12K shall have a dual cover interlock mechanism to prevent unintentional opening of the enclosure cover when the circuit breaker is ON and to prevent turning the circuit breaker ON when the enclosure cover is open.
- F. NEMA 250 Type 7/9 enclosures shall be furnished with a breather and drain kit to allow their use in outdoor and wet location applications.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine elements and surf aces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.
 - 1. Commencement of work shall indicate Installer's acceptance of the areas and conditions as satisfactory.

3.2 PREPARATION

3.3 ENCLOSURE ENVIRONMENTAL RATING APPLICATIONS

- A. Enclosed Switches and Circuit Breakers: Provide enclosures at installed locations with the following environmental ratings.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.
 - 3. Other Wet or Damp, Indoor Locations: NEMA 250, Type 4.

3.4 INSTALLATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- C. Comply with mounting and anchoring requirements specified in Section 260548.16 "Seismic Controls for Electrical Systems."
- D. Temporary Lifting Provisions: Remove temporary lifting of eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- E. Install fuses in fusible devices.
- F. Comply with NFPA 70 and NECA 1.

3.5 IDENTIFICATION

- A. Comply with requirements in Section 260553 "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.6 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

B. Perform tests and inspections with the assistance of a factory-authorized service representative.

C. Tests and Inspections for Switches:

1. Visual and Mechanical Inspection:

- a. Inspect physical and mechanical condition.
- b. Inspect anchorage, alignment, grounding, and clearances.
- c. Verify that the unit is clean.
- d. Verify blade alignment, blade penetration, travel stops, and mechanical operation.
- e. Verify that fuse sizes and types match the Specifications and Drawings.
- f. Verify that each fuse has adequate mechanical support and contact integrity.
- g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.
 - a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify that operation and sequencing of interlocking systems is as described in the Specifications and shown on the Drawings.
- i. Verify correct phase barrier installation.
- j. Verify lubrication of moving current-carrying parts and moving and sliding surfaces.

D. Tests and Inspections for Molded Case Circuit Breakers:

1. Visual and Mechanical Inspection:

- a. Verify that equipment nameplate data are as described in the Specifications and shown on the Drawings.
- b. Inspect physical and mechanical condition.
- c. Inspect anchorage, alignment, grounding, and clearances.
- d. Verify that the unit is clean.
- e. Operate the circuit breaker to ensure smooth operation.
- f. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter.
 - a) Compare bolted connection resistance values to values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the lowest value.
 - 2) Verify tightness of accessible bolted electrical connections by calibrated

torque-wrench method in accordance with manufacturer's published data or NETA ATS Table 100.12.

- a) Bolt-torque levels shall be in accordance with manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
 - g. Inspect operating mechanism, contacts, and chutes in unsealed units.
 - h. Perform adjustments for final protective device settings in accordance with the coordination study.
- 2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 - 3. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
 - F. Prepare test and inspection reports.
 - 1. Test procedures used.
 - 2. Include identification of each enclosed switch and circuit breaker tested and describe test results.
 - 3. List deficiencies detected, remedial action taken, and observations after remedial action.

3.7 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly and lubricate as recommended by manufacturer.
- B. Set field-adjustable circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

END OF SECTION 26 28 16

SECTION 26 29 13.03 - MANUAL AND MAGNETIC MOTOR CONTROLLERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:

1. Manual motor controllers.
2. Enclosed full-voltage magnetic motor controllers.
3. Combination full-voltage magnetic motor controllers.
4. Enclosures.
5. Accessories.
6. Identification.

1.3 DEFINITIONS

- A. CPT: Control power transformer.
- B. MCCB: Molded-case circuitbreaker.
- C. MCP: Motor circuit protector.
- D. NC: Normally closed.
- E. OCPD: Overcurrent protective device.
- F. SCCR: Short-circuit current rating.
- G. SCPD: Short-circuit protective device.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.
- B. Shop Drawings: For each type of magnetic controller.

1. Include plans, elevations, sections, and mounting details.
2. Indicate dimensions, weights, required clearances, and location and size of each field connection.
3. Wire Termination Diagrams and Schedules: Include diagrams for signal, and control wiring. Identify terminals and wiring designations and color-codes to facilitate installation, operation, and maintenance. Indicate recommended types, wire sizes, and circuiting arrangements for field-installed wiring, and show circuit protection features. Differentiate between manufacturer-installed and field-installed wiring.
4. Include features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Product Schedule: List the following for each enclosed controller:

1. Each installed magnetic controller type.
2. NRTL listing.
3. Factory-installed accessories.
4. Nameplate legends.
5. SCCR of integrated unit.
6. For each combination magnetic controller include features, characteristics, ratings, and factory setting of the SCPD and OCPD.

1.5 INFORMATIONAL SUBMITTALS

- A. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For magnetic controllers to include in operation and maintenance manuals.

1. In addition to items specified in Section 017823 "Operation and Maintenance Data," include the following:
 - a. Routine maintenance requirements for magnetic controllers and installed components.
 - b. Manufacturer's written instructions for testing and adjusting circuit breaker and MCP trip settings.
 - c. Manufacturer's written instructions for setting field-adjustable overload relays.
 - d. Load-Current and Overload-Relay Heater List: Compile after motors have been installed and arrange to demonstrate that selection of heaters suits actual motor nameplate full-load currents.
 - e. Load-Current and List of Settings of Adjustable Overload Relays: Compile after motors have been installed and arrange to demonstrate that switch settings for motor-running overload protection suit actual motors to be protected.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
1. Indicating Lights: Two of each type and color installed.

2. Auxiliary Contacts: Furnish one spare(s) for each size and type of magnetic controller installed.
3. Power Contacts: Furnish three spares for each size and type of magnetic contactor installed.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Store controllers indoors in clean, dry space with uniform temperature to prevent condensation. Protect controllers from exposure to dirt, fumes, water, corrosive substances, and physical damage.

1.9 FIELD CONDITIONS

- A. Ambient Environment Ratings: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Not less than 23 deg F and not exceeding 104 deg F.
 2. Altitude: Not exceeding 6600 feet for electromagnetic and manual devices.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code, by a qualified testing agency, and marked for intended location and use.
- B. UL Compliance: Fabricate and label magnetic motor controllers to comply with UL 508 and UL 60947-4-1.
- C. NEMA Compliance: Fabricate motor controllers to comply with ICS 2.

2.2 MANUAL MOTOR CONTROLLERS

- A. Fractional Horsepower Manual Controllers (FHPMC): "Quick -make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
 1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Eaton.
 - c. Siemens Industry, Inc., Energy Management Division.
 - d. Square D; Schneider Electric USA.
 2. Configuration: Non-reversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.

4. Pilot Light: Red.
- B. Integral Horsepower Manual Controllers (IHPMC): "Quick-make, quick-break" toggle or push-button action; marked to show whether unit is off, on, or tripped.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - a. ABB, Electrification Products Division.
 - b. Eaton.
 - c. Siemens Industry, Inc., Energy Management Division.
 - d. Square D; Schneider Electric USA.
 2. Configuration: Non-reversing.
 3. Overload Relays: Inverse-time-current characteristics; NEMA ICS 2, Class 10 tripping characteristics; heaters matched to nameplate full-load current of actual protected motor; external reset push button; bimetallic type.

2.3 ENCLOSED FULL-VOLTAGE MAGNETIC MOTOR CONTROLLERS

- A. Description: Across-the-line start, electrically held, for nominal system voltage of 600-V ac and less.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. ABB, Electrification Products Division.
 2. Eaton.
 3. Siemens Industry, Inc., Energy Management Division.
 4. Square D; Schneider Electric USA.
- C. Standard: Comply with NEMA ICS 2, general purpose, Class A.
- D. Configuration: Non-reversing.
- E. Contactor Coils: Pressure-encapsulated type.
1. Operating Voltage: Manufacturer's standard, unless indicated.
- F. Control Power:
1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
- G. Overload Relays:
1. Thermal Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 20 tripping characteristic.
 - c. Heaters in each phase shall be matched to nameplate full-load current of actual

protected motor and with appropriate adjustment for duty cycle.

2. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.
 - c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and singlephasing.

2.4 COMBINATION FULL-VOLTAGE MAGNETIC MOTOR CONTROLLER

- A. Description: Factory-assembled, combination full-voltage magnetic motor controller consisting of the controller described in this article, indicated disconnecting means, SCPD and OCPD, in a single enclosure.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. ABB, Electrification Products Division.
 2. Eaton.
 3. Siemens Industry, Inc., Energy Management Division.
 4. Square D; Schneider Electric USA.
- C. Standard: Comply with NEMA ICS 2, general purpose, Class A.
- D. Configuration: Non-reversing.
- E. Contactor Coils: Pressure-encapsulated type.
 1. Operating Voltage: Manufacturer's standard, unless indicated.
- F. Control Power:
 1. For on-board control power, obtain from line circuit or from integral CPT. The CPT shall have capacity to operate integral devices and remotely located pilot, indicating, and control devices.
- G. Overload Relays:
 1. Thermal Overload Relays:
 - a. Inverse-time-current characteristic.
 - b. Class 20 tripping characteristic.
 - c. Heaters in each phase shall be matched to nameplate full-load current of actual protected motor and with appropriate adjustment for duty cycle.
 2. Solid-State Overload Relay:
 - a. Switch or dial selectable for motor-running overload protection.
 - b. Sensors in each phase.
 - c. Class 20 tripping characteristic selected to protect motor against voltage and current unbalance and singlephasing.

H. Fusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, fusible switch with clips or bolt pads to accommodate indicated fuses.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

I. Non-fusible Disconnecting Means:

1. NEMA KS 1, heavy-duty, horsepower-rated, non-fusible switch.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

J. MCP Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents, instantaneous-only circuit breaker with front-mounted, field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
2. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

K. MCCB Disconnecting Means:

1. UL 489 and NEMA AB 3, with interrupting capacity to comply with available fault currents; thermal-magnetic MCCB, with inverse-time-current element for low-level overloads and instantaneous magnetic trip element for short circuits.
2. Front-mounted, adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
3. Lockable Handle: Accepts three padlocks and interlocks with cover in closed position.

2.5 ENCLOSURES

- A. Comply with NEMA 250, type designations as indicated on Drawings, complying with environmental conditions at installed location.
- B. The construction of the enclosures shall comply with NEMA ICS 6.
- C. Controllers in hazardous (classified) locations shall comply with UL 1203.

2.6 ACCESSORIES

- A. General Requirements for Control Circuit and Pilot Devices: NEMA ICS 5; factory installed in controller enclosure cover unless otherwise indicated.
 1. Push Buttons, Pilot Lights, and Selector Switches: Standard-duty, except as needed to match enclosure type. Heavy-duty or oil-tight where indicated in the controller schedule.
 - a. Selector Switches: Hand-Auto-Off
 - b. Pilot Lights: Run and Stop.
- B. Motor protection relays shall be with solid-state sensing circuit and isolated output contacts for hardwired connections.
 1. Phase-failure.

2. Phase-reversal, with bicolor LED to indicate normal and fault conditions. Automatic reset when phase reversal is corrected.
3. Under/overvoltage, operate when the circuit voltage reaches a preset value, and drop out when the operating voltage drops to a level below the preset value. Include adjustable time-delay setting.

2.7 IDENTIFICATION

- A. Controller Nameplates: Laminated acrylic or melamine plastic signs, as described in Section 260553 "Identification for Electrical Systems," for each compartment, mounted with corrosion-resistant screws.
- B. Arc-Flash Warning Labels:
 1. Comply with requirements in Section 260573.19 "Arc-Flash Hazard Analysis." Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis.
 2. Comply with requirements in Section 260553 "Identification for Electrical Systems." Produce a 3.5-by-5-inch self-adhesive equipment label for each work location included in the analysis. Labels shall be machine printed, with no field-applied markings.
 - a. The label shall have an orange header with the wording, "WARNING, ARC-FLASH HAZARD," and shall include the following information taken directly from the arc-flash hazard analysis:
 - 1) Location designation.
 - 2) Nominal voltage.
 - 3) Flash protection boundary.
 - 4) Hazard risk category.
 - 5) Incident energy.
 - 6) Working distance.
 - 7) Engineering report number, revision number, and issue date.
 - b. Labels shall be machine printed, with no field-applied markings.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine areas and space conditions for compliance with requirements for motor controllers, their relationship with the motors, and other conditions affecting performance of the Work.

3.2 INSTALLATION

- A. Comply with NECA 1.
- B. Wall-Mounted Controllers: Install magnetic controllers on walls with tops at uniform height indicated, and by bolting units to wall or mounting on lightweight structural-steel channels bolted to wall. For controllers not at walls, provide freestanding racks complying with Section 260529 "Hangers and Supports for Electrical Systems" unless otherwise indicated.

- C. Maintain minimum clearances and workspace at equipment according to manufacturer's written instructions and the Chicago Electrical Code.
- D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.
- E. Setting of Overload Relays: Select and set overloads on the basis of full-load current rating as shown on motor nameplate. Adjust setting value for special motors as required by the Chicago Electrical Code for motors that are high-torque, high-efficiency, and so on.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- B. Perform tests and inspections with the assistance of a factory-authorized service representative.
- C. Tests and Inspections:
 - 1. Comply with the provisions of NFPA 70B, "Testing and Test Methods" Chapter.
 - 2. Visual and Mechanical Inspection:
 - a. Compare equipment nameplate data with drawings and specifications.
 - b. Inspect physical and mechanical condition.
 - c. Inspect anchorage, alignment, and grounding.
 - d. Verify the unit is clean.
 - e. Inspect contactors:
 - 1) Verify mechanical operation.
 - 2) Verify contact gap, wipe, alignment, and pressure are according to manufacturer's published data.
 - f. Motor-Running Protection:
 - 1) Verify overload element rating is correct for its application.
 - 2) If motor-running protection is provided by fuses, verify correct fuse rating.
 - g. Inspect bolted electrical connections for high resistance using one of the two following methods:
 - 1) Use a low-resistance ohmmeter. Compare bolted connection resistance values with values of similar connections. Investigate values that deviate from those of similar bolted connections by more than 50 percent of the

- lowest value.
- 2) Verify tightness of accessible bolted electrical connections by calibrated torque-wrench method according to manufacturer's published data or NETA ATS Table 100.12. Bolt-torque levels shall be according to manufacturer's published data. In the absence of manufacturer's published data, use NETA ATS Table 100.12.
- h. Verify appropriate lubrication on moving current-carrying parts and on moving and sliding surfaces.
- 3. Electrical Tests:
 - a. Test motor protection devices according to manufacturer's published data.
 - b. Test circuit breakers as follows:
 - 1) Operate the circuit breaker to ensure smooth operation.
 - 2) For adjustable circuit breakers, adjust protective device settings according to the coordination study. Comply with coordination study recommendations.
 - c. Perform operational tests by initiating control devices.
- D. Motor controller will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

3.5 SYSTEM FUNCTION TESTS

- A. System function tests shall prove the correct interaction of sensing, processing, and action devices. Perform system function tests after field quality control tests have been completed and all components have passed specified tests.
 - 1. Develop test parameters and perform tests for the purpose of evaluating performance of integral components and their functioning as a complete unit within design requirements and manufacturer's published data.
 - 2. Verify the correct operation of interlock safety devices for fail-safe functions in addition to design function.
 - 3. Verify the correct operation of sensing devices, alarms, and indicating devices.
- B. Motor controller will be considered defective if it does not pass the system function tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 29 13.03

SECTION 26 33 23.11 - CENTRAL BATTERY EQUIPMENT FOR EMERGENCY LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Interruptible (fast-transfer) central battery equipment.
 - 2. Enclosures.
 - 3. Optional and accessory features.

1.3 DEFINITIONS

- A. DDC: Direct digital control.
- B. IBC: International Building Code.
- C. Interruptible: As used in the Section Text, an of f -line, passive-standby or line-interactive, inverter-only unit, with an intentional interruption of power to the load until an internal transfer switch picks up and transfers the load to the unit's inverter and internal battery source on loss of the "normal" source, and then retransfers to the "normal" source when it is restored. Transfer time can be "slow" (up to approximately 1 second) or "fast" (2-4 ms or 40-50 ms, depending on manufacturer).
- D. LED: Light-emitting diode.
- E. Low Voltage: As defined in CHICAGO ELECTRICAL CODE for circuits and equipment operating at less than 50 V or for remote-control, signaling power-limited circuits.
- F. NiCd: Nickel cadmium.
- G. OCPD: Overcurrent protective device.
- H. PC: Personal computer.
- I. PWM: Pulse-width modulated.
- J. TDD: Total demand (harmonic current) distortion (also listed as "THD" in catalog data by manufacturers).
- K. THD(V): Total harmonic voltage demand.

- L. Uninterruptible: As used in the Section Text, an on-line, double-conversion (rectifier/inverter) unit, with no interruption of power to the load on interruption and restoration of the "normal" source.
- M. UPS: Uninterruptible power supply.
- N. VRLA: Valve-regulated lead acid.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type and rating of central battery equipment unit.
 - 1. Include features, performance, electrical ratings, operating characteristics, shipping and operating weights, shipping splits, and furnished options, specialties, and accessories.
- B. Shop Drawings: For each type and rating of central battery equipment unit.
 - 1. Include plans, elevations, sections, and mounting details.
 - 2. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, ventilation requirements, method of field assembly, components, and location and size of each field connection.
 - 3. Include system one-line diagram, internal and interconnecting wiring, and diagrams for power, signal, and control wiring.
 - 4. Include elevation, details, and legends of control and indication displays.
 - 5. Include -circuit current (withstand) rating of unit.

1.5 INFORMATIONAL SUBMITTALS

- A. Coordination Drawings: Floor plans, drawn to scale, showing dimensioned layout, required working clearances, and required area above and around central battery equipment. Show central battery equipment layout and relationships between electrical components and adjacent structural and mechanical elements. Show support locations, type of support, and weight on each support. Indicate field measurements.
- B. Qualification Data: For Installer and testing agency.
- C. Product Certificates: For each type of central battery equipment.
- D. Source quality-control reports.
- E. Field quality-control reports.
- F. Sample Warranty: For special warranty.

1.6 CLOSEOUT SUBMITTALS

- A. Operation and Maintenance Data: For central battery equipment to include in emergency,

operation, and maintenance manuals.

1. Include the following:
 - a. Manufacturer's written instructions for testing central battery equipment.
 - b. Manufacturer's written instructions for testing, adjusting, and reprogramming microprocessor control modules.
 - c. Manufacturer's written instructions for selecting and setting field-adjustable controls and status and alarm points.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Deliver extra materials to Owner.
 1. Fuses: One for every 10 of each type and rating, but no fewer than one of each type.
 2. Output Circuit Breakers: One for every 10 of each type and rating, but no fewer than one of each type.
 3. Output Circuit Breaker Open/Tripped Alarm Contacts: One for every 10 supplied, but no fewer than one of each type.
 4. Cabinet Ventilation Filters: One complete set.
 5. Circuit Board: One spare circuit board for each critical circuit.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.
- B. Testing Agency Qualifications: Member company of NETA or an NRTL acceptable to authorities having jurisdiction.
 1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Deliver equipment in fully enclosed vehicles.
- B. Store equipment in spaces having environments controlled within manufacturers' written instructions for ambient temperature and humidity conditions for non-operating equipment.

1.10 FIELD CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 1. Ambient Temperature: Less than 0 deg F or exceeding 104 deg F, with an average value

- exceeding 95 deg F over a 24-hour period.
- 2. Ambient Storage Temperature: Not less than minus 4 deg F and not exceeding 140 deg F.
- 3. Humidity: More than 95 percent (condensing).
- 4. Altitude: Exceeding 3300feet.

- B. Product Selection for Restricted Space: Drawings indicate maximum dimensions for central battery equipment, including clearances between central battery equipment and adjacent surfaces and other items.

1.11 COORDINATION

- A. Coordinate sizes and locations of concrete bases. Cast anchor-bolt inserts into bases.

1.12 WARRANTY

- A. Special Warranty: Manufacturer agrees to repair or replace central battery equipment that fails in materials or workmanship within specified warranty period. Special warranty, applying to batteries only, applies to materials only, on a prorated basis, for period specified.

- 1. Warranty Period: Include the following warranty periods, from date of Substantial Completion:

- a. Central Battery Equipment (excluding Batteries): Two year(s).

- b. Premium VRLA Batteries:

- 1) Full Warranty: One year(s).
- 2) Pro Rata: 19 years.

PART 2 - PRODUCTS

2.1 INTERRUPTIBLE (FAST-TRANSFER) CENTRAL BATTERY EQUIPMENT

- A. Basis-of-Design Product: Subject to compliance with requirements, provide Myers Emergency Power Systems LLC, Illuminator Series CIII, or comparable product by one of the following:

- 1. ABB, Electrification Products Division.
- 2. Cooper Industries, Inc.

- 3. Dual-Lite.
- 4. Emergi-Lite; a Thomas & Betts brand.
- 5. Lithonia Lighting; Acuity Brands Lighting, Inc.

- B. General Requirements for Interruptible (Fast-Transfer) Central Battery Equipment:

- 1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in CHICAGO ELECTRICAL CODE, by a qualified testing agency, and marked for intended

- location and application.
 - 2. NRTL Compliance: Fabricate and label central battery equipment to comply with UL 924.
 - 3. Comply with the CBC, CHICAGO ELECTRICAL CODE, and NFPA 101.
 - 4. Comply with NEMAPE 1.
- C. Performance Requirements:
- 1. Fast-Transfer Central Battery Equipment: Line-interactive (on-line) system. Automatically sense loss of normal ac supply and use a solid-state static switch to transfer load. Transfer in 2-4 ms or less from normal supply to battery-inverter supply.
 - 2. Automatic Operation:
 - a. Normal Conditions: Supply the load with ac power flowing from normal ac power input terminals, bypassing inverter, with battery connected in parallel via rectifier/charger output.
 - b. Abnormal Supply Conditions: If normal ac supply deviates from specified voltage, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.
 - c. If normal power fails, transfer switch operates and battery supplies constant, regulated ac power through the inverter to the load, with a momentary loss of power to the load.
 - d. If a fault occurs in system when being supplied by inverter and current flows in excess of the overload rating of inverter, inverter automatically protects itself against damage from overloads and short circuits by shutting down.
 - e. When normal ac power is restored at input supply terminals of unit, controls automatically retransfer the load back to the normal ac supply, with a momentary loss of power to the load. Rectifier/charger then recharges battery.
 - f. If normal power failure is prolonged (more than 90 minutes), integral low-voltage battery protective circuit disconnects battery and prevents battery from damage due to deep discharge.
 - g. If battery becomes discharged, and when normal ac supply is again available, rectifier/charger recharges battery. When battery is fully charged, rectifier/charger automatically shifts to float-charge mode.
 - h. If battery is disconnected, and normal ac power is available, central battery equipment continues to supply power to the load with no degradation of its regulation of voltage and frequency of output bus.
- D. Unit Operating Requirements:
- 1. Input AC Voltage Tolerance: Plus 10 and minus 15 percent of central battery equipment input voltage rating.
 - 2. Input Frequency Tolerance: Plus or minus 3 percent of central battery equipment frequency rating.
 - 3. Minimum Off-Line Efficiency: 95 percent at 60 Hz, full load.
 - 4. Minimum Displacement Primary-Side Power Factor: 96 percent under any load or operating condition.
 - 5. Ambient Temperature Rating (Other Than Batteries): Not less than 68 deg F and not exceeding 86 deg F.
 - 6. Ambient Storage Temperature Rating (Other Than Batteries): Not less than minus 4 deg F and not exceeding 158 deg F.
 - 7. Ambient Temperature Rating (Batteries): Not less than 32 deg F and not exceeding 104 deg F.

8. Ambient Storage Temperature Rating (Batteries): Not less than 0 deg F and not exceeding 104 deg F.
 9. Humidity Rating: Less than 95 percent (noncondensing).
 10. Altitude Rating: Not exceeding 3300 feet.
 11. Off-Line Overload Capability: 1.1 times the base load current for 60 seconds; minimum of 1.8 times the base load current for three seconds.
- E. Inverter and Controls Logic: Microprocessor based, isolated from all power circuits; provides complete self-diagnostics, periodic automatic testing and reporting; with alarms.
- F. Controls and Indication:
1. Status Indication: Door-mounted, labeled LED indicators or digital screen displaying the following conditions:
 - a. Normal power available.
 - b. Status of system.
 - c. Battery charging status.
 - d. On battery power.
 - e. System fault.
 - f. External fault.
- G. Self-Protection and Reliability Features:
1. Input transient protection by means of surge suppressors to provide protection against damage from supply voltage surges as defined in IEEE C62.45, Category B and C.
 2. Integral, programmable, self-diagnostic and self-test circuitry; with alarms and logging.
 3. Battery deep-discharge and self-discharge protection; with alarms.
 4. Battery self-test circuitry; with alarms and logging.
- H. Integral Input Disconnecting Means and OCPD: Thermal-magnetic circuit breaker, complying with UL 489.
1. Integrated Equipment Minimum Short-Circuit Current (Withstand) Rating: 65 kA.
- I. Inverter:
1. Description: Solid-state, high-frequency, PWM type, with the following operational features:
 - a. Automatically regulate output voltage to within plus or minus 5 percent, for all load ranges and for maximum 25 percent step-load changes; regulation may increase to 8 percent for 100 percent step-load changes.
 - b. Automatically regulate output frequency to within plus or minus 1 Hz, from no load to full load, at unity power factor, over the operating range of battery voltage.
 - c. Inverter Overload Capability: 115 percent for 10 minutes; 150 percent surge for 10 seconds.
 - d. Load Power Factor: 0.5 lead to 0.5 lag.
 - e. Brownout Protection: Produces rated power without draining batteries when input voltage is down to 75 percent of normal.
- J. Rectifier/Battery Charger:

1. Description: Solid state, variable rate, temperature compensated; automatically maintains batteries in fully charged condition when normal power is available.
2. Maximum Battery Recharge Time from Fully Discharged State: 24 hours.
3. Low-voltage disconnect circuit reduces battery discharge during extended power outages, monitors battery voltage, and disconnects inverter when battery voltage drops to no less than 85.7 percent of nominal voltage.

K. Batteries:

1. Description: Premium VRLA batteries.
 - a. Capable of sustaining full-capacity output of inverter unit for minimum of 90 minutes.
2. Battery Disconnect and OCPD: Manufacturer's standard.

L. Maintenance Bypass Systems:

1. Maintenance Bypass Mode:
 - a. Internal; manual operation only; bypasses central battery equipment power circuits (inverter and static transfer switch); requires local operator selection at central battery equipment. Transfer and retransfer shall be break-before-make, with temporary disrupting power to the load.
2. Bypass Overload Capability: 1.5 times the base load current.

M. Integral Output Disconnecting Means and OCPD:

1. Multiple-Output OCPDs: Thermal-magnetic circuit breakers, complying with UL 489; voltage rating matching unit output voltage rating.

2.2 ENCLOSURES

A. Central Battery Equipment Enclosures: NEMA 250, to comply with environmental conditions at installed location.

1. Dry and Clean Indoor Locations: Type 1 steel cabinets with access to components through hinged doors with flush tumbler lock and latch.
2. Finish: Manufacturer's standard baked-enamel finish over corrosion-resistant prime treatment.

2.3 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate central battery equipment fabricator's quality-control and testing methods.

B. Testing: Test and inspect central battery equipment according to UL 924.

- C. Factory Tests: Test and inspect assembled central battery equipment according to UL 924. Affix standards organization's label. Include the following:
 - 1. Functional test and demonstration of all functions, controls, indicators, sensors, and protective devices.
 - 2. Full-load test.
 - 3. Transient-load response test.
 - 4. Overload test.
 - 5. Power failure test.
- D. Central battery equipment will be considered defective if it does not pass tests and inspections.
- E. Prepare test and inspection reports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Receive, inspect, handle, and store central battery equipment according to NECA 411.
- B. Examine areas, surfaces, and substrates to receive central battery equipment, with Installer present, for compliance with requirements for installation tolerances, structural support, ventilation, temperature, humidity, and other conditions affecting performance of the Work.
 - 1. Verify that manufacturer's written instructions for environmental conditions have been permanently established in spaces where equipment will be installed before installation begins.
- C. Examine equipment before installation. Reject equipment that is wet, moisture damaged, or mold damaged.
- D. Examine roughing-in for electrical connections to verify actual locations of connections before installation.
- E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Coordinate layout and installation of central battery equipment with other construction including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Floor-Mounted Central Battery Equipment: Install central battery equipment on 4-inch nominal-thickness concrete base. Comply with requirements for concrete base specified in Section 033000 "Cast-in-Place Concrete."
 - 1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around the full perimeter of concrete base.
 - 2. For supported equipment, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.

3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 4. Install anchor bolts to elevations required for proper attachment to supported equipment.
- C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- D. Comply with NECA 1.
- E. Wiring Methods:
1. Install conductors and cables concealed in accessible ceilings, walls, and floors where possible.
 2. Conceal raceway and cables except in unfinished spaces.
 3. Provide plenum-rated cable, where installed exposed or in open cable tray, within environmental airspaces, including plenum ceilings.
 4. Comply with requirements for cable trays specified in Section 260536 "Cable Trays for Electrical Systems."
 5. Comply with requirements for raceways and boxes specified in Section 260533 "Raceways and Boxes for Electrical Systems."
- F. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3 CONNECTIONS

- A. Connections: Interconnect system components. Make connections to supply and load circuits according to manufacturer's wiring diagrams unless otherwise indicated.
- B. Ground equipment according to Section 260526 "Grounding and Bonding for Electrical Systems."
1. Separately Derived Systems: Make grounding connections to grounding electrodes and bonding connections to metallic piping systems as indicated; comply with CHICAGO ELECTRICAL CODE.
- C. Connect wiring according to Section 260519 "Low-Voltage Electrical Power Conductors and Cables."

3.4 INSTALLATION OF CONTROL WIRING

- A. Install wiring between central battery equipment and remote devices. Comply with requirements in Section 260523 "Control-Voltage Electrical Power Cables."
- B. Bundle, train, and support wiring in enclosures.

3.5 IDENTIFICATION

- A. Identify central battery equipment, components, and control wiring. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 2. Label central battery equipment with engraved nameplates.
 3. Label each separate cabinet, for multicabinet units.
 4. Label each enclosure-mounted control and pilot device.
- B. Operating Instructions: Frame printed operating instructions for central battery equipment, including control sequences and emergency procedures. Fabricate frame of finished metal, and cover instructions with clear acrylic plastic. Mount on front of central battery equipment units.

3.6 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
- D. Acceptance Testing Preparation:
1. Inspect and Test Each Component:
 - a. Inspect wiring, components, connections, and equipment installations. Test and adjust components and equipment.
 - b. Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
 - c. Test continuity of each circuit.
- E. Tests and Inspections:
1. Inspect central battery equipment, wiring, components, connections, and equipment installation. Test and adjust components and equipment.
 2. Test insulation resistance for all external branch circuit, feeder, control, and alarm wiring connected to central battery equipment element and component.
 3. Test continuity of each circuit.
 4. Verify that input voltages and frequencies at central battery equipment locations are within voltage and frequency limits specified in Part 2. If outside this range, notify Design-Builder before closing input OCPDs.
 5. Perform a load-duration test at rated voltage and rated output current to verify the correct functional operation of the unit under full-load stable operating conditions for the minimum time limits required by UL 924. Monitor and record ambient temperature and temperatures within the unit.
 6. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
 7. Test and adjust controls, remote monitoring, and safeties. Replace damaged and malfunctioning controls and equipment.
- F. Central battery equipment will be considered defective if it does not pass tests and inspections.
- G. Prepare test and inspection reports, including a certified report that identifies central battery

equipment and describes all test results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.7 STARTUP SERVICE

- A. Engage a factory-authorized service representative to perform startup service.
 - 1. Complete installation and startup checks according to manufacturer's written instructions.

3.8 ADJUSTING

- A. Program microprocessors for required operational sequences, status indications, alarms, event recording, and display features. Clear events memory after final acceptance testing and prior to Substantial Completion.
- B. Set field-adjustable switches, auxiliary relays, and other adjustable parts.
- C. Adjust the trip settings of thermal-magnetic circuit breakers with adjustable, instantaneous-trip elements; install fuses if not factory installed.
- D. Set the automatic system test parameters.
- E. Set field-adjustable, circuit-breaker trip ranges as specified in Section 260573.16 "Coordination Studies."

3.9 PROTECTION

- A. Temporary Heating: Apply temporary heat to maintain temperature according to manufacturer's written instructions until controllers are ready to be energized and placed into service.
- B. Replace central battery equipment whose interiors have been exposed to water or other liquids prior to Substantial Completion.

3.10 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain central battery equipment, and to use and reprogram microprocessor-based control, monitoring, and display functions.

END OF SECTION 26 33 23.11

SECTION 26 51 19 - LED INTERIOR LIGHTING**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 1. Downlight.
 2. Highbay, linear.
 3. Linear industrial.
 4. Recessed, linear.
 5. Strip light.
 6. Surface mount, nonlinear.
 7. Suspended, linear.
 8. Suspended, nonlinear.
 9. Materials.
 10. Luminaire support.

1.3 DEFINITIONS

- A. CCT: Correlated color temperature.
- B. CRI: Color Rendering Index.
- C. Fixture: See "Luminaire."
- D. IP: International Protection or Ingress Protection Rating.
- E. LED: Light-emitting diode.
- F. Lumen: Measured output of lamp and luminaire, or both.
- G. Luminaire: Complete lighting unit, including lamp, reflector, and housing.

1.4 ACTION SUBMITTALS

- A. Product Data: For each type of product.
 1. Arrange in order of luminaire designation.
 2. Include data on features, accessories, and finishes.
 3. Include physical description and dimensions of luminaires.
 4. Include emergency lighting units, including batteries and chargers.
 5. Include life, output (lumens, CCT, and CRI), and energy-efficiency data.

6. Photometric data and adjustment factors based on laboratory tests IES LM-79 and IES LM-80.
 - a. Manufacturers' Certified Data: Photometric data certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Shop Drawings: For nonstandard or custom luminaires.

1. Include plans, elevations, sections, and mounting and attachment details.
2. Include details of luminaire assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
3. Include diagrams for power, signal, and control wiring.

C. Product Schedule: For luminaires and lamps. Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Reflected ceiling plan(s) and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Luminaires.
2. Suspended ceiling components.
3. Partitions and millwork that penetrate the ceiling or extend to within 12 inches of the plane of the luminaires.
4. Structural members to which equipment or luminaires will be attached.
5. Initial access modules for acoustical tile, including size and locations.
6. Items penetrating finished ceiling, including the following:
 - a. Other luminaires.
 - b. Air outlets and inlets.
 - c. Speakers.
 - d. Sprinklers.
 - e. Access panels.
 - f. Ceiling-mounted projectors.

B. Qualification Data: For testing laboratory providing photometric data for luminaires.

C. Product Certificates: For each type of luminaire.

D. Product Test Reports: For each type of luminaire, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For luminaires and lighting systems to include in operation and maintenance manuals.

1. Provide a list of all lamp types used on Project; use ANSI and manufacturers' codes.

1.7 MAINTENANCE MATERIAL SUBMITTALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
 - 1. Drivers: One of each type and rating installed.
 - 2. Diffusers and Lenses: One for every 100 of each type and rating installed. Furnish at least one of each type.
 - 3. Globes and Guards: One for every 20 of each type and rating installed. Furnish at least one of each type.

1.8 QUALITY ASSURANCE

- A. Luminaire Photometric Data Testing Laboratory Qualifications:
 - 1. Luminaire manufacturer's laboratory that is accredited under the NVLAP for Energy Efficient Lighting Products.
- B. Provide luminaires from a single manufacturer for each luminaire type.
- C. Each luminaire type shall be binned within a three-step MacAdam Ellipse to ensure color consistency among luminaires.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.10 WARRANTY

- A. Warranty: Manufacturer and Installer agree to repair or replace components of luminaires that fail in materials or workmanship within specified warranty period.
- B. Warranty Period: Five year(s) from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Ambient Temperature: 41 to 104 deg F.
 - 1. Relative Humidity: Zero to 95 percent.
- B. Altitude: Sea level to 1000 feet.

2.2 LUMINAIRE REQUIREMENTS

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Chicago Electrical Code, by a qualified testing agency, and marked for intended location and application.
- B. Factory-Applied Labels: Comply with UL 1598. Include recommended lamps. Locate labels

where they will be readily visible to service personnel, but not seen from normal viewing angle s when lamps are in place.

1. Label shall include the following lamp characteristics:
 - a. "USE ONLY" and include specific lamp type.
 - b. Lamp diameter, shape, size, wattage, and coating.
 - c. CCT and CRI.

C. Recessed luminaires shall comply with NEMA LE 4.

2.3 DOWNLIGHT

A. See Luminaire Schedule for description.

B. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.
4. Recessed luminaires shall comply with NEMA LE 4 and shall be Chicago Approved.

2.4 HIGHBAY, LINEAR

A. See Luminaire Schedule for description.

B. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.5 HIGHBAY, NONLINEAR.

A. See Luminaire Schedule for description.

B. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.6 LINEAR INDUSTRIAL.

A. See Luminaire Schedule for description.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. With integral mounting provisions.

D. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.

2.7 RECESSED, LINEAR.

A. See Luminaire Schedule for description.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leak age under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. Chicago Approved for plenum.
4. NEMA LE 4.

2.8 STRIP LIGHT.

A. See Luminaire Schedule for description.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping of luminaire without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.9 SURFACE MOUNT, LINEAR.

A. See Luminaire Schedule for description.

B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

C. Standards:

1. ENERGY STAR certified.
2. RoHS compliant.
3. UL Listing: Listed for damp location.

2.10 SURFACE MOUNT, NONLINEAR

- A. See Luminaire Schedule for description.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Standards:
 - 1. ENERGY STAR certified.
 - 2. RoHS compliant.
 - 3. UL Listing: Listed for damp location.

2.11 SUSPENDED, LINEAR

- A. See Luminaire Schedule for description.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Standards:
 - 1. ENERGY STAR certified.
 - 2. RoHS compliant.
 - 3. UL Listing: Listed for damp location.

2.12 SUSPENDED, NONLINEAR

- A. See Luminaire Schedule for description.
- B. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Components are designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.
- C. Standards:
 - 1. ENERGY STAR certified.
 - 2. RoHS compliant.
 - 3. UL Listing: Listed for damp location.

2.13 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components shall be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.

- B. Steel:
 - 1. ASTM A36/A36M for carbon structural steel.
 - 2. ASTM A568/A568M for sheet steel.
- C. Stainless Steel:
 - 1. Manufacturer's standard grade.
 - 2. Manufacturer's standard type, ASTM A240/240M.
- D. Galvanized Steel: ASTM A653/A653M.
- E. Aluminum: ASTM B209.

2.14 METAL FINISHES

- A. Variations in finishes are unacceptable in the same piece. Variations in finishes of adjoining components are acceptable if they are within the range of approved Samples and if they can be and are assembled or installed to minimize contrast.

2.15 LUMINAIRE SUPPORT

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.
- B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as luminaire.
- C. Wires: ASTM A641/A641M, Class 3, soft temper, zinc-coated steel, 12 gage.
- D. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 TEMPORARY LIGHTING

- A. If approved by the Design-Builder, use selected permanent luminaires for temporary lighting. When construction is sufficiently complete, clean luminaires used for temporary lighting and install new lamps.

3.3 INSTALLATION

- A. Comply with NECA 1.
- B. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- C. Supports:
 - 1. Sized and rated for luminaire weight.
 - 2. Able to maintain luminaire position after cleaning and relamping.
 - 3. Provide support for luminaire without causing deflection of ceiling or wall.
 - 4. Luminaire-mounting devices shall be capable of supporting a horizontal force of 100 percent of luminaire weight and a vertical force of 400 percent of luminaire weight.
- D. Flush-Mounted Luminaires:
 - 1. Secured to outlet box.
 - 2. Attached to ceiling structural members at four points equally spaced around circumference of luminaire.
 - 3. Trim ring flush with finished surface.
- E. Wall-Mounted Luminaires:
 - 1. Do not attach luminaires directly to gypsum board.
- F. Suspended Luminaires:
 - 1. Ceiling Mount:
 - a. Two 5/32-inch-diameter aircraft cable supports adjustable to 10 feet in length.
 - 2. Pendants and Rods: Where longer than 48 inches, brace to limit swinging.
 - 3. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
 - 4. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.
- G. Ceiling-Grid-Mounted Luminaires:
 - 1. Secure to any required outlet box.
 - 2. Use approved devices and support components to connect luminaire to ceiling grid and building structure in a minimum of four locations, spaced near corners of luminaire.
- H. Comply with requirements in Section 260519 "Low-Voltage Electrical Power Conductors and Cables" for wiring connections.

3.4 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.5 FIELD QUALITY CONTROL

- A. Perform the following tests and inspections:
 - 1. Operational Test: After installing luminaires, switches, and accessories, and after electrical circuitry has been energized, test units to confirm proper operation.
 - 2. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to battery power and retransfer to normal.
- B. Luminaire will be considered defective if it does not pass operation tests and inspections.
- C. Prepare test and inspection reports.

END OF SECTION 26 51 19

SECTION 26 52 13 - EMERGENCY AND EXIT LIGHTING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Emergency lighting.
2. Exit signs.
3. Materials.
4. Luminaire support components.

1.2 DEFINITIONS

- A. Correlated Color Temperature (CCT): The absolute temperature, measured in kelvins, of a blackbody whose chromaticity most nearly resembles that of the light source.
- B. Color Rendering Index (CRI): Measure of the degree of color shift that objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference source.
- C. Lumen (lm): The SI derived unit of luminous flux equal to the luminous flux emitted within a unit solid angle by a unit point source (1 lm = 1 cd-sr).

1.3 ACTION SUBMITTALS**A. Product Data:**

1. For each type of emergency lighting unit, exit sign, and emergency lighting support.
 - a. Include data on features, accessories, and finishes.
 - b. Include physical description of unit and dimensions.
 - c. Battery and charger for light units.
 - d. Include life, output of luminaire (lumens, CCT, and CRI), and energy efficiency data.
 - e. Include photometric data and adjustment factors based on laboratory tests by, or under supervision of, qualified luminaire photometric testing laboratory, for each luminaire type.

1.4 INFORMATIONAL SUBMITTALS

- A. Product Certificates: For each type of luminaire.
- B. Product Test Reports: For each luminaire for tests performed by, or under supervision of, qualified luminaire photometric testing laboratory.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect finishes of exposed surfaces by applying a strippable, temporary protective covering before shipping.

1.6 WARRANTY

- A. Special Installer Extended Warranty for Emergency and Exit Lighting: Installer warrants that fabricated and installed emergency luminaires and exit signs, including batteries, perform in accordance with specified requirements and agrees to repair or replace components and assemblies that fail to perform as specified within extended warranty period.
 - 1. Extended Warranty Period: Two year(s) from date of Substantial Completion; full coverage for labor, materials, and equipment.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR EMERGENCY LIGHTING

- A. Electrical Components, Devices, and Accessories: Listed and labeled in accordance with Chicago Electric Code and UL 924, by qualified electrical testing laboratory recognized by authorities having jurisdiction and marked for intended location and application.
- B. Comply with NFPA 101.
- C. Comply with NEMA LE 4 for recessed luminaires.
- D. Chicago Approved.

2.2 EXIT SIGNS

- A. General Characteristics: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.
- B. Internally Lighted Sign:
 - 1. Refer to Luminaire Schedule for description.
 - 2. Chicago Approved
 - 3. Options:
 - a. Operating at nominal voltage of 277V(ac).
 - b. Lamps for AC Operation:
 - 1) LEDs; 50,000 hours minimum rated lamp life.

2.3 MATERIALS

- A. Metal Parts:
 - 1. Free of burrs and sharp corners and edges.
 - 2. Sheet metal components must be steel unless otherwise indicated.
 - 3. Form and support to prevent warping and sagging.
- B. Doors, Frames, and Other Internal Access:

1. Smooth operating, free of light leakage under operating conditions.
2. Designed to permit relamping without use of tools.
3. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position.

2.4 METAL FINISHES

- A. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within range of approved Samples and are assembled or installed to minimize contrast.

2.5 LUMINAIRE SUPPORT COMPONENTS

- A. Comply with requirements in Section 260529 "Hangers and Supports for Electrical Systems" for channel and angle iron supports and nonmetallic channel and angle supports.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for conditions affecting performance of luminaires.
- B. Examine roughing-in for luminaire to verify actual locations of luminaire and electrical connections before luminaire installation.
- C. Examine walls, floors, roofs, and ceilings for suitable conditions where emergency lighting luminaires will be installed.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

- A. Install luminaires level, plumb, and square with ceilings and walls unless otherwise indicated.
- B. Install lamps in each luminaire.
- C. Supports:
 1. Sized and rated for luminaire weight.
 2. Able to maintain luminaire position when testing emergency power unit.
 3. Provide support for luminaire and emergency power unit without causing deflection of ceiling or wall.
 4. Luminaire-mounting devices must be capable of supporting a horizontal force of 100 percent of luminaire and emergency power unit weight and vertical force of 400 percent of luminaire weight.
- D. Wall-Mounted Luminaire Support:

1. Attached to structural members in walls.
2. Do not attach luminaires directly to gypsum board.

E. Suspended Luminaire Support:

1. Pendants and Rods: Where longer than 48 inch (1200 mm), brace to limit swinging.
2. Stem-Mounted, Single-Unit Luminaires: Suspend with twin-stem hangers. Support with approved outlet box and accessories that hold stem and provide damping of luminaire oscillations. Support outlet box vertically to building structure using approved devices.
3. Do not use ceiling grid as support for pendant luminaires. Connect support wires or rods to building structure.

3.3 IDENTIFICATION

- A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 260553 "Identification for Electrical Systems."

3.4 FIELD QUALITY CONTROL

- A. Field tests and inspections must be witnessed by Design-Builder.
- B. Tests and Inspections:
1. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to emergency power and retransfer to normal.
- C. Nonconforming Work:
1. Luminaire will be considered defective if it does not pass operation tests and inspections.
 2. Remove and replace defective units and retest.
- D. Prepare test and inspection reports.

3.5 ADJUSTING

- A. Adjustments: Within 12 months of date of Substantial Completion, provide on-site visit to do the following:
1. Inspect luminaires. Replace lamps, exit signs, and luminaires that are defective.
 - a. Parts and supplies must be manufacturer's authorized replacement parts and supplies.
 2. Conduct short-duration tests on all emergency lighting.

3.6 PROTECTION

- A. Remove and replace luminaires and exit signs that are damaged or caused to be unfit for use by construction activities.

END OF SECTION 26 52 13

SECTION 27 00 01 - COMMON WORK RESULTS FOR COMMUNICATIONS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, Division 27 Specification Sections apply to all sections.
- B. Obtain the latest City of Chicago Design and Construction Standards document(s) from the Owner. Comply with all Owner-specific requirements in addition to requirements set forth in these specifications and accompanying drawings. Should there be a conflict, the Owner's standards shall take precedence, unless prevailing codes and regulations mandate otherwise.
- C. Related Drawings
 - a. All Civil Drawings
 - b. All Electrical Site Drawings
 - c. All Technology (T-Series) Drawings

1.2 GENERAL DIRECTION

- A. Submittal of a bid indicates that the contractor has examined the drawings, specifications, and had an opportunity to visit the site to be able to provide a comprehensive complete bid.
- B. The intent of these specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes. Interpret these specifications in conjunction with the drawings and provide all work described. If work is shown on drawings and not mentioned in the specifications, or vice versa, it is to be included in the work the same as though clearly set forth by both. Should there be a conflict between the specifications and drawings, provide the greater quantity or better quality. Immediately notify owner's representative and design professional of such conflicts.
- C. The drawings that accompany these specifications are diagrammatic and although size and location of equipment is drawn to scale, wherever possible make use of submittal data and verify all dimensions on site. They do not show every conduit, offset or pull / junction box which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical and install additional pull / junction boxes and offsets where required by site conditions and codes at no additional cost. Install all new work in such manner as to conform to the structure, avoid obstructions, provide required service clearances and preserve headroom. Do not scale from drawings, measurements shall be taken in the field.

- D. Coordinate all new work with all other contractors and installers in addition to existing building obstructions and install accordingly. Refer to coordination drawings of other trades. Comply with requirements of architectural drawings including but not limited to mounting height and locations.
- E. Fully research peculiarities and limitations of space available for installation of work with materials being provided. Work around material lead times to not extend project schedule.
- F. Complete work, or part(s) thereof, at times as may be designated by the Owner's Representative, so that it can be used for temporary or permanent use. Do not construe such use of the system as an acceptance of it by Owner.
- G. During mobilization or construction, if an abnormal condition is uncovered either with existing conditions, equipment loads, submittal data, etc. bring these to the attention of the Design Professional for review.
- H. Owner's Representative or Design Professional may relocate fixtures, devices, equipment, etc. prior to installation within a 20-foot limit at no additional charge.
- I. Phasing - Where the scope of work dictates that the project shall be constructed in phases, all costs shall be incurred by this contractor for any temporary work required so that previous phases can be operational while construction is being done to adjacent spaces.

1.3 GENERAL STANDARDS

- A. Provide work in compliance with applicable provisions of the following standards. Provide listing and labeling for all electrical materials, marked for respective intended uses, from UL or other Nationally Recognized Testing Laboratory (NRTL) that is acceptable to applicable Authorities Having Jurisdiction (AHJs).
- B. Provide materials, installation methods, workmanship, testing, etc., in strict accordance with the latest edition of applicable standards and adopted codes, including (but not limited to) the following.
 - 1. International Building Code
 - 2. State Building Code and applicable amendments
 - 3. State Energy Code
 - 4. Utility company requirements and standards as applicable
 - 5. All provisions and requirements of NFPA (National Fire Protection Association)
 - 6. National Electrical Code (NEC), NFPA 70
 - 7. Life Safety Code, NFPA 101
 - 8. Local governmental and other prevailing codes and ordinances
 - 9. ADA/ADAAG requirements (American with Disabilities Act) including all applicable Standards for Accessible Design.
 - 10. UL (Underwriters Laboratories Inc.)
 - 11. ETL (Intertek Testing Services NA, Inc.)
 - 12. CSA (CSA Group Testing and Certification Inc.)
 - 13. FM (Factory Mutual Insurance Company)
 - 14. ASME (American Society of Mechanical Engineers)

15. NEMA (National Electrical Manufacturers Association).
16. NECA (National Electrical Contractors Association)
17. IP (International Protection Rating / Ingress Protection Rating)

1.4 PERMITS AND REGULATIONS

- A. Obtain and pay for permits, fees, certificates of inspection and approval, etc. required for this branch of the work. Furnish Owner with certificates of final inspection and approval prior to final acceptance of this branch of the work.
- B. Laws and regulations which bear upon or affect the various branches of this work shall be complied with by this contractor and are hereby made a part of this contract.

1.5 DEFINITIONS

- A. Furnish - Procure, supply and deliver to project site, ready for installation, install and warrant (unless indicated otherwise on documents). Include warranty expenses.
- B. Install - Assemble, wire and connect loose-shipped components on site. Place in position for service or use, including material, labor, accessories, services, and testing. Wire, connect, and render fully operational for intended use.
- C. Provide - Furnish and Install. Similar Terms: "include", "shall", "equip with", "consisting of"
- D. Equal or Equivalent - Determination of equivalency to be made by design professional for all products not listed as basis-of-design.
- E. Substantial Completion - Where frontend documentation does not define, products and systems must be fully installed as designed, tested, adjusted, labeled, and functionally demonstrated to owner.
- F. High Voltage: For the sake of this Division, greater than 70.7vac RMS; greater than 100vac P-P; greater than 49vdc.
- G. Low Voltage: For the sake of this Division, less than or equal to 70.7vac RMS; less than 100vac P-P; less than or equal to 49vdc.
- H. Structured Cabling: A standardized repetitive passive physical infrastructure of cables, conductors, terminations, hardware and supporting products that together are used to enable the conveyance of signals, information, and data between different locations. Such systems are commonly constructed in accordance with standards published by various standards organizations, including but not limited to the TIA, EIA and BICSI. In some cases, specialized derivatives of these standards are constructed to meet specialized system needs. Common usages of structured cabling systems include such things as computer or data networks (including wireless infrastructure), telephone systems, building automation systems, electronic safety and security systems, and building intercommunications systems. The structured cabling system does not include any active electronic equipment.

- I. Audio-Visual / Audio and Video Systems Work: That portion of the Project that involves the supply, installation, programming, or testing of products whose fundamental purpose is the reproduction, pickup, storage, transporting, processing, control of audio and/or video signals. Scope of this definition includes all incidentals that are regularly and fundamentally required to provide complete and working systems from the small and simple to the large and complex.

1.6 REQUESTS FOR INFORMATION

- A. See Section 01 25 13 – Request for Interpretations

- B. Acronyms and Abbreviations:

1. ADA: Americans with Disabilities Act.
2. ANSI: American National Standards Institute.
3. AWG: American Wire Gauge.
4. BICSI: Building Industry Consulting Services International.
5. BOM: Bill of Materials.
6. Bps: Bits per second.
7. LEC: Local Exchange Carrier.
8. dB: Decibel.
9. Device ID: A system specific label assigned to a product to uniquely identify it within a given a system.
10. DSL: Digital Subscriber Line.
11. EF: Entrance Facility.
12. EIA: Electronics Industries Association.
13. EMI: Electromagnetic Interference.
14. ER: Equipment Room (a type of Communications Room).
15. Gb/s (Gbps): Gigabits per second.
16. GHz: Gigahertz.
17. IDF: Intermediate Distribution Frame (Replaced by TR).
18. IEEE: Institute of Electrical and Electronics Engineers.
19. ISO: International Organization for Standardization.
20. ISP: Internet Service Provider.
21. LAN: Local Area Network.
22. MAC: Media Access Control.
23. Mb/s (Mbps): Megabits per second.
24. MDF: Main Distribution Frame (Replaced by ER).
25. MHz: Megahertz.
26. MPLS: Multi Protocol Label Switching.
27. OFCI: Owner Furnished Contractor Installed.
28. OFE: Owner Furnished Equipment.
29. OFOI: Owner Furnished Owner Installed.
30. PoE: Power over Ethernet.
31. PSTN: Public Switched Telephone Network.
32. QoS: Quality of Service.
33. RAID: Random Array of Inexpensive Disks.
34. RAM: Random Access Memory.
35. RFC: Request for Comment.
36. RFI: Request for Information/ Radio Frequency Interference.
37. RFP: Request for Proposal.

- 38. RFQ: Request for Quotation.
- 39. SNMP: Simple Network Management Protocol.
- 40. SSD: Solid State Drive.
- 41. TB: Terabyte.
- 42. TCP: Transmission Control Protocol.
- 43. TCP/IP: Transmission Control Protocol/Internet Protocol.
- 44. TIA: Telecommunications Industries Association.
- 45. TR: Telecommunications Room (a type of Communications Room)
- 46. VoIP: Voice over Internet Protocol.

- C. Provide the services of locally licensed and authorized electrician(s) to perform that portion of the Work of this Division that is required by the applicable codes and/or the AHJ to be performed by licensed electrician(s).

1.7 ADMINISTRATION

- A. See Section 01 31 00 Project Management and Coordination

1.8 WARRANTY / GUARANTEE

- A. Provide a warranty/guarantee in written form as part of O&M manual stating that all work, materials, equipment and parts are warranted to be free of defect for a minimum period of one year from the date of Substantial Completion. Warranty period and requirements may be expanded in drawings or subsequent specification sections. Repair or replace (owner's option) any defects or failures at no cost to the owner within the warranty period. Issues arising within warranty period must be attended to in a timely manner and in no case exceed four (2) working days. State this in writing as part of O&M manual. Replace defective items to the satisfaction of the Owner's Representative and the Design Professional.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials, apparatus and equipment shall bear the Underwriter's Laboratory, Inc. label (or other nationally recognized testing laboratory label) where regularly supplied, and as additionally required by Code or the Contract Documents.
- B. Products furnished shall be new, full weight and of the best quality. Similar supplied materials shall be of the same type and from the same manufacturer.
- C. If a specified product is discontinued by the manufacturer and is no longer available for purchase, replacement product of equal or greater value, performance and function as the discontinued Basis of Design product shall be furnished. The replacement product shall be from the same manufacturer as the Basis of Design product unless written permission has been granted by the Designer. The Contractor is solely responsible for

researching and submitting proposed replacement product. The final decision as to whether a Contractor proposed replacement is acceptable lies solely with the Designer.

- D. Substitute products shall only be considered if the Contractor has strictly adhered to the guidelines set forth under “Substitutions” as defined in this Section.

2.2 BASIS OF DESIGN

- A. Some of the Contract Documents are prepared on the basis of specific products that are designated as the “Basis of Design.”
- B. The Basis of Design products for the Work of this Division are designated explicitly within the specifications, and in the case of some products, designated by brand and model on the Drawings.
 - 1. Where a product brand and model is expressly identified on the Drawings, this product represents the Basis of Design for that instance of the product in the associated system.
- C. The combination of Basis of Design products and the interconnection thereof collectively represent a work that includes the feature set and performance intended by the Designer and the Owner. The specifications may identify additional manufacturers whose equipment may be used in the system, provided the use of such products achieves the same capabilities and performance as that of the specified combination of the Basis of Design products.
 - 1. Due to the varied and integrated nature of modern communications products, there is no guarantee that any single product manufactured by any one of the listed additional manufacturers will be an exact equivalent to a single Basis of Design product in terms of functionality, capability or performance. Therefore, where the use of substitute product is considered, the product shall be verified by the substituting party to include the capabilities, features and performance as that of the Basis of Design product.
 - 2. Work of the Contract shall include covering the cost of additional products and labor necessary to achieve the same end results as would be achieved by using the specified combination of Basis of Design products, including additional costs for coordination, modifications to the building, pathway modifications, casework and furniture modifications, power modifications, licensing, or anything else that may cause additional expense to the Owner.
 - 3. In addition, costs incurred by the Owner’s design team to accommodate such changes shall be the responsibility of the party making the substitution.

2.3 SUBSTITUTIONS

- A. A substitution is the use of any product other than that identified as the “Basis of Design,” the “Standard of Quality,” or an “Additional Approved Product.”
- B. Substitutions require pre-bid approval. Only substitutions authorized via addendum shall be considered.
- C. Substitutions are considered on a product-by-product and model specific basis.

- D. Substitution Submittal Requirements:
1. Substitution requests must be received by the Designer sufficiently in advance of the scheduled bid date to allow time for review and issuance of an Addendum. If the timing of the request does not permit an Addendum, substitution shall not be considered or acceptable.
 2. Substitution requests shall consist of the following for each proposed substitution:
 - a. Substitution Request Letter
 - b. Product Datasheets/Brochures
- E. Costs that result from the use of substitute products and/or Additional Approved Manufacturer(s), including costs for additional equipment, coordination, accessories, modules, interface products, cables, software, and programming, as well as costs for any additional labor, materials, and products incurred by other trades or members of the project Design Team or Owner, are the sole responsibility of the Contractor making the substitution. This includes costs that may not be incurred or known until after Contract award or Work execution. Such costs shall be deducted from final sum payable to the Contractor.
- F. Post Contract award substitutions may be considered, but only if the proposed substitution includes substantial additional benefit to the Owner. Post award substitutions are considered solely at the discretion and convenience of the Designer. For a post Contract award substitution to be considered, one or more of the following shall apply:
1. The Designer initiates the request for substitution.
 2. A basis of design product has become discontinued and is no longer available, and as a result, the use of a substitute product has become a necessity to meet the Owner's objectives for the Project. See "Discontinued Products."
 3. The request for substitution is accompanied by a proposal that identifies the benefits to the Owner, including a fair-market Contract price reduction.

2.4 DISCONTINUED PRODUCTS

- A. The availability of products shall be verified by the Contractor prior to submitting pricing for Work of the Contract.
- B. In the event that a specified product is discontinued at any time and becomes unavailable for use on the Project, provide a replacement product deemed acceptable to the Designer. Replacement product shall be of equal or greater value, performance and functionality.
1. Replacement product shall be from the basis of design manufacturer, from one of the additional product manufacturers identified for the product within the Section, or from another manufacturer deemed acceptable to the Designer.
- C. The cost for the supply and installation of suitable replacement product is the sole responsibility of the Contractor.
- D. Replacement products are considered substitutions and require Designer review and authorization. See "Substitutions."

PART 3 - EXECUTION

3.1 WORK AND WORKMANSHIP

- A. Provide labor, materials, equipment, and services necessary for complete installation of systems required to comply with the requirements of authorities having jurisdiction (AHJ), as indicated within the Contract Documents.
- B. Work shall be functional and complete in every detail, including items required to complete the system, regardless of whether each necessary item is fully enumerated in the Specifications or shown on the Drawings.
- C. Contractor and Subcontractors shall be knowledgeable of the details of Work to be performed by other trades and take necessary steps to integrate and coordinate Work of this Division with that of other Divisions and other trades.
- D. Wherever tables or schedules show quantities, they shall not be interpreted to represent the total contract quantity requirement, but instead a portion of the Contract requirement. The Contractor shall be responsible for the higher quantity communicated by the Drawings, within the Specifications and on the schedules/tables. Seek clarification from the Designer should a discrepancy be found.
- E. The Designer and Owner's Representative may, at their sole discretion, condemn or reject any Work, materials, or equipment not in accordance with the Contract Documents or the manufacturer's specifications or drawings reviewed by the Designer or Owner.
- F. Work or equipment that is rejected shall be removed and replaced to the satisfaction of the Owner and Designer at the Contractor's expense. Work or equipment that is rejected shall be so stated in writing by the Owner or Designer.
- G. Work shall fully comply with the Contract Documents and manufacturer's recommended installation guidelines.
- H. Work shall be performed with the best practices of the trade for performance, functionality, safety, endurance and aesthetics.
- I. Coordinate ordering and installation of equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.
- J. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible. Consult the Designer for direction.
- K. Supply scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.
- L. Work shall be installed level and plumb, parallel and perpendicular to prevailing building lines, except as expressly detailed otherwise or required for proper form, function or Designer-intended operation.

- M. Specialty tools shall be used for assembly, installation, termination, and removal of products as recommended by the product manufacturer.

3.2 TESTING

A. General:

1. Upon complete physical installation of products, align, balance, and adjust equipment to make it usable to the Owner for the intended purpose, and ensure compliance with the Contract Documents.
2. Test each system and each component thereof, and correct deficiencies prior to scheduling acceptance testing.
3. Replace malfunctioning or damaged products with new product, following immediately with retesting until satisfactory performance and specification compliant conditions are achieved.

B. Operational Testing:

1. Perform operational testing of supplied products individually and collectively to verify conformance with the Contract Documents, to ensure compliance with the product manufacturer's published specifications, and as additionally necessary for the system to meet the intended purpose.

C. Performance Testing:

1. Perform measurements and testing necessary to demonstrate performance compliance.

3.3 TRAINING

- A. Training shall be supplied for each Section of this Division and for each unique system provided.

- B. The Owner shall have the right to use the total allocated training for a period of 1 year following final completion of onsite work, solely at its discretion.

- C. Training shall be supplied as expressly identified within individual Sections. Where training requirements are not otherwise expressly identified, the Contractor shall furnish a minimum of two (2) hours per unique system, per Section. The Contractor shall presume that at least two (2) discrete trips to the project site shall be required per unique system to conduct training.

- D. Training dates and times shall be coordinated with the Owner's designated training representative(s).

E. Training shall cover the following:

1. Normal system use and operation.
2. Procedures and schedules involved in troubleshooting and performing routine preventative maintenance.
3. Other facets as identified in individual Sections.

- F. Agenda and relevant training handouts shall be prepared and distributed to attendees at each training session.

- G. A sign-in sheet shall be created and used for each training session. The sheet shall identify the following, at a minimum:
 - 1. Specification Section reference and system(s) being trained.
 - 2. Date and starting time of the session.
 - 3. Signatures of attendees.
 - 4. Ending time of the session, along with a separate owner signature certifying the ending time.
 - 5. Training outline/agenda.

- H. Recording of Sessions:
 - 1. Recordings shall be supplied on DVD video format media playable in standard consumer grade reproduction appliance. Recordings do not need to be professionally edited but shall feature intelligible audio and a clear image of the subject trainer and any supplemental visual content material to the training.
 - 2. Recordings shall be turned over and signed for by an Owner's training representative at the end of each session. A copy of a signed delivery receipt shall be included as part of the closeout documentation.
 - 3. Contractor shall require each attendee to sign-in at the start of each training session. The sign-in form shall summarize the training conducted, specification section reference and system being trained on, as well as the starting time and duration of training. Following training, a representative of the Owner shall sign the form, acknowledging the same. Contractor shall retain the original copy of these forms and turn over a photocopy of the form to the Owner's representative as evidence of training. Training conducted without this official record of training shall not be considered as part of the Contractor's training obligation.

- I. For a training session to count towards the training obligation, each of the following shall be met:
 - 1. Training occurs after Training Submittal review.
 - 2. Training session outlines / agenda are distributed at the session.
 - 3. Quality Assurance requirements for the instructor have been met.
 - 4. Training occurs after the system / section is complete and working as intended by the Contract Documents, usually following Acceptance Testing. Training in advance of this requires Designer approval.
 - 5. Sign-in sheets are used, completed, and retained for the session.
 - 6. A master log of training conducted for the project is maintained.

END OF SECTION 27 00 01

SECTION 27 00 02 - QUALITY ASSURANCE FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUBMITTAL REQUIREMENTS

- A. Quality Assurance:
 - 1. Quality Assurance: General Qualifications.

1.2 SUMMARY

- A. Section Includes:
 - 1. Quality Assurance requirements for Work of this Division.
- B. Related Requirements
 - 1. Related Sections
 - a. All Division 27 Sections.

1.3 QUALITY ASSURANCE

- A. General Qualifications:
 - 1. Business history of the last five (5) contiguous years performing work of similar type, value and scope as that required of the Contract Documents.
 - 2. Capable of demonstrating through valid references and other means that it has successfully completed no less than six (6) projects of similar type, monetary size, and scope of work within the last twenty-four (24) calendar months.
 - 3. A "Factory-authorized" reseller (e.g., distributor, dealer, integration partner, value-added reseller, channel partner) for the products furnished for each Section.
 - 4. House substantial business operations within a 300-mile radius of the project site.
 - 5. Employ full-time service staff based within a 50-mile radius of the project site.
 - 6. Financial Disclosure of the Contractor: Prior to contract award, upon request.
- B. Superintendent/Project Manager Qualifications:
 - 1. Furnish the services of an experienced superintendent/project manager who shall be constantly in charge of the Work, together with a qualified foreman and technical specialists to properly install, connect, adjust, start, operate and test the Work involved.
 - 2. Qualifications are subject to the review and acceptance by the Designer and Owner. Unless the Designer and Owner grant prior permission, the same superintendent/project manager shall be utilized throughout the duration of the Project and shall remain responsible for the complete scope of the Work.
- C. Subcontractor Qualifications:
 - 1. If the Contractor, as a singular entity, does not meet 100-percent of the quality assurance requirements for each specification section, the Contractor shall enlist the services of qualified subcontractors to perform the Work of those specific

section(s). This includes, but is not limited to, the supply of the products for the Section and the supply of the project engineering services, preparation of shop drawings and section submittals, technical installation labor, training, warranty, post-installation support and service.

2. The Contractor shall ensure that each subcontractor supplies the services of a project manager to represent its interests at the same project meetings in which the Contractor participates.
3. The Designer and Owner reserve the right to disqualify the use of any subcontractor that does not meet the quality assurance requirements set forth in these specifications. Should a subcontractor be disqualified, the Contractor shall supply the services of a different subcontractor that complies with the published quality assurance requirements. The Contractor is solely responsible for costs incurred as a result. It is therefore incumbent upon the Contractor to pre-qualify subcontractor choice(s) prior to submitting pricing for work.
4. To achieve quality assurance compliance, an equipment vendor that is not performing the technical installation labor associated with work of a Section shall not be considered a subcontractor.

D. Training Qualifications:

1. Personnel conducting training shall be knowledgeable of the product, system and technology on which they train. Personnel shall be factory trained, factory certified and/or otherwise recognized by the Designer as possessing sufficient experience and knowledge in the subject area.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE SUBMITTALS

- A. Provide documentation that demonstrates the qualification for each requirement articulated in this Section and in compliance with Section 01 33 0.

END OF SECTION 27 00 02

SECTION 27 00 03 - OWNER'S STANDARDS DOCUMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, Division 27, and Division 28 (if applicable) Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes the current version of the **City of Chicago Requirements for Cabling Infrastructure, dated 2019**. Comply with the requirements of this Section which shall be referred to as the "Owner's Standards Document."
- B. Related Requirements:
1. The requirements of the Contract Documents and the Owner's Standards Document shall be additive. E.g., if the Contract Documents require cables to be labeled, and the Owner's standards do not indicate labeling, labeling shall be provided as specified in the Contract Documents.
 2. Where other Division 27 and Division 28 Specification Sections and this Section (i.e., the Owner's Standards Document) are in direct conflict, the Owner's Standards Document shall supersede the requirements of other Division 27 and Division 28 Section(s). E.g., if the Contract Documents require cables to be labeled, and the Owner's Standards Document expressly states do not label cables, the Documents are in direct conflict and the Owner's Standards Document shall supersede the Contract Documents.

PART 2 - OWNER'S STANDARDS DOCUMENT

City of Chicago Requirements for cabling Infrastructure

The following pages are meant to service as a guideline for any new voice or data infrastructure work performed on city of Chicago facilities. Working in conjunction with the Department of Innovation and Technology and the Department of Fleet and Facility Management (2FM) the following pages are meant to act as a guide to implement local area network (LAN) technology in a consistent way. This document is the network wiring standards established for the City of Chicago including a standardized cabling system and physical topology for our network.

The audience for the manual is anyone involved in network wiring projects.

. The benefits of following the standardized system include:

- Maintaining district wide consistency and standardization to promote efficient maintenance by city personnel.

- Supporting multi-vendor equipment
- Simplifying moves, additions, and changes
- Allowing for future applications -- “future proofing” the cabling system for any forthcoming technologies
- Saving time and money in cable maintenance.

In summary, network wiring which follows these standards should provide excellent infrastructure to support LANs and backbone wiring from the Main Distribution Frame (MDF) Room to the work stations. All work done In City of Chicago facilities must meet Chicago building codes, and must be coordinated with the department of Fleet and Facility Management (2FM). Installations are to be done to comply with BICSI standards. All the guidelines listed herein are subject to change to meet specific needs if requested.

MDF/IDF layout

Digital photos of MDF's and IDF's are to be submitted at the completion of the project. These closet specifications are for all closets including the IDF's and the MDF. The Construction is to be no smaller than 8' x 8' with exception of netpop. Door should swing out and not into the closet if possible, and width of door must meet industry standards. Network closets are to be accessible from hallway areas and not located inside other rooms. At least one 4' x 8' raised $\frac{3}{4}$ " fire-rated plywood or plywood which is painted with at least two coats of fire resistant white paint shall be in each closet and the location will be determined by Network Services staff member. Closets are not to be shared with other building services, such as electrical and custodial. Reasoning is due to potential EMF interference and possible threat of damage to the equipment and wiring. Telecommunications closets shall not contain any type of sink, be used as janitorial supplies storage or be used general storage areas (books, furniture, etc.). Floors in telecommunications rooms shall be sealed concrete or tile. Carpeted floors are unacceptable due to the potential for static electricity and the subsequent threat of damage to network distribution equipment.

1. Where possible, telecommunication closets will be stacked on each floor.
2. Each telecommunications closet will have a minimum of three (3) four inch Sleeved core holes between floors. Empty core holes will be properly fire-stopped according to Chicago code.
3. All cables shall have a minimum of 15 foot service loops inside the MDF or in the ceiling above it, and shall have a minimum of 6 inch service loop at the workstation outlet. (inside the box)
4. Adequate lighting is required throughout the closet space. .
5. All metal components (racks, ladder tray, etc) are to be properly grounded per Chicago Electrical Code and industry standards.
6. All racks need to be bolted to the floor.

7. Electrical in each IDF is to include:

- (2) 120V 20AMP circuits with duplex receptacles the Location of these outlets will be determined by placement of rack and telephone equipment.
8. All closets need ventilation, exhaust fans are acceptable.
9. Provide a minimum of (1) 2" conduit should be provided from MDF to basement IDF
10. Provide a minimum (1) 7' 19" standard 2 post rack in each IDF.
11. Provide a copper grounding bus bar with #6 MNG.

Riser fiber cabling

The Data Network fiber cable risers consist of a composite of multi-mode and fiber cables terminated to EIA/TIA standards using rack-mounted nineteen inch (19.00") patch panels. The number of fiber pairs from the MDF to each IDF will be minimum 6 multimode strands. All connectors will be dual LC style. All fiber is to be labeled with P-Touch or similar electronic device. Handwritten labeling is not acceptable. Electronic and hard copy test results are to be provided. Contractor is to be certified in fiber termination. All newly installed Fiber is to be 50 micron. All patch cords, hardware and associated accessories must be 50micron as well. 62.5 micron can only be used if specified by 2FM and or DOIT. Fiber is to be terminated in 19" racks complete with vertical and horizontal wire management. Fiber is to be terminated at the top of the rack unless otherwise specified. Network Services. A service loop of 30 feet of fiber is to left inside the MDF and be properly secured and dressed.

Voice Network:

Due to the city wide VOIP migration it may be acceptable to provide the 3rd (Blue cable) for each location on a patch panel in the typical 568B wiring configuration and tested to meet BICSI/TIA EIA standards for cat 6 cable. **OR** Category 6A may be supplied with a 2 cable configuration with approval from 2fm, **OR** in cases where the traditional PBX based system is to be used the following standards should be applied. The voice network backbone will be traditional 100 pr cat 3 copper cable. The cabling from the workstation for the voice is punched on 110 Blocks on the plywood in the IDF. Copper for voice services is to be terminated on category 6 or higher with appropriate 110 blocks on a raised backboard. All cables are to be terminated according to EIA/TIA 568-A Cat 6 standards. Station locations are to be terminated to the right of the riser pair terminations. All riser and station terminations are to be electronically labeled with a P-touch or similar device, no handwritten labeling is accepted. Riser cables will be terminated on 110 style punch down blocks. Punch-down order should follow traditional USOC color code order for multi-pair telephone cables punched on 110 Blocks. The amount of riser cable to IDF will be dependent upon the amount of stations needed to be fed + 25%

An electronic CAD drawing accurately reflecting all cable drop locations and corresponding labeling must be submitted to DOIT and 2FM.

Voice/Data Workstations, Conduits, Wiremold and Outlets:

All cable drops must have a minimum of 1 voice (category 6) and 2 data (category 6 or higher) unless specified differently by Network Services. The color of the cable and matching jacks should be as follows: 1 Red cat 6, 1 White Category 6, and 1 Blue category or 1 White and 1 Blue Category 6A cable. From the systemax gigaspeed product line made by Commscope or equivalent in performance. Example: Outlets models MGS400 for Cat 6 and MGS600 for Category 6A. All cabling for data should meet or exceed 1 Gigabit, or 10 Gigabit performance respectively between the patch panel IDF and work stations. Any office space greater than 8' x 8' should have a minimum of 2 cable drops (STOs or LOCs) if not specified on print with 3 copper cables (1 voice and 2 data or 3 Data in the case of VOIP). Locations of the cable drops are to be on opposite sides of the room, enclosed within the walls and conduit provided to each location. Metal conduit is to be one 3/4" at a minimum. Any unused conduits are to have a pull string left in place. Any unused gang openings will be filled with a blank module filler*. In the event that the cabling cannot be run behind the walls, wire mold or exposed conduit may be used if signed off on by 2FM project manager., i.e. existing concrete walls . The height of the network location is to meet industry cable standards or determined by the architect. Each cable drop will be labeled with IDF and numerically from 001-999. The drop # is determined by walking into the room and numbering the cable drops from left to right working in a clockwise direction. All labels are to be electronically labeled with a P-touch or similar device, no handwritten labeling is accepted.

Patch Panels

Patch Panels must be category 6 and must be labeled to match field labeling. Patch panels shall be 48 port in size. Each rack unit taken up by a patch panel must be accompanied by an equivalent amount of horizontal wire management with covers. Generally patch cords are supplied by DOIT, but if requested must fit within wire management, be of correct length, category, and be installed in a neat and workman like manner.

Cable and outlet color code

- Wireless access point (AP) pulls are to be 1 category 6 **grey** in color.
- Time clock pulls (if required) are to be done with category 6 cabling **yellow** in color.
- Camera cables are to be done with category 6 cabling **purple** in color terminated on a separate patch panel in the telecommunications closet.
- Work station voice cables are to be done with category 6 cabling **blue** in color
- Work station Data cables are to be done with category 6 cabling **Red** in color for Primary outlet and **White** in color for the secondary outlet.
- If colored conduit is required it should be **White** in color. • Outlet color should match cable color

Certification Requirements:

The Telecommunications contractor must be an approved Commscope or other Certified Installer (CI) A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with Commscope or other pre-approved manufacturer's recommendations.

PART 3 - EXECUTION (NOT USED)

END OF SECTION 27 00 03

SECTION 27 01 00 - OPERATION AND MAINTENANCE OF COMMUNICATIONS**PART 1 - GENERAL****1.1 SUBMITTAL REQUIREMENTS**

- A. Closeout
 - 1. Operation and Maintenance Manual: For equipment and systems to include in operation and maintenance manuals.
- B. Shop Drawings
 - 1. As-Built Drawings: For recording installed conditions that deviate from design documents.

1.2 OPERATION AND MAINTENANCE MANUAL

- A. The contents of operating and maintenance manual shall include the following:
 - 1. Project Information Cover: Title of Project; Name and address of Owner, Design Professionals, Contractor of Record and Subcontractor; System name and specification references.
 - 2. Index: Contents of the manual.
 - 3. Warranty Statements: Furnish a warranty statement for each system, reiterating the terms of warranty identified within the Contract Documents, and identifying how the Owner is to obtain warranty service. Clearly identify which products are covered by Manufacturer warranties beyond the Contractor required minimum warranty period. The term of manufacturer warranty shall also be identified (e.g., 1-year parts and labor). Identify the date that the warranty for the system starts. This date shall be the date listed on the Certificate of Substantial Completion (if one was issued to the contractor specifically for the system) or the date listed on the Notice of Final Completion. Supply standard out-of-warranty service rates and service contact information.
 - 4. Bill of Materials: List of products supplied, and serial numbers of each product.
 - 5. Product Datasheets and Shop Drawings: Manufacturer datasheets and shop drawings for each product and system supplied.
 - 6. Manufacturer Owner / User Manuals: Manufacturer's Owner's or User's manual for each product, and Manufacturer's Installation instructions and other documentation supplied with the product.
 - 7. Extra Material Schedule:
 - a. Complete spare parts schedule for components of equipment furnished, which are not factory generic information, but accurate for the equipment provided.
 - b. Itemized list of each piece of communications, architectural and Owner equipment having communications connections with termination locations; also, list related expendable equipment required for each item as applicable.
 - 8. Maintenance Procedures: Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; testing, aligning and adjusting instructions.

9. Function and Operating Descriptions: Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
10. Operating Procedures: Manufacturer's printed operating procedures including start-up, break-in, normal operating instructions, regulation, control, stopping, shutdown, and emergency instructions.
11. Include Product Certificates, Source quality-control test reports and Field Quality-Control Reports
12. Test Reports and Checklists: Test reports, checklists, and other forms generated and completed for the Project.
13. Training Information: Copy of training outlines/agendas, training session handouts, training sign-in sheets, and signed delivery receipt for each training session recording; Separate USB drive, labeled, for audio/video-recorded instructions to Owner, for operations and maintenance for each system.
14. As-Built Drawings.
15. Software: Application and operating software documentation; Software licenses; Software service agreements; Manufacturer's operating specifications; design user's guide for software and hardware; Editable configuration files for system equipment; Software source code used in supplied products; Compiled versions of configuration files and source code; IP addresses of products configured to have static IP addresses; MAC addresses of products featuring network communication ports (wired and/or wireless); Network device names for products configured for DHCP; Software required for reviewing and editing supplied files.

1.3 AS-BUILT DRAWINGS

- A. Obtain two complete sets of communications prints and use them to provide progress record drawings which are separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed (including routing of conduit and cables). These drawings also serve as work progress report sheets. Make notations, neat and legible thereon daily as work proceeds. Make these drawings available for inspection at all times and keep them at the job at a location designated by the Owner's Representative.
- B. Maintain the clean, undamaged set of prints of drawings as well as a set of submittal drawings and coordination drawings. Mark the sets to show the actual installation where the installation varies from the Documents as originally shown. Include locations of underground and concealed items if placed other than shown on the Documents. Where shop drawings are used, record a cross-reference at the corresponding location on the Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- C. Show changes in: size, type, capacity, etc., of material, device or piece of equipment, location of device or piece of equipment; location of outlet or source of building service systems; routing of piping, conduit, or other building services. Record location of concealed equipment, by indication of measured dimensions to each line from readily identifiable and accessible walls, column lines or corners of building. Indicate approved substitutions, modifications, and actual equipment and materials installed.

- D. Affix near the title block on each drawing the Contractor's Company Name(s), signature of Contractor's Representative(s) and current date.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTRUCTION OF THE OWNER'S PERSONNEL

- A. Provide instruction in the proper operation and maintenance of equipment that requires routine servicing. Include the following:
1. Review of operation and maintenance manuals.
 2. Required tools.
 3. Extra Materials.
 4. Cleaning.
 5. Hazards.
 6. Warranties and maintenance agreements.
- B. Demonstrate equipment and systems operation including the following:
1. Start-up.
 2. Shut-down.
 3. Emergency conditions.
 4. Safety procedures.
 5. Setpoint and schedule adjustments.
 6. Economy and efficiency adjustments.

END OF SECTION 27 01 00

SECTION 27 05 01 - BASIC MATERIALS & METHODS**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: Requirements applicable to work of this Division.
 - 1. Basic materials, methods and installation guidelines applicable to the installation of all communication systems.

1.2 QUALITY ASSURANCE

- A. Explosives
 - 1. Use of explosives at the project site shall not be permitted.
- B. Welding
 - 1. Welding at the project site, where necessary, shall be performed only by persons licensed to perform such work at the project site(s). Welding shall require a permit and the approval of the Owner's Representative. Request for permission to perform onsite welding shall be submitted in writing through designated project channels.

PART 2 - PRODUCTS**2.1 CABLE BUNDLING HARDWARE**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hellermann Tyton.
 - 2. Millepede, Inc.
 - 3. Panduit.
 - 4. Velcro.
- B. General: Provide reusable, adjustable cable straps.
 - 1. Hook and Loop Fastener:
 - a. Shall be utilized within all cabinets and racks and below the ceiling of Telecommunications and Equipment rooms.
 - b. Provide plenum rated ties in plenum environments.
 - c. Minimum cable strap width shall be 3/4-inch.
 - d. Basis of Design: Velcro One-Wrap Qwik Ties.
- C. Nylon Plastic Cable Management Ties:
 - 1. Not to be used within cabinets or racks or below the ceiling line in Telecommunications or Equipment rooms.
 - 2. Provide plenum rated tie in plenum environments.

3. Outdoor ties shall be Weather and ultraviolet resistant.
4. Sized as necessary for the quantity of cables.
5. Cable tie shall have no sharp edges when cut.
6. Basis of Design: Panduit PLT series.

PART 3 - EXECUTION

3.1 COORDINATION

- A. High Voltage Wiring
 1. Review all high voltage provisions for This Contractor's work with the Division 26 electrical contractor. Coordinate specific device termination, loading and circuiting requirements with the electrical contractor.
- B. Coordinate installation of new pathways with parties and the Work that will utilize the pathways, prior to installation.
- C. Review pre-existing pathways prior to installation of the Work, and report to the Designer any discrepancies between specified pre-existing pathway conditions and actual existing pathway conditions.
- D. Participate in coordination efforts through the preparation of shop drawings and details prior to fabrication or installation of any products. Coordinate actual clearance requirements of installed products.
- E. Begin coordination immediately upon award of contract. Coordinate the Work with other parties and adjust equipment locations accordingly. Participate in the preparation of coordination drawings.
- F. Devices and equipment shall be located symmetrical with architectural elements and shall be installed at the heights and locations shown on the Drawings. If a height or location is in question, seek immediate clarification from the Designer.
- G. Evaluate the Contract Documents and existing conditions to gain an understanding of the peculiarities and limitations of the spaces where the Work is to be performed. The final Work shall be accessible for servicing. Although the locations of equipment and conduit may be shown on the Drawings in certain positions, the architectural details and conditions existing on the Project shall guide the Contractor, coordinating the Work with that of others. Provide necessary offsets to provide a neat workmanlike arrangement.
- H. The Drawings are generally diagrammatic and indicate the design intent, required sizes, points of termination and, in some cases, suggested routes of raceways. However, it is not intended that the Drawings indicate fully coordinated routing and placement or necessary offsets.
- I. Refer to each Drawing, including enlarged plans, elevations, sections, and details for additional information that may include dimensions and greater resolution and notes that serve to refine the intent and further assist and guide installation.

- J. Work in harmony with other parties performing work at the project site so as not to cause any delays in pouring concrete or erecting masonry walls. Consult each Contract Drawing, including those predominately used by other trades, before installing Work so as to ensure that performance of Work will not interfere with or be adversely affected by Work of others.
- K. Attend each regularly scheduled project meeting as well as any special meetings called to coordinate and/or resolve special issues that arise during the course of the Project.
- L. Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with drawings of other trades, work with the other trades to correct the conflict while coordinating the Project (prior to installation). If a conflict cannot be resolved, seek the direction of the Owner's representative. Refer to the drawings used by other trades for details, dimensions and locations of their work and route around their work so as not to conflict. Work installed that creates a conflict shall be removed and readjusted to the satisfaction of the Owner's representative at the Contractor's expense.

3.2 INSTALLATION

A. General:

1. Cabling installed within open ceilings shall be ran in conduit or fully concealed from view behind the building structure.
2. Work installed in finished areas shall be concealed.
3. Sequence, coordinate, and integrate installations of communications materials and equipment with the work of other trades for efficient flow of the Work.
4. Install systems, materials, and equipment to conform to reviewed submittal data, including coordination drawings.
5. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and architectural/structural components (prevailing building lines), except as expressly detailed otherwise or required for proper form, function or Designer intended operation. Except where otherwise specified, detailed or directed by the Designer, install visible products level to within 1/8-inches per 100-feet.
6. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.
7. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
8. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
9. Verify dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed.
10. If during construction it becomes apparent that certain minor changes in layout would result in a neater appearance or better arrangement, such alterations shall be made as part of the Contract. Designer's review shall be obtained before making such changes.

11. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches shall not be permitted on any exposed materials, fixtures or fittings. Interiors of panels and equipment boxes shall be left clean.
- B. Cabling
1. Use caution not to exceed the manufacturer allowed bending radius for cables and not to compromise the integrity of the cables during installation by pulling cable management devices too tightly, damaging cables. Raceway/cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant where necessary to ensure cable does not experience tension beyond manufacturer limits during installation. Compounds used shall be compatible with the cable and pathway products and shall not cause deterioration of either.
 2. Where indicated, provide color-coded jackets to identify runs of different systems.
 - a. See related specifications and drawings for applicable color coding.
 3. Neatly route cables parallel and perpendicular to building architectural lines.
 - a. Cables and cable assemblies shall be run as straight as possible and symmetrical (perpendicular to or parallel with) with architectural items and at a consistent elevation. Work installed diagonal to building members shall not be permitted.
 4. Neatly comb out multiple cable bundled runs to remove tangling and crossing of cables within the bundles. Neatly dress all cable work and provide vertical and horizontal cable management (or other approved method) for properly dressing all work at racks, control panels, backboards etc. See detail(s) if applicable.
 - a. To avoid Alien Crosstalk, do not cinch UTP cables into tight bundles.
 5. Cable shall be installed within approved pathways. Cables not installed within raceway, cable tray or ladder rack shall be supported by discrete cable supports. Support cables at box and faceplate.
 6. All penetrations to walls and floors designed to shall include metal sleeves. All sleeves shall be mechanically secured in place and sealed between the sleeve and structure. Apply firestop to the interior of the sleeve.
 7. Loosely bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
 8. Plenum-rated cable ties shall be used wherever wire ties are permitted and wherever plenum rated cable is used.
 9. Cable ties shall never be used in a manner that causes deformation of the cable jacket, damage to the cable, or has any adverse effect on the usability, specifications or longevity of the cable(s) on which it is applied.
 10. Velcro type wire ties shall be used in non-plenum spaces; in equipment racks; in rack cabinets, and; in related equipment housing enclosures and backboards.
- C. Cable Support
1. All cables shall be supported/anchored every 5 feet (or less) and within 12" of device boxes, outlets, racks/cabinets and cable tray.
 2. Use J-Hook type cable supports for all cables run outside of conduit or cable tray. Bridle rings shall not be used for Communications Technology cables.
 - a. Use separate J-Hook cable support systems for cables belonging to different systems and for cables carrying different operating levels. See Cable Separation guidelines in this section.
 3. Loosely secure cables at each J-Hook.

4. Cables shall not be directly or indirectly supported by a suspended ceiling or any other surface, support, material or structure not permissible for this use by all applicable codes and standards.
5. Cable pathway
 - a. Use and positioning
 - 1) Pathway shall be installed to form a reusable pathway system.
 - 2) Totally enclosed raceways (i.e. conduit, wireway, etc.) shall be utilized to span in-accessible or working spaces (i.e. offices, classrooms, etc.).
 - 3) Cable trays and discreet cable supports shall be utilized to support cables.
 - a) To form an open-top reusable pathway
 - b) Shall be used in accessible ceiling cavities and areas not accessible by the public (i.e. mechanical and service areas).
 - c) Shall follow corridors unless specifically noted otherwise.
 - d) Shall provide usable clearances above, below and beside for access space for the re-use of the pathway. Minimum 6" below and beside and 12" above.

D. Cable Separation:

1. Low-voltage cables shall be kept as far from electrical cables and equipment as possible. Avoid running low-voltage cables parallel to medium and high-voltage cables. When parallel runs cannot be avoided, keep low-voltage cables at least 24 inches away and cross cables at 90 degrees to minimize the risk of interference
2. Low-voltage cables shall not be permitted in the same conduit with high-voltage electrical cables.
3. Avoid running low-voltage cables any closer than 24 inches to any ballast type lighting fixture or other high RF energy producing device.
4. Cables for each system shall be installed separately and isolated from cables from other systems.
5. Cables carrying signals of different types and different nominal operating levels shall be kept separated to reduce the risk of undesirable interference and cross-talk between cables.
 - a. As a general rule, for each 25dBV difference in nominal operating level between cables, provide at least 6 inches of separation. Example 1: Cables with a 75dBV level difference between them shall be separated by 18 inches or greater. Example 2: Cables with a 13dBV difference between them shall be separated by 3 inches or greater.
 - b. Contractor shall provide additional separation to prevent and to remedy any crosstalk that adversely affects the performance and usability of the system, or that exceeds specific crosstalk performance guidelines defined elsewhere in these specifications.
 - c. Provide greater separation than this guideline where the contractor believes and/or determines it is necessary to prevent or remedy interference between cables.
6. Keep length of parallel runs to a minimum. Cross cables of different nominal levels at 90 degrees.
7. In common areas where cables from multiple systems are run in general proximity to one another, cables from each system shall be labeled to identify the system the cables serve.

8. Additional pathway devices/systems shall be provided as required to comply with cable separation requirements, including, but not limited to, conduits, sleeves, discrete pathway devices and cable tray.
- E. Cable Splices:
1. Splices shall not be permitted in any cable except where expressly specified and/or approved by the Designer.
 2. In cases where splices are specified and/or otherwise reviewed and permitted, splices shall be made within UL listed junction or device boxes. Open air connections shall not be permitted.
- F. Cable Terminations:
1. Termination types shall correctly match cable and device termination. As an illustration, if “spade lug” type of termination is appropriate, then the spade lug cable entry size shall match the cable used. The spade lug shall also have the correct stud size to match the terminal to which it is connected. Terminations shall be completed with tools designed and sized for the specific application and connector.
 2. Where field installed cables connect to manufactured products via pig-tails or connectorized cable assemblies, terminations shall be made within the product enclosure or within a UL approved box. Exposed and open air splices shall not be permitted.
- G. Strain Relief:
1. Permanently installed cables shall be properly secured with an approved device. Strain relief shall be applied typically within 6 inches from the point of entry into a product enclosure, junction box, pull box, or device box. When properly applied, the strain relief device shall not damage the cable being secured and shall not permit movement of the cable in any way that may adversely affect the long-term integrity of nearby connections.
- H. Identification:
1. General:
 - a. Identification shall be in English, except as otherwise noted.
 - b. Where identification is applied to surfaces that require a finish, install identification after the surface finish is applied.
 - c. Labeling products, color, sizes, nomenclature and location of the identification product are subject to the review of the Designer.
 2. Cables:
 - a. Each cable shall be uniquely labeled at each end.
 - b. Labels shall be permanent and feature computer generated type-written text.
 - c. Label text shall be bold-type and clearly readable by a person with average sight, and under the lighting conditions typical within the area of installation.
 - d. Labels shall be applied approximately 4-6 cable-inches from the point of termination.
 - 1) Adjust application to make legible during service/maintenance of system.
 - e. Systems cables installed for “Future Use” shall be clearly identified as such at both ends. Such cables shall be labeled to identify where the opposite end of the cable can be found.
 - 1) Not applicable for Structured Cabling for voice/data connectivity.

- f. Each cable installed shall be recorded on the as-built drawings.
- 3. Boxes:
 - a. Junction boxes and pull boxes shall be labeled on their interior and on their exterior covers with the identity of the system(s) the box serves along with the function of the box. Interior markings shall be made using permanent marker. Permanent marker may also be used on the cover of boxes installed in concealed areas (above accessible ceilings, for example). Exposed boxes shall be labeled with engraved plastic labels. Labels shall closely match the color of the box.
 - b. Device boxes, when first installed, shall be identified on its interior as to the system(s) served and the device(s) the box will contain.
 - 1) Where conduit feeding the device box is concealed, label the exterior of the conduit with permanent marker.
- 4. Equipment Racks, Cabinets, Enclosures:
 - a. Equipment racks and enclosures shall be labeled.
 - b. The nomenclature, color, size, installed location, and type of labels are subject to the Designer's review.
- 5. System Equipment:
 - a. Each individual instance of system equipment shall be labeled.
 - b. Front panel controls of equipment shall be labeled with nomenclature meaningful to the end user based on the intended use of the equipment in the system. Examples include, but are not limited to:
 - 1) Label router/matrix control panels with system specific input/output names.
 - 2) Label patch panels with meaningful input/output destination names.
 - 3) Label mixer input and output controls to identify the signal source and destination.
 - c. Professionally prepared, installed and readily visible "cheat sheets" may be acceptable under select circumstances with the approval of the Designer.
 - d. The nomenclature, color, size, installed location, and type of labels are subject to the Designer's review and approval.
- I. High Voltage Cabling (greater than 70.7 Volts):
 - 1. Cabling that carries voltages higher than 70.7 Volts RMS AC or DC shall be installed and terminated by persons licensed to perform such work.
- J. Plates and Panels:
 - 1. Box covers and faceplates shall be installed flush against the surface over which it is mounted. There shall be no visible gap between the backside of a plate/panel and the wall, ceiling or floor; there shall be no visible gap between the backside of plate/panel and a surface mount box to which the plate/panel mounts). Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.
 - a. The same shall apply to other wall and ceiling mounted products.
 - 2. Plates and panels shall be installed with all screw holes filled and fastened securely.
- K. Device Boxes, Pull-Boxes, Junction Boxes:
 - 1. Boxes installed in walls and ceilings shall be installed so that the box does not stand proud (protrude out beyond) of the finished surface. Boxes shall be installed such that when the mounted devices and cover plates are installed, the backside

of the cover plate rests flush with the finished surface of the wall or ceiling. Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.

3.3 GROUNDING

- A. Equipment shall be properly bonded to ground for the safety of personnel and property and as additionally necessary to satisfactory performance of the equipment.
- B. Comply with Section "Grounding and Bonding for Communications."

3.4 CUTTING, PATCHING AND SEALING

- A. General:
 - 1. Perform cutting as required for the execution of the Work. Unless directed otherwise in the field, provide related patching and painting to match surrounding methods, materials and colors. Any damage caused during the progress of Work shall be remediated. Perform cutting, fitting, and patching and materials as required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials within existing structures.
 - 2. Upon written instructions from the Owner's representative, uncover and restore Work to provide for observation of concealed Work by Owner's representative or by inspection by the Authority Having Jurisdiction.
 - 3. During cutting and patching operations, protect adjacent installations (e.g., structure, finishes, and furnishings). Where applicable, provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to system components and components of other trades.
 - 4. Patch surfaces and building components using new materials matching existing materials and using experienced Installers. Refer to Division 01 for definition of experienced "Installer" or determine qualifications as directed in the field by the Owner's representative.
 - 5. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. Materials used for patching shall be installed to meet or exceed the smoke and fire rating of the respective surface being patched.
 - 6. Neatly cut and drill openings in walls and floors where openings are required for installation of the Work. Secure the approval of the Owner's Representative before cutting and drilling in existing facilities. Neatly patch any openings created.
 - 7. Cutting and patching shall be held to a minimum by arranging with other parties for sleeves and openings before construction is started.
 - 8. Provide factory-assembled watertight wall and floor seals, of types and sizes required, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.

9. Pipe sleeves shall be fabricated from Schedule 40 rigid, heavy wall, full weight galvanized steel pipe; remove burrs. Use sleeves which are two standard sizes larger than conduit passing through respective sleeve.
10. Provide sleeve seals for piping that penetrates foundation walls below grade, or through exterior walls or roofs. Caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal. Elsewhere provide mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
11. Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, bearing walls, fire walls and masonry construction. Furnish and set forms required in masonry walls or foundation to accommodate pipes.

B. Grout:

1. Provide non-shrink, nonmetallic grout, pre-mixed, factory-packaged, non-staining, non-corrosive, and non-gaseous grout, recommended for interior and exterior applications.

C. General Joint Sealer Application:

1. Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
2. Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
3. Clean affected surfaces, joints, etc. immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.
4. Apply sealant primer to substrates as recommended by manufacturer. Protect adjacent areas from spillage and migration of sealant, using masking tape. Remove tape immediately after tooling without disturbing seal.
5. Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
6. Immediately after sealant application and prior to time skinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
7. Colors for exposed seals shall be as selected by the Owner's representative from manufacturer's standard colors.

3.5 FIRESTOPPING

- A. Penetrations created in support of any work of this Division shall be firestopped in accordance with locally applicable codes as acceptable to the Authority Having Jurisdiction.

END OF SECTION 27 05 01

SECTION 27 05 26 - GROUNDING AND BONDING FOR COMMUNICATIONS**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM).
 - 2. Product Datasheets.
- B. Shop Drawings:
 - 1. Interconnectivity diagram, representing the total system as it is planned to be installed.
 - 2. Details and locations of components with description and routing of interconnecting cabling.
 - 3. Labeling schema.
- C. Closeout Submittals:
 - 1. System test results.
 - 2. Product Datasheets, one for each product.
 - 3. As-Built Drawings:
 - a. Interconnectivity diagram, representing the total system as it is installed.
 - b. Details and locations of components with description and routing of interconnecting cabling.
 - c. Labeling schema.

1.2 SUMMARY

- A. Section Includes:
 - 1. Grounding and Bonding System for Communications, including:
 - a. Copper Conductors.
 - b. Busbars.
 - c. Grounding/Bonding termination devices.
 - d. Mounting, connection and supporting hardware.

1.3 REFERENCES

- A. Definitions:
 - 1. Bonding: The joining of metallic parts to form an electrically conductive path.
 - 2. Bonding conductor (BC): A conductor that joins metallic parts to form an electrically conductive path.
 - 3. Bonding backbone conductor (BBC): The conductor that interconnects elements of the telecommunications grounding infrastructure.
 - 4. Common bonding network: Set of metallic components that are interconnected to form the principle means for effectively bonding equipment inside a building to the grounding electrode system.

5. Ground: A conducting connection, whether intentional or accidental, between an electrical circuit (e.g., telecommunications) or equipment and the earth, or to some conducting body that serves in place of earth.
 6. Grounding Electrode Conductor (GEC): Conductor used to connect the grounding electrode to the equipment grounding conductor, or to the grounded conductor of the circuit at the service equipment, or at the source of a separately derived system.
 7. Mesh Bonding Network: Bonding network to which all associated equipment (e.g., cabinets, racks, frames, trays, pathways) are connected using a bonding grid, connected to multiple points on the common bonding network.
 8. Primary bonding busbar PBB: A busbar placed in a convenient and accessible location and bonded, by means of the telecommunications bonding conductor, to the buildings service equipment (power) ground (formerly known as the telecommunications main grounding busbar TMGB).
 9. Secondary bonding busbar SBB: A common point of connection for telecommunications system and equipment bonding to ground, and located in the distributor room (formerly known as the telecommunications grounding busbar TGB).
 10. Telecommunications bonding backbone (TBB): A conductor that interconnects the telecommunications main grounding busbar (PBB) to the telecommunications grounding busbar(s) (SBB).
 11. Telecommunications bonding conductor (TBC): A conductor that interconnects the telecommunications bonding infrastructure to the building's service equipment (power) ground.
 12. Telecommunications equipment bonding conductor (TEBC): A conductor that connects the telecommunications main grounding busbar (PBB) or telecommunications grounding busbar (SBB) to equipment racks or cabinets.
- B. Reference standards:
1. ANSI/TIA-607-C, or most current version, Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises
 2. ATIS (Alliance for Telecommunications Industry Solutions) 0600313-2013, Electrical Protection for Telecommunications Central Offices and Similar Type Facilities
 3. ATIS 0600318-2010, Electrical Protection Applied to Telecommunications Network Plant at Entrances to Customer Structures or Buildings
 4. ATIS 0600321-2010, Telecommunications – Electrical Protection For Network Operator Type Equipment Positions
 5. ATIS 0600333-2013, Grounding And Bonding Of Telecommunications Equipment
 6. ATIS 0600334-2013, Electrical Protection Of Communications Towers And Associated Structures
 7. IEEE C2-2012, National Electrical Safety Code ® (NESC ®)
 8. IEEE Standard 1100-2005, or most current version, "Recommended Practice for Powering and Grounding Electronic Equipment" (IEEE Emerald Book).
 9. IEEE Standard 142-2007 or most current version, "Recommended Practice for Grounding of Industrial and Commercial Power Systems" (IEEE Green Book).
 10. NFPA 70, "National Electrical Code" (NEC).
 11. UL 467, "Grounding and Bonding Equipment."
 12. NFPA National Electric Code Article 250, "Grounding."
 13. TIA/EIA-606-B, or most current version, Administration Standard for Commercial Telecommunications Infrastructure.

14. The most current published edition of the "Telecommunications Distribution Methods Manual" published by the Building Industry Consulting Services International (BICSI).

1.4 SYSTEM DESCRIPTION

- A. The system shall provide Standards and Code compliant bonding of products to ground for the safety of equipment, personnel and property and for the stable and reliable operation of connected equipment.
 1. The system shall be configured to ensure proper operation of equipment. The system shall not result in ground currents that adversely affect the performance of the connected systems using the system.
 2. The system shall derive its main ground connection from the Electrical Grounding Electrode System as defined by the NEC, the same electrode system used to establish the main/common ground for the building electrical system.
 3. The system shall connect to Electrical Grounding Electrode System at a single point. Coordinate and comply with Section 260526 "Grounding and Bonding for Electrical Systems" where applicable.
 4. The system shall be visually verifiable and adequately sized to handle expected currents safely, directing potentially damaging currents away from sensitive network equipment.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.
- B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 1. Chatsworth.
 2. Erico Electrical Products.
 3. Harger Lightning & Grounding
 4. Storm Power Components.
 5. Panduit.
 6. Thomas and Betts
- C. Bonding and grounding connectors shall be Listed for the application (e.g., above ground, direct buried, bonding to the metal frame of a building).

2.2 BUSBARS

- A. Primary Bonding Busbar (PBB) (Formerly TMGB):
 1. UL Listed.
 2. Electro-tin plated to inhibit corrosion.

3. 1/4-inch thick (minimum) copper bar.
 4. Insulated stand-offs.
 5. For use with matched Listed lugs and hardware.
 6. 4 inches high (minimum) by 20 inches wide (minimum).
 7. Comply with BICSI and TIA/EIA-607-B requirements.
 8. Provide hole spacing to match Panduit LCC series two-hole lugs.
 9. Basis of Design: Panduit GB4B0624TPI-1.]
- B. Secondary Bonding Busbar (SBB)(Formerly TGB):
1. UL Listed.
 2. Electro-tin plated to inhibit corrosion.
 3. 1/4-inch thick (minimum) copper bar.
 4. Insulated stand-offs.
 5. For use with matched Listed lugs and hardware.
 6. 2 inches high (minimum) by 20 inches wide (minimum).
 7. Comply with BICSI and TIA/EIA-607-B requirements.
 8. Provide hole spacing to match Panduit LCC series two-hole lugs.
 9. Basis of Design: Panduit GB2B0312TPI-1.
- C. Rack Bonding Busbar Kits:
1. Optimized for installation on 19-inch racks or cabinets meeting EIA-310-D.
 2. Available pre-assembled with mounting screws.
 3. Electro-tin plated to inhibit corrosion.
 4. Provide quantities of busbars to handle a quantity of two-hole connectors equal to a minimum of one-half of the total rack units (RUs).
 5. Provide hole spacing to match Panduit LCC series two-hole lugs.
 6. Basis of Design: Panduit RGRB19U (minimum) for threaded rail fasteners and Panduit RGRB19CN for cage nut rail fasteners.

2.3 TERMINATIONS AND HARDWARE

- A. Conductor Terminations – Compression Lugs:
1. Two-hole lugs long barrel type, with window.
 2. Shall meet TIA/EIA-607-B requirements for network systems grounding applications.
 3. Tin-plated copper to inhibit corrosion.
 4. Long barrel to maximize the number of crimps, providing premium wire pull-out strength and electrical performance.
 5. Color coded on barrel for correct die selection.
 6. Inspection window to assure full conductor insertion.
 7. Available with NEMA and BICSI hole sizes and spacing.
 8. UL Listed.
 9. Basis of Design: Panduit LCC series.
- B. Conductor HTAP Kits:
1. Used as a splice or to tap smaller conductors into larger continuous conductors.
 2. Tin-plated to inhibit corrosion.
 3. Slotted design to assist assembly.
 4. Matching clear covers with UL 94V-0 flame rating.
 5. Color coded for correct die selection.

6. UL Listed.
 7. Basis of Design: Panduit HTCT series and CLRCVR series.
- C. Conductor CTAP (splice):
1. Used for copper-to-copper splicing or pigtail tap splicing.
 2. Manufactured from high conductivity wrought copper. Tin-plated to inhibit corrosion and oxidation.
 3. Ribbed design for high strength.
 4. Color coded for correct die selection.
 5. UL Listed.
 6. Basis of Design: Panduit CTAPF series.
- D. Grounding Clamps for Conduit:
1. Creates electrical bond for copper conductor parallel to, or at a right angle to a rod, tube or pipe.
 2. Made from high strength, electrolytic cast bronze.
 3. High strength silicon bronze hardware providing long-term, reliable assembly.
 4. Accommodates wide range of pipe, tube, rod and conductor sizes.
 5. UL Listed for grounding and bonding with AWG conductor and suitable for direct burial in earth or concrete.
 6. Basis of Design: Panduit GPL series.
- E. Universal Structure Grounding Clamps:
1. Bonds structural steel (e.g., steel beams, steel columns) to bonding network.
 2. Universal, fitting a wide-range of standard (angled) and wide flange structural members.
 3. Provides a mounting pad suitable for a two-hole compression lug.
 4. UL Listed.
 5. Basis of Design: Panduit GUBC500-6.
- F. Split Bolts:
1. Tin-plated to inhibit corrosion and bond to galvanized wire baskets and Flex Tray.
 2. Manufactured from high strength copper alloy to resist corrosion and provide premium electrical and mechanical performance.
 3. Utilizes pressure bar to connect securely to range of conductor combinations.
 4. UL Listed.
 5. Basis of Design: Panduit SBC series.
- G. Auxiliary Cable Brackets (Conductor Pathway):
1. Used for mounting telecommunications bonding conductors outside of cable tray.
 2. Supports grounding conductors in the telecommunications room, allowing separation of grounding conductors from other cables.
 3. Holds up to four (4) conductors in sizes up to 750 kcmil.
 4. Maintains minimum 2-inch separation between bonding conductors and other types of cabling per TIA/EIA-607-B.
 5. Paint piercing teeth provide electrical continuity between cable pathway sections.
 6. Provide with bonding jumper kits to bond sections of basket tray or ladder rack.
 7. Front and back mounting screw options for installation and visual inspection.
 8. Basis of Design: Panduit GACB series.
- H. Armored Cable Grounding Kit:

1. Provides a secure bond to the armor sheath on indoor and indoor/outdoor cables.
2. Work-gear design to evenly distribute force across the armor.
3. Manufactured from steel and aluminum material compatible with common armor.
4. Black insulating cover/protector.
5. Basis of Design: Panduit ACG series.

I. Bonding Accessories:

1. Anti-oxidation paste for copper-to-copper and copper-to-steel connections.
 - a. Basis of Design: Panduit CMP-300-1.
2. Thread Forming Bonding Screws:
 - a. Color coded Green.
 - b. Penetrates painted surfaces to provide electrical connection.
 - c. Shall have "Phillips" head.
 - d. Basis of Design: Panduit RGTBS series.
3. Bonding Cage Nut:
 - a. Color coded Green.
 - b. Creates electrical bond between the mounting rails and equipment.
 - c. Basis of Design: Panduit CNB series.
4. Paint Piercing Grounding Washer Kit:
 - a. Color coded Green.
 - b. Penetrates painted surfaces to provide electrical connection.
 - c. Supplied with antioxidant compound.
 - d. Basis of Design: Panduit RGW series.
5. Bonding Stud Kit:
 - a. Color coded Green.
 - b. Incorporates paint piercing serrations to create a bond point between the rack and painted patch panels, mounted equipment, servers, busbars and jumpers.
 - c. Basis of Design: Panduit TRBS series for threaded rail fasteners and Panduit CGNBSK for cage nut rail fasteners.

2.4 BONDING CONDUCTORS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work, include, but are not limited to, the following:
1. American Insulated Wire Corp.
 2. Brintec Corporation.
 3. Cablec.
 4. Carol Cable Co., Inc.
 5. General Cable.
 6. Senator Wire and Cable Co.
 7. Southwire Company.
- B. Bonding and grounding conductors shall be copper. Conductors may be insulated.
1. When conductors are insulated, they shall be Listed for the application and environmental conditions.
 2. The telecommunications bonding conductor (TBC), each telecommunications bonding backbone (TBB), and each backbone bonding conductor (BBC) shall be green or marked with a distinctive green color.

- C. Conductors shall be sized using engineered calculations. Reference Table 1 (Part 3 of this Section).
 - 1. The TBB conductor shall be sized at 2 kcmil per linear foot of conductor length up to a maximum size of 750 kcmil. The minimum TBB conductor size shall be a No. 6 AWG.
 - 2. The bonding conductor for telecommunications (TBC) shall be, as a minimum, the same size as the largest TBB.
 - 3. The backbone bonding conductor (BBC) shall be, as a minimum, the same size as the largest TBB.
- D. Grounding conductors shall not decrease in size as the grounding path moves closer to earth.

PART 3 - EXECUTION

3.1 GENERAL

- A. Ground electrical systems and equipment as required by code, utility, local ordinances, and requirements herein, including referenced Standards.
- B. Work shall be installed in accordance with the Contract Documents, manufacturer's recommended installation practices, applicable codes and referenced Standards.
- C. System installation and connections shall be visually verifiable.
- D. Contractor shall bring to the Owner's attention any existing system elements not compliant with modern grounding and bonding requirements for possible remediation.

3.2 INSTALLATION

- A. General:
 - 1. Provide PBB/SBB, required conductors and terminations for each communications room or space for grounding and bonding. Provide required connections, terminations and products for a complete communications grounding and bonding system.
 - a. Isolate grounding busbars from the structure support by a 2-inch minimum separation using manufacturer's recommended insulating stand-offs and hardware.
 - 2. Minimize practical lengths and number of bends of bonding conductors to the PBB/SBB.
 - 3. Bonding conductors shall be continuous and routed in the shortest possible straight-line path, avoiding changes in elevations and sharp bends.
 - 4. Utilize H-Tap compression fittings with clear insulating covers to tap cables.
 - 5. Make connections in such a manner as to minimize possibility of galvanic action or electrolysis. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
 - 6. Coat and seal connections involving dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

7. Use electroplated or hot-tin-coated materials to assure high conductivity and make contact points closer in order of galvanic series.
8. Make connections with clean bare metal at points of contact.
 - a. Utilize bonding screws and paint piercing grounding washer kits to attach painted surfaces.
9. Clean and apply an anti-oxidant to grounding busbars before fastening conductors.
10. Utilize exothermic welded connections for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods. Comply with manufacturer's written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.
11. Tighten bonding and grounding connectors and terminals in accordance with the manufacturer's published tightening methods and practices. Where manufacturer's requirements are not indicated, tighten connections to comply with UL 486A and UL 486.
12. Utilize hydraulic compression tools to provide the correct circumferential pressure for compression-type connectors. Use tools and dies recommended by the manufacturer of the connectors. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on the ground conductor.
13. Where insulated ground conductors are connected to ground rods, insulate the area of the connection and seal against moisture penetration of the insulation and cable.

B. Primary Bonding Busbar (PBB):

1. Locate the PBB in the telecommunications entrance facility (EF), and install on a plywood backboard (wall Lining).
2. Placement of the PBB shall provide for the shortest and straightest practical routing of the for telecommunications bonding conductor (TBC) and the primary protector grounding conductor.
3. The PBB shall be as close as practical to the electrical power panel (panel board) and shall be installed to maintain clearances required by applicable electrical codes.
4. When a panel board is located in the same room or space as the PBB, bond the alternating current equipment ground (ACEG) (when equipped) or the panel board enclosure to the PBB.
 - a. When a panel board for telecommunications equipment is not installed in the EF, the PBB shall be located near the backbone cabling and associated terminations.
 - b. Connections (bonds) between the communications grounding and bonding system and associated electrical panels shall be completed by a qualified electrician in accordance with guidelines in TIA/EIA-607-C and applicable electrical codes.
5. Coordinate with Division 26 for connection of the primary protector grounding conductor to the PBB. The TBC shall bond the PBB to the service equipment (power) ground.
6. TBC and TBB connections and conductors for bonding telecommunications equipment and pathways to the PBB shall utilize exothermic welding, Listed compression two-hole lugs, or two-hole exothermic lugs.
7. The PBB shall serve telecommunications equipment that is located within the same room or space.

8. When outside plant cables in the EF or equipment room (ER) incorporate a cable shield isolation gap, the cable shield on the building side of the gap shall be bonded to the PBB.
9. Minimum size of the PBB is as specified. If required, increase the size of the PBB to accommodate the number of necessary bonded connections.

C. Secondary Bonding Busbar (SBB):

1. Install SBB (s) on a plywood backboard (wall lining).
2. SBB shall be as close as practical to the electrical power panel (panel board) and shall be installed to maintain clearances required by applicable electrical codes.
3. When a panel board is located in the same room or space as the SBB, bond the alternating current equipment ground (ACEG) (when equipped) or the panel board enclosure to the SBB.
 - a. When a panel board for telecommunications equipment is not installed in the same room or space as the SBB, the SBB shall be located near the backbone cabling and associated terminations.
 - b. Connections (bonds) between the communications grounding and bonding system and associated electrical panels shall be completed by a qualified electrician in accordance with guidelines in TIA/EIA-607-C and applicable electrical codes.
 - c. When a panel board for telecommunications equipment is not installed in the same room or space as the SBB, the SBB shall be bonded to the panel board that feeds the space.
4. When a bonding backbone conductor (BBC) is required, it shall be bonded to the SBB.
5. TBBs shall be bonded to the SBB with a conductor the same size as the SBB.
6. BBC and TBB connections and conductors for bonding telecommunications equipment and pathways to the SBB shall utilize exothermic welding, Listed compression two-hole lugs, or two-hole exothermic lugs.
7. The SBB shall serve telecommunications equipment that is located within the same room or space.
8. Minimum size of the SBB is as specified. If required, increase the size of the SBB to accommodate the number of necessary bonded connections.

D. Conductors:

1. Bonding conductors shall be continuous and routed in a direct path to the point of termination. Conductors shall be copper and sized not less than a No. 6 AWG.
2. Bonding and grounding conductors for telecommunications shall not be placed in ferrous metallic conduit. If it is necessary to route through ferrous metallic conduit due to building constraints, the conductors shall be bonded to each end of the conduit using appropriately sized HTAP and conduit grounding clamps or grounding bushings at both ends of the conduit, as described in TIA/EIA-607-C.
3. The TBC and the BBC shall be, as a minimum, the same size as the largest TBB.
4. TBBs shall be sized for the length of the circuit between the connected SBB and PBB.
5. Conductors shall be sized, as a minimum, in accordance with the following chart. Individual conductors shall be upsized as indicated in the TIA/EIA-607-C Standard.
 - a. Table 1 – TBB conductor size versus length:

TBB/GE linear length feet (m)	TBB/GE size (AWG)
----------------------------------	----------------------

Less than 13 (4)	6
14 – 20 (4 – 6)	4
21 – 26 (6 – 8)	3
27 – 33 (8 – 10)	2
34 – 41 (10 – 13)	1
42 – 52 (13 – 16)	1/0
53 – 66 (16 – 20)	2/0
67 – 84 (20 – 26)	3/0
85 – 105 (26 – 32)	4/0
106 – 125 (32 – 38)	250 kcmil
126 – 150 (38 – 46)	300 kcmil
151 – 175 (46 – 53)	350 kcmil
176 – 250 (53 – 76)	500 kcmil
76 – 91 (251 – 300)	600 kcmil
Greater than 301 (91)	750 kcmil

6. Telecommunications bonding backbone (TBB):
 - a. TBBs shall be connected to the PBB and follow the backbone pathways.
 - b. TBBs shall be connected to the PBB and follow the backbone pathways.
 - c. Protect the TBBs from physical and mechanical damage.
 - d. TBBs shall be installed without splices.
 - 1) If splices are required due to distance and material limitations, required splices shall be accessible and located within telecommunications spaces. Splices shall be kept to a minimum.
 - 2) Segments of TBBs shall be joined by means of an exothermic weld, Listed irreversible compression-type connectors, or equivalent.
 - 3) Joints shall be supported and protected from damage.
7. Backbone Bonding Conductor (BBC):
 - a. Whenever two or more TBBs are used within a multistory building, bond the TBBs together with a backbone bonding conductor (BBC) at the top floor and every third floor in between (minimum) to the lowest floor level.
8. Telecommunications equipment bonding conductor (TEBC):
 - a. The TEBC connects the PBB/SBB to equipment racks, cabinets and other enclosures.
 - b. Cabinets, racks and other enclosures shall not be bonded serially. Each shall have a dedicated bonding conductor.
 - c. TEBC shall be continuous copper conductor sized not less than a No. 6 AWG or as the largest size equipment grounding conductor in the AC branch power circuit(s) serving the racks/cabinets. See Table 1, and size conductors accordingly.
 - d. Cable shields do not satisfy the requirements for a TEBC.
 - e. Connections to the TEBC shall be made with Listed irreversible compression connectors and with rack bonding conductors routed toward the PBB/SBB.

- f. TEBCs may be routed within cable trays, on the outside of ladder rack, tray supported at no greater than 3-foot intervals, or along equipment platforms.
 - g. TEBCs shall be separated a minimum of 2 inches from conductors of other cable groups (e.g., power, telecommunications cables).
 - 1) Exception: An exception may occur when conductors are grouped together to enter or exit a cabinet or enclosure. This grouping is acceptable, provided the conductors are separated on either side of the opening.
 - h. TEBCs shall be separated from ferrous material by a distance of at least 2 inches where achievable or shall be effectively bonded to the ferrous material.
 - i. TEBCs shall be connected to the cabinets/equipment racks. Each rack/cabinet shall have a suitable connection point to which the bonding conductor shall be terminated.
- E. Pathways, equipment, communications cabling and building steel:
- 1. Bond exposed cables in a telecommunications facility to ground as close as practical to the point of entrance, including bonding to ground the cable shields and metallic sheath members according to manufacturer's installation instructions.
 - 2. Where the building backbone telecommunications cabling incorporates a shield or metallic member, bond the shield or metallic member to the PBB or SBB where the cables are terminated or where pairs exit the cable sheath.
 - 3. Bond telecommunications conduits to the PBB/SBB.
 - a. Exception: short metallic pathways (e.g., wall and floor sleeves, J-hooks) are not required to be bonded.
 - 4. Bond cable runway/ladder sections together and to the PBB/SBB.
 - 5. Where building steel is accessible and in the same room as the PBB/SBB, bond the PBB/SBB to building steel. Test to verify ground conductivity to earth.
 - 6. Where the building steel is external to the room, but readily accessible, bond the building steel to the PBB/SBB. Test to verify ground conductivity to earth.
 - 7. Bond metallic enclosures, including telecommunications cabinets and racks, to the PBB/SBB.
 - a. Cabinets, racks and other enclosures shall not be bonded serially. Each shall have their own dedicated bonding conductor to the PBB or SBB.
 - 8. Bond equipment containing metallic parts in cabinets and racks to the telecommunications grounding system in accordance with the manufacturer instructions.
- F. Bonding of Equipment Racks and Cabinets:
- 1. The welded construction of a welded cabinet or equipment rack may serve as the method of bonding the structural members of the cabinet/rack together.
 - 2. Bolted cabinets/equipment racks shall incorporate bonding hardware (e.g., bolts, washers, nuts and screws) specifically designed to accomplish integral bonding of the cabinet and rack assembly, frame and support, and tested to meet applicable NRTL requirements.
 - a. If the hardware (e.g. bolts, washers, nuts and screws) are not specifically designed for grounding purposes, the paint shall be removed from bonding contact areas.
 - 3. Detachable metallic parts of equipment cabinets (e.g., frame, door, side panel, top panel) shall be connected to ground.

- a. When grounding/bonding jumpers are provided, the jumper shall be minimum No. 12 AWG stranded, high strand count, insulated copper conductor with green or green with yellow stripe jacket. The jumper shall have an easily visible quick connect to facilitate detaching/attaching the door or panel.
- 4. Larger equipment (e.g., chassis switches) with integral grounding terminals or pads shall be bonded to the rack-mounted busbar with equipment grounding kits.
- G. When secondary protection is provided, connect the secondary protector grounding conductor to the nearest PBB or SBB using the shortest grounding conductor practical.
- H. Comply with manufacturers' grounding and bonding requirements when installing equipment.

3.3 FIELD QUALITY CONTROL

- A. Visually verify continuity of the communications grounding and bonding system throughout the installation, including, but not limited to the continuity of the communications bonding system from equipment, through racking systems, to overhead or underfloor backbone to the wall-mounted busbar between and within each communications room.
- B. Visually verify the use of appropriate grounding and bonding accessories in the racking systems, including, but not limited to grounding washers, thread-forming grounding screws and ESD ports and wrist straps.
- C. Visually verify size and installation of the telecommunications bonding backbone, including properly sized and installed grounding equalizer conductors between backbones contained in separate risers.
- D. Verify that where conductors pass through conduit, the conduit is bonded to the grounding conductor and as required by TIA/EIA-607-C.
- E. Verify conductors and connections for proper tightness and installation, including verification that proper dies were used on compression taps and fittings.
- F. Opens or gaps in the grounding and bonding system shall be documented and remedied.

3.4 TESTING

- A. Comply with testing identified in TIA/EIA-607-C.
- B. Utilize a two-point ground/continuity testing to determine if there is an acceptable maximum level of resistance between any point in the telecommunications bonding and grounding system and the building's electrical grounding electrode system.
- C. Test is performed using an earth ground resistance tester configured for a continuity test (i.e., two-point test or a "dead earth" test).

- D. Prior to testing, perform a visual inspection to verify that the bonding and grounding system is installed according to applicable codes and the guidelines of the TIA-607-C.
 - 1. Due to the possibilities of ground faults traveling through the telecommunications bonding and grounding system, perform a voltage test prior to conducting the two-point continuity test and verify with the test equipment manufacturer's printed instructions. Consult with other contractors to ensure other work does not interfere with the test.
- E. Test shall be performed in the following areas:
 - 1. PBB/SBB to the electrical ground in communications rooms.
 - 2. PBB/SBB to the building steel.
 - 3. PBB to SBB.
 - 4. Building steel to the electrical ground.
- F. In order for valid test results, test shall be performed prior to communications equipment installation; otherwise, parallel paths may invalidate test results.
- G. The recommended maximum value for resistance between any point in the telecommunications bonding and grounding system and the building's electrical grounding electrode system shall be 100 milliohms.
 - 1. In the case of long TBB and BBC conductor runs, the resistance of the conductor must be factored into the total resistance. For example, 1 km of a No. 3/0 conductor has a resistance of 0.2028 ohms (0.06180 ohms per 1000 feet).
- H. Based on test results, the Owner reserves the right to request testing on 100-percent of the exothermic and compression bonds within the system.
- I. Bonded connections failing testing shall be remedied and retested by the installing contractor at the contractor's expense.

3.5 LABELING

- A. Comply with TIA/EIA-607-C for labeling requirements.
- B. Comply with TIA/EIA-606-B, or most current version, Administrative Standard for Telecommunications Infrastructure.
- C. Comply with Section 270553 "Identification for Communications".
- D. Label each component of the Grounding and Bonding System.
- E. Label for bonding and grounding conductors shall be nonmetallic and include the following information:

IF THIS CONNECTOR OR CABLE IS
LOOSE OR MUST BE REMOVED,
PLEASE CALL THE BUILDING
TELECOMMUNICATIONS MANAGER.

- F. Uniquely label PBB and SBB. Clearly record and key this information on the as-built drawings.

END OF SECTION 27 05 26

GROUNDING AND BONDNG FOR COMMUNICATIONS
 TEST REPORT
 (Form: F-270526-1)

Project Name: _____

Crew Members: _____

Test Date: _____

—

Tester Used: _____

Current (High\Low) _____

—

Serial Number: _____

Filter (On\Off) _____

—

Frequency (Hz) _____

TMGB/TGB Identification: _____

Reference Test Resistance: _____ Ω

Ground Reference System Continuity Test Data					
TMGB/TGB		TMGB/TGB with Panelboard Ground		TMGB/TGB with Panelboard and Building Steel Ground	
Reference	Test (Difference)	Reference	Test (Difference)	Reference	Test (Difference)
Ω	Ω	Ω	Ω	Ω	Ω

Provide a completed version of this Form for each TGB included in the project.

SECTION 27 05 28 - PATHWAYS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product Data:
 - 1. Raceway.
 - 2. Innerduct.
 - 3. Spillways/waterfalls.
 - 4. Floor boxes.
 - 5. Device boxes.
 - 6. Cable spillways.
 - 7. Discrete cable supports.

- B. Shop Drawings:
 - 1. Coordinated floor plan drawings depicting the size(s), locations, and dimensions of the following:
 - a. Primary pathways.
 - b. Conduit sleeves (e.g., thru-the-wall, thru-the-floor, and thru-the-bulkhead).
 - c. Roof penetrations.
 - d. Conduits: Trade-size 2 inches and larger.
 - e. Raceway: Featuring a cross-sectional area of ≥ 4 square inches.
 - f. Vertical and horizontal working clearances around tray and ladder rack.
 - 2. Conduit Interconnect Diagrams: for each totally-enclosed pathway system.

- C. Closeout Submittals:
 - 1. Accurate up-to-date as-built versions of shop drawings.

1.2 REFERENCES

- A. Definitions:
 - 1. Hybrid Pathway System: A pathway system built from a varied mixture of boxes, raceway, cable tray and discrete cable supports. Fundamentally a pathway system that is not a totally-closed pathway system. A hybrid pathway system supports cables in the horizontal at increments not exceeding 60 inches.
 - 2. Pathway: A collection of products that when used together achieve a complete means for the conveyance of cable(s) from one location to another. A pathway system protects and supports cables to various degrees depending upon the application and products used. The pathway system most frequently terminates into an enclosure, boxes or other apparatus where cables are terminated and associated devices are mounted.
 - 3. Primary Pathway: A cabling pathway typically located in a corridor, public area, or dedicated vertical cable chase and used to enclose and/or support large quantities of compatible-signal cables from one or more systems to the general vicinity of where cables are terminated. Cables carried by a primary pathway transfer to secondary pathways.

4. Raceway: An enclosed pathway component used for the routing of cables. The raceway envelops the cables that pass through it to protect them from physical damage, and at times from heat, humidity, corrosion and water intrusion. A raceway may feature a continuous outer shell, or in select cases (such as surface raceway) may feature a removable outer shell that facilitates installation and removal of cables. Raceway frequently terminates directly into boxes or enclosures used for the purpose of mounting devices and termination of the cables.
5. Secondary Pathways: Pathways typically branching from a primary pathway and routing to a space(s) where a cable is terminated. A secondary pathway typically accommodates sixteen (16) cables or less. A secondary pathway carries cables from a single system that together can be run in tight parallel proximity to one another without any negative impact on adjacent cables or cause distortion or induce consequential interference on the signals they carry.
6. Totally Enclosed Pathway System: A pathway system that is built from a mixture of boxes and raceway that when assembled are closed on all sides. Fundamentally it is a pathway system where the cables within the system are not visible and not accessible except when a component of the system, or a device mounted to it is removed. A totally enclosed pathway system supports cables run horizontally and continuously.

1.3 SPECIAL REQUIREMENTS

- A. Contract Division of Work and issuance of separate contracts notwithstanding, the entity(s) performing work of this Section shall have the responsibility to provide complete, working and code compliant pathway systems for the systems specified in this Division and for the additional systems so specified in the Contract Documents. Such systems shall be constructed in compliance with the Contract Documents.
- B. Provide complete, working and code compliant pathway systems for Division 27 and Division 28 Systems (where applicable), and as otherwise identified in the Contract Documents. Note that the Drawings may not fully detail the required complete pathway system and components.
- C. Should Work of this Section be performed by a party that is different from the party responsible for providing components (e.g., cabling) that utilize the pathway systems, the pathway provider shall:
 1. Review specifications of this Division and Division 28 Systems (where applicable) and the related Drawings to gain a complete understanding of the specific systems that will utilize the pathways.

1.4 SYSTEM DESCRIPTION

- A. General:
 1. Each communications pathway system shall consist of products to support, protect, enclose, manage and secure the cables that are part of the communication system they serve.
 2. Pathway systems shall be supplied and installed to meet the unique requirements of individual communications systems.

3. Separate pathway systems shall be provided for individual communication systems. Individual communication systems shall have unique and dedicated conveyances. Cables from individual communication systems shall be run in separate conveyances (e.g., data system cables shall be run in separate conveyances from sound system cables).
 4. Separate pathway conveyances shall be provided for cables that carry incompatible signal types (e.g., analog microphone level and speaker level cables shall be run in separate conveyances).
 5. Pathway systems shall include penetrations through walls, floors, ceilings, roofs, bulkheads and other physical barriers that are necessary to route cable between adjacent spaces.
 6. Pathway penetrations shall be prepped, installed, sealed and fire stopped in a code-compliant manner.
 7. Pathways through expansion joints shall include expansion and deflection joint fittings with bonding straps.
 8. Pathways shall be assembled from components that are listed by a recognized safety testing laboratory.
 9. The cable fill capacity of each pathway segment shall meet or exceed the capacity necessary to accommodate cables initially installed. Additional capacity shall be provided as identified in the Contract Documents. The sizes and quantities of conveyances shown on the Drawings shall be interpreted as minimums. Larger sizes, or additional quantities, shall be provided as required or further identified herein.
 10. Pathway systems shall be provided with sufficient support to carry the weight of the system, plus a full capacity of cables, with a safety factor of greater than or equal to 5. In addition, each individual above-the-floor vertical hanging support shall feature an installed static weight support capacity of not less than 200 lbs. (e.g., hanging all-thread, multi-anchor mounting flange and support cable).
 11. Pathway systems shall include matching cover plates over junction and pull boxes.
- B. Pathway Systems for Horizontal Copper, Coaxial and Fiber Cabling:
1. Hybrid pathway system.
 2. Minimum permissible conduit size: 1-inch.
- C. Pathway Systems for Building Intercommunication Systems (e.g., Central Sound/Intercom):
1. Hybrid pathway system.
 2. Minimum permissible conduit size: 1-inch.
- D. Pathway Systems for Voice Paging, Background Music, Foreground Music Systems:
1. Hybrid pathway system.
 2. Minimum permissible conduit size: 3/4-inch.
- E. Pathway Systems for Speech Privacy / Sound Masking Systems:
1. Hybrid pathway system.
 2. Minimum permissible conduit size: 3/4-inch.
- F. Pathway Systems for Audio and Video Systems:
1. Totally enclosed raceway system.
 2. Minimum permissible conduit size: 3/4-inch.

- G. Pathway Systems for Sound Reinforcement Systems:
1. Totally enclosed raceway system.
 2. Minimum permissible conduit size: 3/4-inch.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 RACEWAY

- A. Conduit:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell-Raco (Raco).
 - b. Allied Tube & Conduit / Atkore (Allied).
 - c. Republic Conduit (Republic).
 - d. CalConduit (CalConduit).
 2. Rigid Steel Conduit (RMC):
 - a. NEC Type RMC recognized.
 - b. Threaded rigid steel conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads.
 - c. Constructed in accordance with ANSI C80.1, Underwriters Laboratories Safety Standard UL6.
 3. Intermediate Metallic Conduit (IMC):
 - a. NEC Type IMC recognized.
 - b. Threaded intermediate metallic conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads.
 - c. Constructed in accordance with ANSI C80.6, Underwriters Laboratories Safety Standard UL6.
 4. Electric Metallic Tubing (EMT):
 - a. NEC Type EMT recognized.
 - b. Electric metallic tubing shall be manufactured from mild steel, zinc galvanized both inside and outside.
 - c. Constructed in accordance with ANSI C80.2, Underwriters Laboratories Safety Standard UL6.
 5. Flexible metallic conduit (FMC):
 - a. NEC Type FMC recognized.
 - b. Spirally wound double sized zinc galvanized steel.
 - c. Unjacketed.
 - d. Integral ground conductor.
 - e. Color: Natural zinc.
 6. Liquid-Tight Flexible Metal Conduit (LFMC):
 - a. NEC Type LFMC recognized.

- b. Spirally wound double sized zinc galvanized steel.
 - c. Overall liquid-tight outer jacket.
 - d. Integral ground conductor.
 - e. Color: Gray.
 - 7. Polyvinylchloride (PVC-A, PVC-B):
 - a. Constructed of Type C300 virgin polyvinylchloride.
 - b. Schedule 40 or Schedule 80 rated to 90°C.
 - c. Constructed in accordance with NEMA TC2 and Federal Specifications W-C-1094A.
 - 8. Conduit LB
 - a. Built in bend radius to protect cabling
 - b. Madison Electric Products Smart LB
- B. Communication Pole:
- 1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product listed, or Designer approved comparable product from one of the following manufacturers:
 - a. Panduit.
 - b. Wiremold.
 - c. Hubbell.
 - 2. Characteristics:
 - a. Designed for multi-service applications.
 - b. Metal construction.
 - c. Baked enamel or powder coat finish.
 - d. Factory pre-terminated AC outlets.
 - e. Dual internal cable compartments providing isolation for NEC Class 1 power and NEC Class 2 communications cables.
 - f. Designed for mounting Decora-style electrical and communication receptacles using NEMA-standard gang size plates.
 - g. Provided with manufacturer accessory mounting hardware, entrance end fitting, and ceiling trim plate.
 - h. Provide with manufacturer recommended accessories to allow Telecommunications Outlets to be installed, including cable entrance fittings, expansion fittings, etc.
 - 3. Reference Division 26 for specific information.

2.3 DISCRETE CABLE SUPPORTS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into work include:
- 1. Erico CableCat™ Series.
 - 2. Panduit J-Pro™ Series.
 - 3. Cooper/B-Line BCH Series.
- B. Product Requirements:
- 1. UL 2043 Listed and NEC compliant for use in plenum air returns.
 - 2. J-Hook style design.
 - 3. No sharp edges that could come in contact with supported cables during or after installation.
 - 4. Linear bearing surface for cable:

- a. For use with backbone cables: Greater than or equal to 1-3/4 inches.
- b. For use in primary pathways: Greater than or equal to 1-3/4 inches.
- c. For use in secondary pathway: Greater than or equal to 1-3/8 inches.
- d. For use with individual cables less than 0.400 inch diameter: Greater than or equal to 7/8 inch.

2.4 FITTINGS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 1. Hubbell-Raco (Raco).
 2. Allied Tube & Conduit / Atkore (Allied).
 3. Republic Conduit (Republic).
 4. CalConduit (CalConduit).
 5. Cooper Crouse Hinds.
- B. Rigid Steel or Intermediate Metallic Conduit:
 1. Threaded to NEMA standards for conduit.
 2. Integral non-conductive plastic throat liner to minimize/eliminate risk of cable abrasion during installation.
 3. Zinc galvanized steel.
 4. Conductive.
- C. Electric Metallic Tubing:
 1. Compression type.
 2. Integral non-conductive plastic throat liner to minimize/eliminate risk of cable abrasion during installation.
 3. Attachment: 100-percent concentric compression.
 4. Zinc galvanized steel.
 5. Conductive.
- D. Flexible Metallic Conduit:
 1. Fittings shall be manufactured by the same manufacturer as the raceway(s) it connects.
 2. Integral non-conductive plastic throat liners to minimize/eliminate risk of cable abrasion during installation.
- E. Polyvinylchloride (PVC-A, PVC-B):
 1. Fittings shall be manufactured by the same manufacturer as the raceway(s) it connects.
 2. Seal connections using PVC cement.
- F. Conduit Sealing Bushings:
 1. Factory-fabricated watertight conduit sealing bushing assemblies.
 2. Suitable for sealing around conduit or tubing passing through concrete floors and walls.
 3. Constructed of steel sleeve, malleable iron body, neoprene sealing grommets or rings, metal pressure rings, pressure clamps, and cap screws.

- G. Insulating Bushings:
1. Designed to protect cables from damage caused by sharp edges on the exposed end(s) of conduit and associated fittings, fully insulating the exposed end.
 2. Rated for use in the environment where the product is installed.
 3. Sized to match the conduit or conduit fitting to which it is applied.
 4. Soft radius non-conductive front edge to prevent damage to cables passing through the bushing.
 5. Sized to hold firmly to the conduit or fitting to which it attaches with sufficient strength that the bushing cannot and will not come free during the installation of cable.
 6. Non-conductive version:
 - a. Threaded version: Provide threaded version for use on the threaded end of conduits or fittings.
 - b. Press-on version: Provide press-on version for use on non-threaded end of conduits and conduit fittings.
 - c. Internal diameter of one end equal to or slightly less than the internal diameter of the conduit or fitting to which it attaches. The opposite end sized to match the conduit or fitting to which it is applied.
 - d. Designed for installation before any cable is installed.
 7. Conductive version:
 - a. Conductive metal frame.
 - b. Integral grounding lug.
 - c. Separate non-conductive insulator to protect cable.
 - d. Designed for installation before any cable is installed.
- H. Expansion/Deflection Fittings:
1. Shall provide 4" axial expansion/contraction
 2. Shall allow 3/4" parallel misalignment
 3. Shall allow up to 30 degree angular misalignment in any direction
 4. Basis of Design shall be Cooper Crouse Hinds:
 - a. 2" Expansion/Deflection joint fitting XJGD64 (Galv. Rigid Conduit)
 - b. Tinned copper Braid Bonding Jumper 24" BJ64
 - c. 2.5" Expansion/Deflection joint fitting XJGD74 (Galv. Rigid Conduit)
 - d. Tinned copper Braid Bonding Jumper 24" BJ74
 - e. 3" Expansion/Deflection joint fitting XJGD84 (Galv. Rigid Conduit)
 - f. Tinned copper Braid Bonding Jumper 24" BJ84
 - g. 4" Expansion/Deflection joint fitting XJGD104 (Galv. Rigid Conduit)
 - h. Tinned copper Braid Bonding Jumper 36" BJ108

2.5 PENETRATIONS

- A. All penetrations through walls, floors, and ceilings shall be sleeved.
1. Reference Firestopping for Communications specification for fire rated sleeve assemblies.
 2. All sleeves shall be metallic and shall have bushings at both ends.

2.6 BOXES

- A. Standard Wall and Ceiling Device Boxes:

1. General:
 - a. Stamped steel, code-compliant gauge, zinc galvanized.
 - b. Available in various depths from 2-1/2 to 3-1/2 inches deep, minimum.
 - c. Corrosion protection suitable for the atmosphere in which they are installed.
 - d. Non-modular sheet-steel construction.
 - e. Conduit knockouts of the size, quantity and locations required.
 - f. Threaded device-mounting screw holes.
 - g. Rated for installation in the space where the box is installed.
 - h. Equip boxes with code compliant accessory Class-1 and Class-2 service partitions when boxes are used in multi-service applications.
 2. Boxes in Masonry or Tile Walls:
 - a. "Masonry" style box construction.
 - b. Available in standard gang sizes from 1 to 10.
 - c. Available in various depths from 2-1/2 inches to 3-1/2 inches.
 - d. Conduit knockouts to suit the application.
 3. Boxes used within interior framed walls (e.g., gypsum board walls):
 - a. 1 to 2 Gang Sizes, 2-1/2 inches box depth:
 - 1) 4 inches square or 4-11/16 inches square box, 2-1/8 inches deep.
 - 2) 3/4" deep device ring (single or double as required).
 - b. 3 to 10 Gang Sizes:
 - 1) Multi-gang style box construction (not gangable), 2-1/2" depth.
 - 2) 3/4" deep device ring.
 - 3) Conduit knockouts to suit the application.
- B. Exterior Surface Mount Outlet Style Boxes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 2. Adalet / Scott Fetzer Company (Adalet).
 3. Appleton Electric (Appleton).
 4. Characteristics:
 - a. Hinged cover, sized to accommodate the devices being mounted to the box.
 - b. Cast aluminum construction.
 - c. Available in standard gang sizes from 1 to 3.
 - d. Threaded conduit hubs.
- C. Junction Boxes and Pull Boxes:
1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Hubbell-Raco (Raco).
 - b. Allied Tube & Conduit / Atkore (Allied).
 - c. Republic Conduit (Republic).
 - d. CalConduit (CalConduit).
 - e. Hoffman.
 2. Characteristics:
 - a. Screw-cover type enclosure.
 - b. Covers fabricated of the same material and with the same finish as the box itself.
 - c. Boxes installed flush in wall shall be provided with oversize cover plates painted to match the surrounding building surface.

- d. Boxes shall be NEMA rated for the atmospheric condition in which the box is installed.
 - e. Boxes in exterior or moist locations shall meet NEMA 3R (at minimum).
- D. Specialty Wall/Ceiling Boxes:
- 1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product listed, or Designer approved comparable product from one of the following manufacturers:
 - a. FSR, Inc.
 - b. Legrand/Wiremold.
 - c. Hubbell Inc.
 - d. Chief.
 - 2. Type WB:
 - a. Recessed activation type wall box designed to allow connectorized cables to be plugged into internally mounted connectorized device plates while the cable connector is hidden behind a cover plate.
 - b. Material: 14-gauge zinc coated steel box.
 - c. Nominal rough opening size required for the back box: 14.25 inches by 7.1 inches.
 - d. Designed for multi-service.
 - e. Three separate 1-gang knock-outs for box attachment.
 - f. Accommodates NEMA standard-size gang plate for AC power.
 - g. Accommodates both pre-manufactured and custom manufactured plates for mounting low-voltage connectors.
 - h. Designed in part to serve the connection needs of wall mounted video flat panel applications.
 - i. UL-listed AC power compartment.
 - j. Standard Covers:
 - 1) Nominal size: 14.75 inches by 7.5 inches.
 - 2) Stamped steel construction.
 - 3) Cable passage slot in cover to allow cables to exit while hiding connectors beyond.
 - 4) Finish: baked on enamel.
 - 5) Color: To be selected from White, Black and custom paintable in the field.
 - k. Provide box with Architect/Designer choice of standard cover.
 - l. Basis of Design: FSR PWB-250.
- E. Floor Boxes:
- 1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product listed, or Designer approved comparable product from one of the following manufacturers:
 - a. FSR, Inc.
 - b. Legrand/Wiremold.
 - c. Hubbell Inc.
 - 2. See Division 26 for specific types

2.7 ACCESSORIES

A. Pull Strings:

1. Construction: nylon.
 2. Designed and rated by the manufacturer for use as a pull-rope.
- B. Fiber Optic Innerduct:
1. Manufacturers: Subject to compliance with requirements, provide the Basis of Design product listed, or Designer approved comparable product from:
 - a. Arnco.
 - b. Endot.
 - c. Opti-Com.
 - d. Pyramid.
 2. NEMA TC 5, UL listed, corrugated, specifically designed for optical fiber cable pathways.
 - a. Color: Orange.
 - b. 1-inch minimum inside diameter.
 - c. 600 pounds minimum pulling strength.
 - d. Factory installed pull rope.
 - e. UL Listed and NEC approved for the environment in which it is installed.
 - f. Basis of Design:
 - 1) Riser Rated Environments: Carlon DF4X1C-****.
 - 2) Plenum Rated Environments: Carlon CF4X1C-****.
- C. Cable Waterfalls (Spillways) – for Conduit:
1. Manufacturers: Subject to compliance with requirements, available manufactures offering products that may be incorporated into Work include, but are not limited to, the following:
 - a. Bejed, Inc.
 - b. LincTek, Inc.
 - c. Cooper/B-Line.
 - d. Chatsworth.
 - e. Cable Management Corp.
 - f. Panduit
 2. Product Requirements:
 - a. Available in 2 inches and 4 inches diameter for direct attachment to conduit stubs and sleeves.
 - b. Integral clamp for securing to EMT conduit.
 - c. Maintains proper bending radii for cabling entering the conduit served.
 - d. Self-fastening tie down system.
 - e. UL Listed and NEC approved for the environment in which it is installed.
- D. Supports:
1. General:
 - a. Supports, support hardware, and fasteners shall be manufacturer protected with zinc coating or with treatment of equivalent corrosion resistance using approved alternative treatment, finish, or inherent material characteristic.
 - b. Products used outdoors shall be hot-dip galvanized.
 2. Material Types:
 - a. Raceway Supports:
 - 1) Clevis hangers, riser clamps, conduit straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring steel clamps.
 - b. Fasteners:

- 1) Types, materials, and construction features as follows:
 - a) Expansion anchors: Carbon steel wedge or sleeve type.
 - b) Toggle bolts: All-steel springhead type.
 - c) Powder-driven threaded studs anchors: Heat-treated steel, designed specifically for the intended service.
 - d) Solid concrete anchors: Drop-in zinc plated steel tubular expansion shield with solid, cone-shaped expander plug.
- c. Cable supports for vertical conduit:
 - 1) Factory-fabricated assembly consisting of threaded body and insulating wedging plug for non-armored electrical cables in riser conduits.
 - 2) Provide with plugs with the number and size of conductor gripping holes as required to suit each individual application.
 - 3) Body construction: Malleable-iron casting with hot-dip galvanized finish.
- d. Threaded Rod Stock (All-Thread Rod):
 - 1) Available in 1/4-inch, 3/8-inch, 1/2-inch, and 5/8-inch sizes.
 - 2) Utilize 1/2 " for ladder/tray installations under 24" and 5/8" for 24" or larger.
 - a) Rod lengths over 6' will require a "Rod Stiffener" installation for 1/2" and 5/8" rods.
- e. Slotted Metal Angle and U-channel Systems:
 - 1) 16-gauge steel U-shaped channel;
 - 2) Available in a variety of sizes including: 1-5/8 inches square, 1-1/4 inches square and 13/16 inch square.
 - 3) Available with pre-punched and un-punched versions.
 - 4) Available with holes on top or sides of channel.
 - 5) Available with a wide-variety of fittings for field construction of structural support assemblies.
- E. Bushing, Knockout Closures and Locknuts:
 1. Provide corrosion-resistant box knockout closures, conduit locknuts and malleable iron conduit bushings, offset connectors, of types and sizes, to suit respective installation requirements and applications.
- F. Pipe Curb Assemblies:
 1. Manufacturers: Subject to compliance with requirements, available manufactures offering products that may be incorporated into the Work include, but are not limited to:
 - a. The Pate Company, PCC-series.
 2. Product Requirements:
 - a. Designed to seal around pipes penetrating through conventional or metal roofs.
 - b. Prevents the ingress of water into the building under all weather conditions.
 - c. Models available to accommodate all standard sizes or pipe from 1/2 inch to 10 inches O.D.
 - d. Stainless steel pipe fasteners.
 - e. Provide with manufacturer recommended accessories and options necessary to seal and prevent water infiltration.

PART 3 - EXECUTION**3.1 COORDINATION**

- A. Review and coordinate the size requirements of pathways with the suppliers and installers of cabling and devices. Pathway segments shall accommodate the quantity and type of cables that will be installed. Upsize pathway segments from any default and minimum size(s) identified so as to accommodate the cables that will be installed, including any future expansion capacities, as identified in the Contract Documents.
- B. Review the specific routes and composite length of planned pathway routes with parties responsible for supplying or installing cables as distance limitations will apply differently for different cables and applications.
- C. Coordinate the location and routing of pathways with work of this Division, the work of other trades, the work of the Owner, and existing site conditions (where applicable) to ensure adequate headroom, post installation access to and working clearances around the pathways. Review and verify HVAC, Fire Suppression, Electrical Power, Lighting and other Drawings for design coordination. Provide routes accordingly.
- D. Proactively participate with other trades in the creation of coordination drawings that depict primary and major secondary pathways. Emphasis shall be placed on ensuring that pathways are accessible for initial cable installation and readily accessible for reuse in accommodating future cable moves, additions and changes.
- E. Coordinate the colors and types of surface raceway with the color of surface raceway provided as work of both Division 26 and Division 28. Colors of raceways shall match, except where expressly reviewed and approved by the Architect/Designer.
- F. Ensure that pathways, as installed, are adequately sized for the cables to be installed and any future expansion capacities as identified in the Contract Documents.

3.2 GENERAL

- A. Provide specified pull wires in all cabling pathways.
- B. Ground and bond all systems in accordance with the NEC and ANSI/TIA/EIA 607.
- C. All installation material and practices shall fully comply with NFPA 70 "National Electrical Code" and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.
- D. Coordinate work with the building structural systems and electrical installation.
- E. All work shall fully comply with these Specifications and related Drawings and all manufacturers' recommended installation practices.

3.3 PATHWAY SIZING

- A. Raceways shall be sized so that they are the larger of the following:
 - 1. Minimum size indicated within the Contract Documents.
 - 2. In accordance with the National Electric Code.
 - 3. As recommended by the product manufacturer.
- B. Discrete cable supports shall be sized so that they are the larger of the following:
 - 1. Minimum size indicated within the Contract Documents.
 - 2. In accordance with the National Electric Code.
 - 3. As recommended by the product manufacturer.

3.4 RACEWAY USAGE

- A. Rigid Steel (GRC) Conduit:
 - 1. Above grade, outside the building envelope, in exposed areas.
 - 2. Above grade, inside the building envelope, within high moisture areas.
 - 3. As a transitional component of a below grade conduit path where the conduit needs to pass through a poured-in-place concrete slab.
 - 4. As a sleeve through poured-in-place concrete slabs.
 - 5. Where specifically indicated on the Drawings.
- B. Intermediate Metallic Tubing (IMC) Conduit:
 - 1. Where specifically indicated on the Drawings.
- C. Electric Metallic Tubing (EMT) Conduit:
 - 1. Within the building envelope concealed within walls and ceilings.
 - 2. Above grade, inside the building envelope, where no other type of raceway is identified to be used.
 - 3. Where specifically indicated on the Drawings.
- D. Flexible Metal Conduit (FMC):
 - 1. Inside the building envelope as a component of a secondary pathway system where flexibility is necessary for constructability to meet specified objectives and where length of the segment does not exceed 6 feet.
 - 2. Inside the building envelope as the transitional segment of a raceway system and interconnection to permanently-cabled systems-furniture is necessary and where the length of the FMC segment does not exceed 12 feet.
 - 3. Where specifically indicated on the Drawings.
- E. Liquid-Tight Flexible Metal Conduit (LFMC):
 - 1. Above grade, outside the building envelope, between junction (or pull) boxes and connected devices (e.g., cameras) and where cables to/from the devices would otherwise be visually exposed or exposed to the elements.
 - 2. Above grade, outside the building envelope, between junction (or pull) boxes and connected devices requiring regular movement where cables to/from the device would otherwise be visually exposed or exposed to the elements.
 - 3. Above grade, inside the building envelope, between junction (or pull) boxes and connected devices (e.g., cameras) and where cables to/from the connected

- devices would otherwise be exposed to water or sustained periods of high moisture.
4. Above grade, outside the building envelope, between junction (or pull) boxes and connected devices requiring regular movement where cables to/from the device would otherwise be exposed to water or sustained periods of high moisture.
 5. Where specifically indicated on the Drawings.
- F. Polyvinylchloride (PVC) Conduit:
1. Below grade, where conductive conduit is not otherwise required.
 2. Where specifically indicated on the Drawings.
- G. Electrical Nonmetallic Tubing:
1. Where specifically indicated on the Drawings.
- H. Non-metallic:
1. Non-metallic raceway shall be used only where specifically indicated to be used in the Contract Documents.
 2. Non-metallic raceway shall only be used where specifically approved for use by the Designer.
- I. Conduit Sleeves:
1. In accessible but concealed ceiling cavities, wherever a cable needs to pass through a wall, floor, ceiling, bulkhead (or similar building obstruction) to get from one space to another.
 2. In unfinished areas, high to the ceiling, where a cable not installed in raceway, needs to pass through a wall, floor, ceiling, bulkhead (or similar building obstruction) to get from one space to another.
 3. Wherever one or more conduits must pass through a poured-in-place formed concrete structure.
- J. Wireway:
1. Where specifically indicated on the Drawings.
- K. Communications Poles:
1. Where specifically indicated on the Drawings.
- 3.5 DISCRETE CABLE SUPPORT USAGE
- A. Discrete cable supports shall be used to support cable that is not installed within raceway, cable tray or ladder rack.
 - B. Discrete cable supports shall be supported from the building structure, in a manner that is code compliant.
 - C. Discrete cable supports shall be anchored using accessories and hardware that is manufactured or recommended by the support manufacturer.
 - D. Discrete cable supports shall be spaced at horizontal increments not exceeding 60 inches on center. Additional supports shall be installed to limit cable sag to less than 9 vertical inches.

3.6 BOX USAGE

A. Boxes:

1. Boxes shall be used at device and equipment locations. Raceway shall terminate into an approved box, except where indicated.
2. Standard wall and ceiling boxes shall be used in walls and ceilings except where specialty boxes are indicated.
3. Boxes designed expressly for use within floors shall be used within floors. The type of box used shall be appropriate for the floor construction.
4. The size and type of boxes used shall accommodate the quantity and type of cable, raceway and devices the box must accommodate.
5. Junction boxes and pull boxes shall be sized to comply with the NEC, but not less than the sizes indicated in the Contract Documents.
6. Custom size and special order boxes shall be provided where custom sizes and special order boxes are required to meet the project requirements.

3.7 INSTALLATION

A. General:

1. Install in accordance with local codes. Adhere to clearance and fire protection regulations.
2. Install above-grade pathways parallel to and perpendicular to building elements.
3. Install pathways plumb and level except where changes in elevation are specifically necessary for constructability.
4. Document the exact routing of concealed pathways on as-built drawings.

B. Bonding and Grounding:

1. Conductive components of the pathway systems shall be bonded to ground in accordance with the NFPA and the NEC.
2. Additional grounding and bonding shall be provided as set forth in the Contract Documents.

C. Rustproof Fasteners and Hardware:

1. Install pathway components and associated mounted devices with stainless steel nuts, bolts, screws and washers when installed on the exterior of the building, when installed within unconditioned building spaces, and when the pathway serves exterior devices or devices in areas prone to sustained humidity levels in excess of 60-percent.

D. Conduit:

1. Install conduit in a concealed manner except where approved by the Designer in advance.
2. Install conduit terminations into boxes and enclosures using fittings featuring locknuts and insulating throat liners.
3. Install insulating bushings on the exposed ends of conduit stubs and sleeves.
4. Install insulating bushings on the exposed threaded portion of conduits and conduit fittings that terminate conduit to a box or equipment enclosure.
5. Support conduits by using pipe straps or trapeze hangers. Space supports not more than 8 feet on center. Secure supports by means of toggle bolts, inserts or expansion bolts.

6. Space wall brackets supporting conduits not more than 4 feet 6 inches on center. Secure supports by means of toggle bolts, inserts or expansion bolts.
7. Support raceway components directly from structural building systems, not from ceiling suspensions systems. Provide supplemental supports for junction or pull boxes.
8. Conceal conduit raceways under floors, in walls, above ceilings and in furred spaces within finished building areas.
9. Support single conduits 1-1/2 inches and larger by means of rod and cast ring hangers. Support multiple runs in similar manner or use a common trapeze hanger system.
10. Provide two-hole sheet metal pipe straps for surface mounted conduit supports on walls up to a height of 8 feet above the finished floor.
11. Pinch type hangers similar to minerallac shall only be used at heights greater than 8 feet.
12. Protect conduits during construction with temporary plugs or caps. Securely cap conduits until pull string, or cable is installed.
13. Do not install conduit horizontally in concrete slabs on grade.
14. Provide expansion/deflection fittings where raceway crosses the building expansion joints.
 - a. Utilize manufacturer recommendations for installation
 - b. Provide external bonding jumpers to bond metallic conduits across joint.
15. Conduit Routing:
 - a. If specific routing information appears on the Drawings, route and maintain conduits as shown. Should interference or a conflict arise, consult the Designer before proceeding with the Work.
 - b. If specific routing information does not appear on the Drawings, Determine the best route for the conduit in accordance with code, accessibility and other project guidelines.
16. Conduit bends:
 - a. Bends shall be made so that the conduit will not be flattened or kinked and so that the internal diameter of the conduit is not reduced.
 - b. The radius of the curve of the inner edge of any bend shall not be less than indicated by the National Electrical Code and TIA/EIA-569 Commercial Building Standard for Telecommunications Pathways and Spaces.
 - c. All conduit bends or fabricated elbows shall have a bend radius equal or greater than 4 times the trade size.
 - d. When it is necessary to make field bends, use tools manufactured for conduit bending.
 - 1) Heating of metallic conduit to facilitate bending is not permitted.
 - e. Constructing an outside entrance to a building from buried conduit to penetrate above the ceiling line will allow an exception for a 4 inches LB fitting at one end to allow placement of the conduit flat to the building outside wall.
17. Do not cut, burn, or drill any structural member to pass through or mount any pathway product without first obtaining approval in writing from the building architect and structural engineer.
18. Install above-ceiling conduits a minimum of 7 inches above ceiling tiles to permit ceiling tile removal.
19. Install conduits at least 6 inches away from insulated pipes, steam lines or any other hot pipes which they pass. Where the lines are not insulated, the clearances

shall be increased until the temperature of the conduit, with no live conductors enclosed, does not rise above the ambient temperature of the installation area.

20. Install flashing and counter flashing or pitch pockets for waterproofing of raceways, outlets and fittings that must penetrate the roof.
21. Install oversized sleeves in forms for new concrete walls, floor slabs, and partitions to allow for the passage of raceways.
22. Waterproof sleeved raceways shall be provided below grade and in areas prone to high moisture and condensation.
23. Outside Plant Conduits
 - a. All conduits shall drain into open bottom hand holes.
 - b. Minimum depth is 24-30"
 - c. Conduits may slope from middle of run

E. Pull Boxes:

1. Install each pull box indicated on the Drawings.
 - a. As additionally required by Code.
2. Install additional pull boxes outside the building envelope:
 - a. Every 500 running feet of below-grade raceway.
 - b. Every 180 degrees of raceway bend.
 - c. Every 100 feet of above-grade raceway. (less than 2")
 - d. Every 200 feet of above-grade raceway (2" and larger)
 - e. As additionally required by Code.
3. Install pull boxes in areas that will be accessible after installation. Accessible areas include spaces above removable tile ceilings and behind access doors that are installed expressly for this purpose. Do not install pull-boxes in locations that will not be accessible after construction is complete and is not accessible after permanently installed furniture or fixtures are installed.
4. Size boxes in accordance with the NEC. Use larger boxes where so specified.
5. Support boxes rigidly.
6. Land conduits on the boxes such that conduits enter and exit across from each other on opposite sides of the box so as to facilitate straight line pulling of cable through the box.
7. Do not use pull boxes in lieu of conduit bends, except as necessary by design or to meet constructability constraints.
8. When directional transition of the cables is necessary through a box, land conduits on the box so that they permit the largest possible bending radius for those cables that will pass through the box.

F. Pull Stings:

1. Install a usable pull string in every pathway prior to the installation of cables. The string shall be installed after pathway installation and prior to such time as the cable installer desires to install cable within the pathway. The string shall be used as an aid to the installation of cables.
2. Install a replacement pull string in each pathway as part of the cable installation process to facilitate installation of additional cable(s). Tie the pull-string off and tag for "Future Use."

G. Innerduct:

1. Install innerduct within and along pathways that will be used to accommodate fiber optic cables.

- a. Plenum rated innerduct shall be used in pathways that are not 100-percent conduit.
 - b. Exception: Innerduct is not required in those pathways that will contain exclusively armored-type fiber optic cables.
- H. Spillways:
1. Install cable spillways where cable(s) will exit a conduit sleeve, cable tray, or wireway and where they would otherwise be unsupported for more than 6 inches.
- I. Telecommunication Poles:
1. Mount straight and anchor to building structure above the ceiling line.
 2. Provide mounting hardware, entrance end fitting, and ceiling trim plate.
 3. Utilize cutouts or add-on compartments for jack frames.
 4. Isolated pathway from electrical circuits with separate internal raceway.
- J. Discrete Cable Supports:
1. Install supports in areas that will be readily accessible after installation (e.g., above accessible suspended ceilings; up within the building structure in unfinished areas).
 2. Do not install supports in any location that is not readily accessible and cannot be reached by the hand of an individual standing flat footed on the ground, a ladder or scaffolding. Do not install in areas where an individual has to strain to reach or where a pole will be required to access.
 3. Install separate discrete cable support pathways for cables from each system. Where the allowed capacity of an individual support will be exceeded, install multiple parallel pathways.
 4. Install separate discrete cable support pathways for cables from the same system that carry signals that could negatively interfere with one another. Array supports vertically using an appropriate spacing not less than 6 inches for every 6 dB of nominal voltage differential between the cables.
 5. Attach supports directly to vertical building surfaces, or from overhead structural members using threaded rod and other approved attachment methods. Support of cables by use of suspended ceiling wires shall not be permitted.
 6. Install supports plumb and square.
 7. Install horizontal runs of cables supports level. Change elevation only where necessary for coordination with other trades and pathways of other systems.
 8. Mount the bottom of supports approximately 12 inches above the top of suspended ceilings.
 9. Install cable supports at intervals not exceeding 5 cable feet.
 10. Install supports so that they will not interfere with the removal or installation of ceiling tiles.
 11. Provide support in close proximity of device conduit pathway termination for service loop.
- K. Device Boxes:
1. New-work and old-work device boxes shall be installed flush with or slightly recessed below the finished surface. Do not recess boxes more than is permitted by code, nor more than .078 inches (2mm). Old-work boxes require advanced craftsmanship and construction techniques to achieve specification compliance for communications Work.

2. The installed elevation of boxes shall generally be as indicated on the drawings. Elevations shall be adjusted in the field to ensure a clean appearance resulting from coordination of the new box elevations to match the existing box elevations. Where the specified box elevations and existing condition box elevations differ by more than 4 inches, seek the direction of the Designer prior to installation.
 3. Device boxes and associated cover plates shall not span different types of wall finishes either vertically or horizontally. Horizontal and vertical position of boxes shall be adjusted at time of installation to ensure that this condition does not exist after finish is completed.
 4. Boxes in masonry shall be installed so that the specified over plates will cover the mortar joints and cut openings completely.
 5. Device boxes shall be installed so that they are securely and rigidly attached to structure. Gypsum board and similar non-structural board shall not be used for box support.
 6. Devices boxes shall not rely on raceway as a means of support. Boxes shall be fully supported by surrounding building structure.
 - a. Provide sufficient support for ceiling device boxes to support weight of installed products.
 - b. Provide tile support bridge for device box in accessible ceiling.
 7. Device boxes shall be installed plumb and level to within the following limits:
 - a. Maximum one-tenth (1/10) of one degree from plumb and from level, and;
 - b. Maximum difference from level of .078 inch (2mm) at one end of the box relative to the other end of the box, and;
 - c. Maximum difference from plumb of .078 inch (2mm) at the top of the box relative to the bottom of the box.
 8. Boxes shall be shimmed as necessary to insure level and plumb installation.
 9. Install gaskets on boxes installed outside and in wet or damp locations (e.g., tunnels, crawlspaces, pits).
 10. Device boxes shall be protected from plaster, drywall mud, mortar, and other construction debris.
 11. Floor boxes shall be installed flush and true with the finished floor, or otherwise in accordance with the manufacturer's instructions.
 12. Boxes shall be cleaned of debris after installation.
 13. Boxes shall be cleaned of debris thoroughly prior to installation of cover plates;
 14. Install blank cover plates on each unused device box.
 15. Knock out requirements exceeding manufacturers standard sizes shall be accommodated with punch of correct size.
- L. Sleeves and Penetrations:
1. Sleeves through poured-in-place concrete surfaces shall be set in place prior to the concrete pour and protected from concrete ingress.
 2. Sleeves through floors shall be installed to prevent the passage of water between the sleeve and the floor.
 3. Install cable-protecting insulating bushings on the each end of each sleeve.
 4. Extend through-the-wall sleeves a minimum of 2 inches beyond the wall surface. Extend the sleeve a greater distance where necessary to permit proper installation of cable-protecting bushings and any associated cable waterfalls.
 5. Extend through-the-floor sleeves to a consistent elevation of 4 inches to 6 inches above finished floors, except where otherwise noted on the Drawings.
 6. Fill the voids between sleeve and building surface with approved fire stop material sufficient to maintain the fire-rating of the building surface.

7. Firestop or plug all penetrations, conduits and sleeves to prevent the movement of air between spaces.
- M. Conduit Stubs:
1. Install cable-protecting insulating bushings on each conduit stub.
- N. Supports:
1. Fabricated Support Devices:
 - a. Conform to the manufacturer's recommendations for selection and installation of supports.
 - b. Install individual and multiple (trapeze) raceway hangers and riser clamps as necessary to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assembly and for securing hanger rods and conduits.
 - c. Support parallel runs of horizontal raceways together on trapeze-type hangers.
 - d. Support individual horizontal raceways by separate pipe hangers. Spring steel fasteners shall be used in lieu of hangers for 1-1/2 inches and smaller raceways above suspended ceilings only.
 - e. For hanger rods with spring steel fasteners, use 1/4 inch diameter or larger threaded steel. Use spring steel fasteners that are specifically designed for supporting single conduits or tubing.
 - f. Support exposed and concealed raceway within 1 foot of box and access fittings. In horizontal runs, support at the box and access fittings shall be omitted where box or access fittings are independently supported and raceway terminals are not made with chase nipples or threadless box connectors.
 - g. In vertical runs, arrange supports so the load produced by the weight of the raceway and the enclosed conductors is carried entirely by the conduit supports with no weight load on the ends of the raceway.
 2. Miscellaneous supports:
 - a. Support miscellaneous electrical components as required to produce the same structural safety factors as specified for raceway supports. Install metal channel racks for mounting cabinets, pull boxes, junction boxes, and other devices.
 - b. Support sheet metal boxes directly from the building structure or by bar hangers. Where bar hangers are used, attach the bar to raceways on opposite sides of the box and support the raceway with an approved type of fastener not more than 24 inches from the box.
 3. Fastening:
 - a. Fasten pathway products and its supporting hardware securely to the building structure in accordance with the following:
 - 1) Fasten by means of wood screws or screw-type nails on wood, toggle bolts on hollow masonry units, concrete inserts or expansion bolts on concrete or solid masonry, machine screws, welded threaded studs, or spring-tension clamps on steel. Threaded studs driven by a powder charge and provided with lock washers and nuts shall be used instead of expansion bolts and machine or wood screws. Do not weld conduit, pipe straps, or items other than threaded studs to steel structures. In partitions of light steel construction, use sheet metal screws.

- 2) When installing fasteners in concrete or CMU structures, do not cut reinforcing bars.
 - 3) Ensure that the load applied to any fasteners does not exceed 25-percent of the proof test load. Use vibration-and shock-resistant fasteners for attachments to concrete slabs.
 - b. Raceway supports: Hanger spacing shall be as required for adequate support of the raceway, but in no case shall there be less than one hanger per 5 feet of raceway length.
- O. Pathway Evacuation:
1. Prior to the installation of cable:
 - a. Clean and vacuum boxes, raceway, cable tray, and discrete cable supports.
 - b. Remove solids or other hindrances that could impede its full utilization or that could damage cable during or after installation.
 - c. Remove liquids. Blow out until raceway is dry, sufficiently that the installed cables will not be subjected to contact with them.
 2. Where existing raceways are reused, remove liquid from the raceway.
- P. Water Proofing:
1. Protect raceways from moisture infiltration in areas where moisture penetration is probable (e.g., outdoors, natatoriums, wash bays).
 2. Provide watertight fittings where one or more cables exit the pathway in areas where moisture penetration is probable.
 3. Seal below-grade conduit joints to prevent moisture infiltration.
 4. Seal joints of conduits in high-moisture areas to prevent moisture infiltration.
 5. Pressure or vacuum test below-grade conduits before and after concealing the conduits to ensure resistance to moisture ingress.
- Q. Repair and Patching:
1. Holes and other penetrations into building surfaces or structure that are created to facilitate pathway installation but that are not ultimately used shall be filled, repaired, and restored to their original strength, appearance and integrity.
 2. Damage to building or property that occurs during the course of pathway installation shall be repaired and restored to its original condition prior to damage.
- R. Cover Plates
1. Provide cover plates over the openings of junction boxes, pull boxes and cast boxes.

END OF SECTION 27 05 28

SECTION 27 05 36 - CABLE TRAYS FOR COMMUNICATIONS

1.1 SUBMITTALS

- A. Product Data:
 - 1. Cable tray
 - a. Fittings
 - b. Accessories
 - c. Spillways/waterfalls.
- B. Shop Drawings:
 - 1. Coordinated floor plan drawings depicting the size(s), locations, and dimensions of the following:
 - a. Primary pathways.
 - b. Cable tray elevations.
 - c. Vertical and horizontal working clearances around tray.
- C. Closeout Submittals:
 - 1. Accurate up-to-date as-built versions of shop drawings.

1.2 SPECIAL REQUIREMENTS

- A. Contract Division of Work and issuance of separate contracts notwithstanding, the entity(s) performing work of this Section shall have the responsibility to provide complete, working and code compliant pathway systems for the systems specified in this Division and for the additional systems so specified in the Contract Documents. Such systems shall be constructed in compliance with the Contract Documents.
 - 1. Provide complete, working and code compliant pathway systems for Division 27 and 28 (where applicable) Systems, and as otherwise identified in the Contract Documents. Note that the Drawings may not fully detail the required complete pathway system and components.
- B. Should Work of this Section be performed by a party that is different from the party responsible for providing components (e.g., cabling) that utilize the pathway systems, the pathway provider shall:
 - 1. Coordinate with the parties providing cable and other products that will utilize the pathways to ascertain a complete understanding of the pathway needs of each system, including cable separation requirements.

1.3 SYSTEM DESCRIPTION

- A. General:
 - 1. Each communications pathway system shall consist of products to support, protect, enclose, manage and secure the cables that are part of the communication system they serve.
 - 2. Pathway systems shall be supplied and installed to meet the unique requirements of individual communications systems.

3. Separate pathway systems shall be provided for individual communication systems. Individual communication systems shall have unique and dedicated conveyances. Cables from individual communication systems shall be run in separate conveyances (e.g., data system cables shall be run in separate conveyances from sound system cables).
4. Separate pathway conveyances shall be provided for cables that carry incompatible signal types (e.g., analog microphone level and speaker level cables shall be run in separate conveyances).
5. Pathway systems shall include penetrations through walls, floors, ceilings, roofs, bulkheads and other physical barriers that are necessary to route cable between adjacent spaces.
 - a. Pathway penetrations shall be prepped, installed, sealed and fire stopped in a code-compliant manner.
6. Pathways shall be assembled from components that are listed by a recognized safety testing laboratory.
7. The cable fill capacity of each pathway segment shall meet or exceed the capacity necessary to accommodate cables initially installed. Additional capacity shall be provided as identified in the Contract Documents. The sizes and quantities of conveyances shown on the Drawings shall be interpreted as minimums. Larger sizes, or additional quantities, shall be provided as required or further identified herein.
8. Pathway systems shall be provided with sufficient support to carry the weight of the system, plus a full capacity of cables, with a safety factor of greater than or equal to 5. In addition, each individual above-the-floor vertical hanging support shall feature an installed static weight support capacity of not less than 200 lbs. (e.g., hanging all-thread, multi-anchor mounting flange and support cable).

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 CABLE TRAY

- A. Type CB – Ceiling Hung: Basket Type
 1. Manufacturers: Subject to compliance with requirements, provide one (1) of the following:
 - a. WBT Performance Cabletray
 - b. Cooper/B-Line FLEXTRAY™ Series.
 - c. Legrand/Cablofil – Wiremesh CF Series.
 2. Product Requirements:
 - a. Center hung ceiling-mount design using tray manufacturer's ceiling mount accessories.
 - b. Basket-style, fully ventilated tray design.
 - c. UL or ETL listed.

- d. Depth: Available in various usable depths ranging from 2 to 6 inches.
 - e. Width: Available in various usable widths from 4 to 32 inches.
 - f. Tiers: Available in single and double tier configurations. Double tier version assembled from multiple single-tier models and tray manufacturer accessories.
 - g. Cable protecting sleeves around tray supports emanating from within the tray.
 - h. Standard Segment Length: Greater than or equal to 10 feet (3 meters).
 - i. Designed to enable the establishment of full-width and half-width double-tier stacks of tray where additional capacity is needed and where discrete parallel pathways are required for cables from different systems.
 - j. Provide tiered trapeze mounting.
- B. Type WA – Wall: Basket Type
- 1. Manufacturers: Subject to compliance with requirements, provide one (1) of the following:
 - a. WBT Performance Cabletray
 - b. Cooper/B-Line FLEXTRAY™ Series.
 - c. Legrand/Cablofil – Wiremesh CF Series.
 - 2. Product Requirements:
 - a. Designed for wall mounting using tray manufacturer’s wall mounting accessories.
 - b. Basket-style, fully ventilated tray design.
 - c. UL or ETL listed.
 - d. Depth: Available in various usable depths ranging from 2 to 6 inches.
 - e. Width: Available in various usable widths from 2 to 6 inches.
 - f. Standard Segment Length: Greater than or equal to 10 feet (3 meters).
 - g. Tiers: Available in single and double tier configurations. Double tier version assembled from multiple single-tier models and tray manufacturer accessories.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Review and coordinate the size requirements of pathways with the suppliers and installers of cabling and devices. Pathway segments shall accommodate the quantity and type of cables that will be installed. Upsize pathway segments from any default and minimum size(s) identified so as to accommodate the cables that will be installed, including any future expansion capacities, as identified in the Contract Documents.
- B. Review the specific routes and composite length of planned pathway routes with parties responsible for supplying or installing cables as distance limitations will apply differently for different cables and applications.
- C. Coordinate the location and routing of pathways with work of this Division, the work of other trades, the work of the Owner, and existing site conditions (where applicable) to ensure adequate headroom, post installation access to and working clearances around

the pathways. Review and verify HVAC, Fire Suppression, Electrical Power, Lighting and other Drawings for design coordination. Provide routes accordingly.

- D. Proactively participate with other trades in the creation of coordination drawings that depict primary and major secondary pathways. Emphasis shall be placed on ensuring that pathways are accessible for initial cable installation and readily accessible for reuse in accommodating future cable moves, additions and changes.
- E. Coordinate the colors and types of surface raceway with the color of surface raceway provided as work of both Division 26 and Division 28. Colors of raceways shall match, except where expressly reviewed and approved by the Architect/Designer.
- F. Ensure that pathways, as installed, are adequately sized for the cables to be installed and any future expansion capacities as identified in the Contract Documents.

3.2 GENERAL

- A. Ground and bond all systems in accordance with the NEC and ANSI/TIA/EIA 607.
- B. All installation material and practices shall fully comply with NFPA 70 "National Electrical Code" and ANSI/TIA/EIA 569A Commercial Building Standard for Telecommunications Pathways and Spaces.
- C. Coordinate work with the building structural systems and electrical installation.
- D. All work shall fully comply with these Specifications and related Drawings and all manufacturers' recommended installation practices.

3.3 PATHWAY SIZING

- A. Raceways shall be sized so that they are the larger of the following:
 - 1. Minimum size indicated within the Contract Documents.
 - 2. In accordance with the National Electric Code.
 - 3. As recommended by the product manufacturer.
- B. Cable Trays shall be sized so that they are the larger of the following:
 - 1. Minimum size indicated within the Contract Documents.
 - 2. In accordance with the National Electric Code.
 - 3. As recommended by the cable tray manufacturer.
 - 4. Sized so that it will not be loaded beyond 40-percent of the rated capacity, regardless of a code or manufacturer rated capacities greater than this.

3.4 CABLE TRAY USAGE

- A. Cable tray shall be used on the Project, as defined below:
 - 1. Where a hybrid pathway system is identified to be provided, above accessible ceilings within corridors, where the tray serves as a primary pathway for the system served.

2. Where a hybrid pathway systems is identified to be provided, above accessible ceilings where the tray serves as a secondary pathway and sixteen (16) or more cables need to traverse a horizontal cable distance of 50 feet or more from a primary pathway to reach their final destination.
 3. Where a hybrid pathway system is identified to be provided, within unfinished spaces without suspended ceilings, where the tray can be installed above an elevation of 8 feet 6 inches, and where the exposed installation of tray is approved by the Designer in advance.
 4. Where specifically indicated on the Drawings.
- B. Cable tray shall not be used where conduit or another form of raceway is expressly required.

3.5 INSTALLATION

- A. General:
1. Install in accordance with local codes. Adhere to clearance and fire protection regulations.
 2. Install above-grade pathways parallel to and perpendicular to building elements.
 3. Install pathways plumb and level except where changes in elevation are specifically necessary for constructability.
 4. Document the exact routing of concealed pathways on as-built drawings.
- B. Bonding and Grounding:
1. Conductive components of the pathway systems shall be bonded to ground in accordance with the NFPA and the NEC.
 2. Additional grounding and bonding shall be provided as set forth in the Contract Documents.
- C. Rustproof Fasteners and Hardware:
1. Install pathway components and associated mounted devices with stainless steel nuts, bolts, screws and washers when installed on the exterior of the building, when installed within unconditioned building spaces, and when the pathway serves exterior devices or devices in areas prone to sustained humidity levels in excess of 60-percent.
- D. Cable Tray:
1. Install tray so that segments of the tray system remain fully re-usable.
 2. Install tray only in locations where the tray is accessible and the cable conveyance area of the tray is accessible.
 3. Where tray is installed above lay-in ceilings, ensure there is ready access to the cable storage area through the ceiling grid.
 4. Install tray in accordance with the manufacturer's installation recommendations, using the fittings and accessories manufactured by and expressly recommended by the manufacturer.
 5. Utilize pre-manufactured fittings where changes in direction and elevation occur.
 6. Install tray so that mounting height(s) will be sufficient to clear light fixtures, piping, and equipment and so that it is readily accessible.
 7. Ensure that components of the tray system are free of sharp edges, burrs, or projections that could damage cable.

8. Install protective caps on the exposed ends of cable tray rungs.
9. Install waterfall fittings at each location where cable(s) exit the tray downwards.
10. Do not install cable tray high to the structure or above equipment, pipes, or ductwork where the tray may become inaccessible after installation or project completion.
11. Discontinuity of Cable Tray:
 - a. Where cable tray cannot be installed contiguous, because the pathway must pass through an otherwise inaccessible building space, install conduit sleeves of equivalent usable cross-sectional area through the inaccessible building space. The minimum number of sleeves shall not be less than one (1) 4-inch conduit for every 3 inches of cable tray width.
 - b. Where cable tray cannot be installed contiguous, because of obstacles that simply cannot be coordinated out of the way, furnish and install conduit sleeves or a discrete cable support system to traverse the obstacles. This intermediate pathway segment shall contain the same or greater usable cross-sectional area as the cable tray.
12. Working Clearances for Cable Tray:
 - a. 7 inches above the ceiling line of accessible ceilings to the bottom of the single or multi-tier cable tray to allow for removal and reinstallation of ceiling tiles.
 - b. Vertical clearance between tray and objects above:
 - 1) 6 inches vertical clearance above the top of trays less than or equal to 12 inches wide.
 - 2) 12 inches vertical clearance above the top of trays 12 inches to 24 inches wide.
 - c. Vertical clearance between tray and objects below:
 - 1) With the exception of suspended ceiling grid there shall be no objects located below the cable tray that could impede access to the cable tray.
 - 2) Vertical clearance is required above cable tray.
 - d. Horizontal clearance minimums between tray and objects installed beside the tray:
 - 1) 12 inches of clearance left and right of tray that is less than or equal to 12 inches wide.
 - 2) 18 inches of clearance left and right of trays 12 inches to 18 inches wide.
 - 3) 24 inches of clearance left and right of trays greater than 18 inches wide.
 - 4) Wall mounted tray requires clearance on one side of the tray.
 - 5) Suspended tray requires clearance on both sides of the tray.
13. Supports for Cable Tray:
 - a. Support cable trays from building structure.
 - b. Install supports for suspended cable trays at increments not more than 60 inches on center and additionally at each splice, tee, elbow, bend, intersection, and transition.
 - c. Suspended tray shall be installed with lateral bracing to prevent side-to-side movement of the tray.
 - d. Support rod sizing:
 - 1) Tray 12 inches or less in width shall utilize 1/2-inch all-thread-rod, minimum.

- 2) Tray greater than 12 inches in width shall utilize 5/8-inch all-thread-rod, minimum.
 - e. Support rod lengths over 6 feet shall be equipped with a rod stiffener.
 - f. Under-floor cable tray systems shall be installed using such means so that no lateral loads are applied to the risers of the raised floor system. Where cantilever type tray or tray mounting adapters are used, provide accessory supports designed to ensure that tray loads are carried vertically to the floor.
14. Multi-Tier Cable Tray:
- a. Multiple-tier cable tray shall be provided in lieu of single tier cable tray where space constraints and working clearance requirements limit the use of wider single tier cable tray solution.
- E. Repair and Patching:
1. Holes and other penetrations into building surfaces or structure that are created to facilitate pathway installation but that are not ultimately used shall be filled, repaired, and restored to their original strength, appearance and integrity.
 2. Damage to building or property that occurs during the course of pathway installation shall be repaired and restored to its original condition prior to damage.

END OF SECTION 27 05 36

SECTION 27 05 43 - UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM).
 - 2. Product Datasheets.
- B. Shop Drawings:
 - 1. Site Plans, coordinated: depicting the planned pathways and routing of pathways.
 - 2. Floor Plans, coordinated: depicting the planned pathways and routing of pathways.
 - 3. Traffic Control Plan:
 - a. Proposed work schedule and traffic control details.
- C. Closeout Submittal:
 - 1. Product Datasheets.
 - 2. As-Built Drawings:
 - a. Site Plans.
 - b. Floor Plans.

1.2 REFERENCES

- A. Definitions:
 - 1. OSP (Outside Plant): Communications spaces, pathways, cabling, and termination hardware required to connect two or more buildings or structures and includes work through the building or structure penetration to the point of termination.
- B. Reference Standards:
 - 1. TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
 - 2. TIA/EIA-569-C, or most current version, Telecommunications Pathways and Spaces.
 - 3. TIA/EIA-606-B, or most current version, Administration Standard for Commercial Telecommunications Infrastructure.
 - 4. TIA/EIA-607-B, or most current version, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 - 5. TIA/EIA-758-B, or most current version, Customer-Owned Outside Plant Telecommunications Infrastructure Standard.
 - 6. ANSI/SCTE 77-2007 Specification for Underground Enclosure Integrity

7. The most current published version of the “Telecommunications Distribution Methods Manual” published by the Building Industry Consulting Services International (BICSI).
8. The most current published version of the “Outside Plant Design Reference Manual” published by the Building Industry Consulting Services International (BICSI).
9. Comply with applicable codes, including the most current version of the National Electrical Safety Code (NESC).

1.3 SYSTEM DESCRIPTION

- A. The underground ducts and raceways system shall be a system of conduits, boxes, hand holes and other raceways and accessories between communications rooms, entrance points and facilities of building(s), structures on a campus, towers, poles, maintenance holes, hand holes, and telecommunications pedestals or cabinets as part of a complete pathways system infrastructure. The underground ducts and raceways infrastructure shall meet the requirements of the authority having jurisdiction (AHJ) and applicable codes.
- B. Locate, identify, and avoid all existing utilities utilizing the marking service required by State Law and information from the Owner where new facilities or excavation is required.
 1. Provide all necessary traffic control (vehicular and pedestrian), hazard protection, construction site barriers/warning tape, trench wall supports, and any other safety provisions customary to provide a safe working environment where new work is required.
- C. Pathway System includes the following items and all necessary related activities necessary to provide a fully functional system.
 1. System components shall be located and/or provided as indicated on the Drawings.
 2. Provide all indicated entrances into specified Buildings and as detailed on the Drawings.
 - a. Provide necessary penetrations through the facility walls and restore the wall to the same condition as prior to cutting.
 - b. Provide all required Conduits and Boxes to construct the entrance pathway as indicated on the Drawings.
 - 1) Conduit utilized on an exterior wall above grade shall be Galvanized Rigid Conduit (GRC).
 - a) This shall include sleeves extending into the facility.
 - b) The GRC conduit shall continue to the first below grade Hand Hole.
 - 2) Transition boxes used on an exterior wall above grade shall be NEMA 3R rated.
 - 3) Conduit utilized in the interior of a building to extend to an Entrance Facility or termination/transition space shall be GRC.
 - 4) Conduit utilized to stub up into a termination/transition space from or below the slab of the building shall be GRC.
 - c. Provide all necessary hardware to secure and/or protect the entrance pathway.
 3. Provide underground conduit pathway system as shown on the Drawings.

- a. Provide all necessary Hand Holes including the minimum requirements shown on the Drawings.
 - 1) Provide gravel base in bottom of open bottom hand holes.
 - 2) Provide 6" a re-bar reinforced concrete apron, at least 12" deep, around each hand hole installed in a sidewalk, paved area, roadway (paved or unpaved).
 - 3) Provide enclosure covers with a minimum Tier 15 rating.
 - a) All covers shall indicate a label of "Communications" and Owner Name and telephone number (coordinate with Owner).
 - b) Field verify lid/cover construction requirements or provide all Tier 22 covers.
 - c) Bolt the lid to the enclosure.
 - b. Provide all conduits between Hand Holes/ Maintenance Holes/ Entrances and any other points as shown on the Drawings.
 - 1) Quantities and trade sizes shall be as indicated on the Drawings.
 - a) Unless otherwise noted, underground conduits shall be 4" schedule 40 PVC or HDPE.
 - b) (Note: Directional drilling installations shall utilize SDR 11)
 - c) Provide steel casings or concrete encasement around all conduits installed under public roadways to extend at least 5 feet beyond the paved surface on each side of the roadway or 2' beyond the right-of-way of a public roadway, whichever is farther.
 - d) Exception: Private drives located on Owner's property shall not require casings where conduits are installed at a minimum depth of 6' (six feet) below the drive or encased in concrete to eliminate "Live Load" impact.
4. Accessories
- a. Provide inner-duct system (textile unless specifically noted).
 - 1) Each primary pathway utilizing a single 4" conduit shall have three 3 cell duct units (9 cells).
 - 2) Each primary pathway utilizing more than one 4" conduit shall have the textile innerduct in one conduit; the remaining conduits shall receive only a pull rope.
 - b. Provide a #6 locate conductor inside the Primary Pathway conduit along each underground pathway segment; leave 5' coiled at each end.
 - 1) Alternate constructions such as locatable textile inner-duct are acceptable.
 - c. Provide a 1/4" nylon pull rope in each conduit segment with 5' minimum slack at each end; coil slack and anchor to enclosure side.
 - d. Provide warning tape above all pathway runs.
 - 1) Provide a 4" wide "Buried Cable Below" warning tape at a 3-6" depth along the underground pathway where the pathway is not covered by pavement, concrete, etc.
 - 2) "Slice" into ground below the surface over each pathway (One per pathway not one per duct).
 - e. Provide plugs in duct(s) entering a building.
 - 1) Install plugs in all conduits entering a building below grade or below the level of the next/last hand hole.

- 2) Install plugs in all unused conduits opening into a ceiling cavity from a transition box. (Plug all conduits/sleeves with cables installed with a removable barrier.)

D. Communications

1. All work schedules on site shall be communicated to the Owner and Site Manager at least 2 days in advance unless otherwise noted.
2. At all times during work hours the lead technician shall:
 - a. Carry a cellular telephone equipped with voice mail and local telephone number.
 - b. Provide the access numbers for the device to the Owner, Site Manager, and Consultant.

E. Restoration:

1. Completely restore all areas to how they existed before construction.
2. Provide erosion control, including bailed hay and sediment control fencing, as specified in the referenced standards.
3. Where trenching has been performed, restoration shall include additional trench fill after settlement of original fill has completely subsided and reseeding as necessary for complete restoration. Provide area safety as specified throughout restoration.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 PATHWAYS AND SPACES

A. Hand Holes:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Strongwell (Quazite).
 - b. Oldcastle Precast.
 - c. Pencil.
2. General: Underground enclosures and associated components shall be provided by a single manufacturer, including coupling, lids/covers, adapters, fittings, brackets, hangers and other accessories recommended by the manufacturer and/or necessary for a complete and functional system, as indicated.
3. Underground Enclosures and Covers:
 - a. Manufactured of high strength polymer concrete material consisting of an aggregate mix bound together with a polymer resin.
 - b. Materials shall be non-conductive, non-corrosive, and unaffected by moisture, freezing, subsoil chemicals and UV light.

- c. Hardware shall be corrosion resistant stainless steel.
- d. Equip enclosures with adequate provisions for knockouts, cable racking and pulling irons for proper duct and cable installation per code, standards, and practice.
- e. Minimum design load: 22,500 lbs. over 10-inch by 20-inch plate.
- f. Minimum test load: 33,750 lbs. over 10-inch by 20-inch plate.
- g. Size:
 - 1) Sufficient to allow figure-eight coiling of cable slack without violating the bend radius restrictions of the cable.
 - 2) Sufficient to accommodate splice closures.
- h. Basis of Design: Strongwell (Quazite) PG2436BA30 (24-inch by 36-inch by 30-inch deep box) and PG3636BA30 (36-inch by 36-inch by 30-inch deep box).
- i. Lids/Covers:
 - 1) Covers shall be labeled "Communications" and Owner Name and telephone number (coordinate with Owner).
 - 2) Field verify lid/cover construction requirements or provide the highest grade cover (i.e., Grade 3) available.
 - 3) Support crossbars shall be provided from the manufacturer to meet load characteristics.
 - 4) Test loads for ANSI/SCTE 77-2007

APPLICATION	LOADING REQUIREMENTS			
Light Duty Pedestrian Traffic Only	Vertical	Test Load	13.3kN	3000 pounds
TIER 5 Sidewalk applications with a safety factor for occasional non-deliberate vehicular traffic	Vertical	Design Load	22.2 kN	5000 pounds
		Test Load	33.3 kN	7500 pounds
	Lateral	Design Load	28.7 kPa	600 pounds/sq.ft.
		Test Load	43.1 kPa	900 pounds/sq.ft.
TIER 8 Sidewalk applications with a safety factor for non-deliberate vehicular traffic	Vertical	Design Load	35.6 kN	8000 pounds
		Test Load	53.4 kN	12000 pounds
	Lateral	Design Load	28.7 kPa	600 pounds/sq.ft.
		Test Load	43.1 kPa	900 pounds/sq.ft.
TIER 15 Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	Vertical	Design Load	66.7 kN	15000 pounds
		Test Load	100.1 kN	22500 pounds
	Lateral	Design Load	38.3 kPa	800 pounds/sq.ft.
		Test Load	57.5 kPa	1200 pounds/sq.ft.
TIER 22 Driveway, parking lot, and off-roadway applications subject to occasional non-deliberate heavy vehicular traffic	Vertical	Design Load	100.1 kN	22500 pounds
		Test Load	150.1 kN	33750 pounds
	Lateral	Design Load	38.3 kPa	800 pounds/sq.ft.
		Test Load	57.5 kPa	1200 pounds/sq.ft.
AASHTO H-20 Deliberate vehicular traffic applications.	Certified precast concrete, cast iron, or AASHTO-recognized materials.			

Table 1 – Test Loads

- 5) Three grades of lids/covers are acceptable dependent on the location of placement.
 - a) Grade 2, Tier 15, Light Traffic and Mowers: Covers shall have a minimum design load of 15,000 lbs. and a minimum test load of 22,500 lbs. Basis of Design shall be Strongwell (Quazite) PG2436HA12.
 - b) Grade 3, Tier 22, Traffic Areas and Parking Lots: Covers shall have a minimum design load of 22,500 lbs. and a minimum test

load of 33,750 lbs. Basis of Design shall be Strongwell (Quazite) PG2436HH12.

- c) Covers located in Roadways shall have a AASHTO H-20 rating.

B. Conduit:

1. Rigid steel conduit:
 - a. Threaded rigid steel conduit shall be manufactured from mild steel, zinc galvanized both inside and outside including threads. It shall be constructed in accordance with ANSI C80.1, Federal Specification WW-C-581; UL listed.
2. Non-metallic raceways,
 - a. Polyvinylchloride (PVC):
 - 1) PVC conduit shall be virgin C300 type, Schedule 40 or 80 (90° C) constructed in accordance with NEMA TC2 and Federal Specifications W-C-1094A.
 - b. Schedule 40 HDPE duct is acceptable for buried ducts but is not permitted indoors or for use with standard conduit fittings.
 - 1) Conduit shall be a nonmetallic flexible raceway manufactured from High Density Polyethylene (HDPE) for use in underground applications. It shall be a smooth-walled interior and exterior configuration with wall construction of SDR 13.5. (Note: Directional drilling installations shall utilize SDR 11) Each conduit shall have a one-half inch pre-lubricated, woven, 1130lb. minimum polyester tape made from low friction, high abrasion resistant yarns placed within the conduit and secured at each end. Tape shall be printed with sequential footage markings for accurate measurements. Each conduit shall be black with (3) unique colored stripes, to be specified in the part number to replace the "XX" or as specified on the drawings. (i.e. 3D=3 buff stripes, 3E=3 gray stripes, 3F=3 green strips, 3G=3 lilac stripes)
 - a) Standard of quality shall be Carlon 4" smooth-walled HDPE conduit, part #A16C9N7AXXC

C. Pull rope:

1. Jacketed, unidirectional aramid fiber, custom woven flat pull rope.
2. Required within each conduit, innerduct or cell.
3. Manufactured using a process that encapsulates the aramid fiber and bonds an exterior waterproof tape to the aramid fibers.

D. Cable lubricant:

1. Use a non-hardening, non-toxic, non-corrosive, non-sensitizing, lubricating compound during installation of cabling to reduce friction. Do not use liquid detergent.

E. Underground Warning Tape (UWT)

- a. Material: Linear low density polyethylene.
- b. Width: 6 inches (150 mm).
- c. Thickness: 100 microns manufactured to ENATS 12-23 specification.
- d. Lead free pigments with virgin grade film.
- e. Soil tolerance: pH 2.5 to pH 11.0 inclusive.
- f. Dual lines of continuous text.
 - 1) Line 1 Text: "Caution" repeated infinitum

- 2) Line 2 Text: Custom labeled to identify what is below (e.g., "Telephone Conduit Below" or "Cable TV Cable Below").
- g. Tape Color: Use tape with major color in accordance with the American Public Works Association Uniform Utility Color Code.

- F. Duct Plugs:
1. Removable.
 2. Forms a watertight seal.

2.3 SOURCE QUALITY CONTROL

- A. System components shall be tested and listed by one of more United States NRTL.

PART 3 - EXECUTION

3.1 GENERAL

- A. Secure applicable permits for work specified in this Section.
- B. Refer to the Drawings for types and quantities of pathways and backbone cabling requirements. Review and coordinate pathways prior to installation.
1. Coordinate to identify quantities and sizes of backbone cables that the pathway system is required to support.
 2. Coordinate to resolve deviations, defects or other problems with pathways prior to installation. Allow adequate time for corrections so as to avoid delays to the Project completion date.
 3. Provide additional or supplemental TIA/EIA-569-C, or most current version, compliant pathways and cable support where required. Provide additional sleeves through walls/floors/ceilings, as necessary to route cables within buildings.
 4. Locate, identify, and avoid existing utilities utilizing the marking service required by State Law and information from the Owner where new facilities or excavation is required.
 5. Coordinate installation of pathway products with work of other trades and other Divisions.
 - a. Provide necessary traffic control (vehicular and pedestrian), hazard protection, construction site barriers, signage, supports, fencing, and any other customary provisions.
 6. Coordinate with the Owner and utility company(s) prior to beginning the Work.
 - a. Locate, identify, and avoid existing utilities (public and private), including but not limited to electric, water, sewer, gas, and telecommunications.
 - b. Repair damage occurring to existing underground utilities as a result of the Project.
- C. Installation practices followed shall use the latest available machinery, equipment, and tools. Installation techniques used on the Project shall result in the ease of maintenance and ready access to components.
- D. Right of Way

1. Right-of-way will be secured by the Owner. Provide work specified within the requirements of the right-of-way agreement.

3.2 EXISTING UTILITIES

- A. Comply with the “call before you dig” damage prevention program (Utility Marking Service) prior to excavation.
- B. Locate, identify, and avoid existing utilities (public and private), including but not limited to electric, water, sewer, gas, and telecommunications.
- C. Identify underground utilities by marking on the ground with color coded paint in accordance with the most current version of the American Public Works Association Uniform Utility Color Code.
 1. Electric – red
 2. Gas/oil – yellow
 3. Communications/CATV – orange
 4. Water – blue
 5. Sewer – green
 6. Limits of exposed excavation – white
 7. Temporary survey marking – pink
- D. Where the actual location is uncertain, identify obstacles located along the proposed construction area by means of test holes.
- E. Create test holes either directly above or to the side of the assumed location of any obstacle. After obstacle is located, take exact measurements and create a profile drawing identifying the obstacle’s exact location.
- F. Repair damage occurring to existing underground utilities as a result of this Project.

3.3 INSTALLATION

- A. Provide conduit pathway system(s) as indicated on the Drawings.
 1. Provide hand holes, including the minimum requirements shown on the Drawings.
 - a. Hand holes shall meet applicable code requirements, including the most current version of the National Electrical Safety Code (NESC).
 - b. Provide pea gravel base to a minimum depth of 6 inches in the bottom of open-bottom hand holes.
 - c. Provide rebar reinforced concrete apron, at least 12 inches deep, around each hand hole installed in a sidewalk, paved area and roadway (paved or unpaved).
 - 1) The Concrete apron shall be compliant with the Contract Documents, including applicable and/or referenced Standards.
 - 2) A fiber expansion joint shall be placed between the apron and the box and between the apron and the surfacing material outside.
 - d. Field verify lid/cover construction requirements.
 - 1) Provide a suitable rated cover as specified.
 - 2) Covers located in Roadways shall have a AASHTO H-20 rating.

- e. Covers shall be labeled as indicated.
- f. Bolt the cover to the enclosure.
- 2. Provide conduit pathways between Hand Holes and any other points shown on the Drawings.
 - a. Quantities and trade sizes of pathways shall be as indicated on the Drawings.
 - 1) Unless otherwise noted, underground conduits shall be 4-inch, Schedule 40 PVC.
 - 2) Conduits shall be installed at a nominal depth of 30 inches (\pm 6 inches) below grade and as indicated in the Contract Documents.
 - 3) Where minimum depth is unattainable, cover duct system with concrete.
 - b. Provide galvanized steel casings around conduits installed under public roadways, including paved street or highways, railroads, river or stream crossing to extend at least 5 feet beyond each side, or 2 feet beyond the right-of-way of a public roadway, whichever is farther.
 - 1) Exception: Private drives located on Owner's property shall not require casings where conduits are installed at a minimum depth of 6 feet below the drive or encased in concrete to eliminate Live Load impact. Ducts under roadways shall be directionally bored.
 - 2) After installation of underground duct system, fill casing with fine sand (blown in under pressure) and seal both ends with a 3-inch concrete wall.
 - c. No single continuous conduit run shall exceed 300 feet between pull points.
 - 1) Provide additional maintenance holes, hand holes, or vaults as required to comply with this requirement.
 - d. No more than a total of 180 degrees of bends shall be in any conduit segment between two maintenance holes, hand holes, or vaults. Avoid back-to-back 90-degree bends.
 - 1) Provide additional maintenance holes, hand holes, or vaults as required to comply with this requirement.
 - e. Where bends are required, manufactured bends shall be used whenever possible. Bends made manually shall not reduce the internal diameter of the conduit. Bends shall be sweeps with a minimum radius of six times the internal diameter for conduits up to 2 inch and ten times the internal diameter for conduits larger than 2 inch.
 - f. Multi-cell duct systems shall be installed to manufacturer's instructions, including 65-foot bend radius on turns.
 - g. Minimum bend radii shall be observed (for concrete encasement, compacted fill, or directionally bored). Inside radii of bends and sweeps shall not be less than 40 inches.
 - h. Changes in conduit depth shall be accomplished with smooth sweeps of no less than a 10-foot bend radius, or the change shall be considered a 45-degree bend.
 - i. Install underground duct system with a drain slope to allow drainage and to prevent the accumulation of water. Provide a drain slope of 0.125 inches per foot extending away from all building structures and between underground enclosures extending from mid-span towards each enclosure.
 - j. Hand-trench within 5 feet of each side and across existing underground services.

- 1) All trenches deeper than 5' shall have side walls shored, sheeted, braced or otherwise supported per OSHA requirements unless the side walls are cut to a slope of 12" horizontal for each 24" vertically.
- k. Clearances: Provide and maintain the following clearances from the system at times:
 - 1) 12 inches of well-tamped earth or 3 inches of concrete between system and any electric power of other conduit.
 - 2) 6 inches when crossing and 12 inches when parallel of well-tamped earth between system and any pipes (e.g., gas, water, oil).
 - 3) 50 inches below the top rail of any railroad crossing.
 - 4) 36 inches below the top rail of any street railway crossing.
- l. Seal conduit ends during construction to prevent intrusion of foreign debris. Provide duct plugs on duct ends at underground enclosures and building penetrations to prevent water and gas infiltration.
- m. Conduit ends shall be smooth and free from burrs and sharp edges.
- n. After complete installation of the system, and before the installation of any cabling, pull completely through each innerduct a spherical template having a diameter not less than 75-percent of the inside diameter of the innerduct to ensure absence of obstruction(s).
- o. Textile innerduct system shall be provided for Outdoor underground conduit system(s).
 - 1) Each textile innerduct unit shall consist of 3 cells (minimum), unless noted otherwise.
 - 2) Each cell shall accommodate cables up to 1-inch O.D.
 - 3) Construction shall allow maximum pull lengths of up to 4,000 feet (optimum 1,500 feet).
 - 4) The system shall include pull ropes in cells.
 - 5) Cell Quantities:
 - a) Each primary pathway utilizing a 4-inch conduit shall have three (3) 3-inch, 3 cell duct units (9 cells) (minimum).
 - b) Each primary pathway utilizing more than one 4-inch conduit shall have three 3 cell duct units (9 cells) in one conduit; the remaining conduits shall receive only a pull rope, unless noted otherwise.
 - 6) Anchor the ends of each innerduct in each hand-hole or box.
3. Entrance Facilities and Entrance Points
 - a. Cable entrance points for each building shall be as indicated on the Drawings.
 - b. Provide penetrations through the facility walls, and restore the wall to the same condition as prior to cutting. Wall and penetrations shall be water-tight and weather-tight.
 - c. Provide conduits and boxes as required to construct the entrance pathway as indicated on the Drawings.
 - 1) Conduit utilized on an exterior wall above grade shall be Galvanized Rigid Conduit (GRC), including sleeves extending into the building. The GRC conduit shall continue to the first below grade Hand Hole.
 - 2) Conduits shall slope upward at least 1% to the facility from the last pull box/vault.
 - 3) Conduit utilized to stub up from or below the slab of the building shall be Schedule 40 PVC.

- d. Provide transition point(s) between cable entrance points and the termination point of the cable(s), as required by Code and/or the Drawings.
 - 1) Transition points shall be secured in a 24-inch by 24-inch by 6-inch (minimum) screw-secured covered box. Provide provisions for padlocks.
 - 2) Provide telecommunications backboards at each interior entrance point where a transition box is required.
- e. Provide hardware to secure and protect the entrance pathway.
- f. Entrance Facilities allowing cable entrance to a ducted ceiling space may use open cable supports to support the cable (minimum 5-foot spacing between supports) to a termination point within 50 feet. Prior to installation, verify and comply with the AHJ and Code requirements.
 - 1) Exception: Indoor/Outdoor plenum rated loose tube fiber optic cable(s).
 - 2) If the termination point is in excess of 50 feet, a closed metallic conduit shall be continuous from the Entrance Point to the termination point, or an adequately sized splice point must be provided in a serviceable area to splice properly rated indoor cable(s) to the unlisted OSP cable(s).
- g. Entrance Points allowing cable entrance to a plenum (air return) ceiling space shall use closed metallic conduits to support the cable to a termination or splice point.
 - 1) Exception: Indoor/Outdoor plenum rated loose tube fiber optic cable.
 - 2) If it is impractical to provide a closed metallic conduit continuous from the Entrance Point to the termination point, an adequate splice point shall be installed in a serviceable area to splice properly rated indoor cable(s) to the unlisted OSP cable(s).
- h. Entrance Point(s) stubbing up into a Communications Room (e.g., Equipment Room (ER), Telecommunications Room (TR), and Entrance Facility (EF)) shall extend 4 to 6 inches above the finished floor, shall be approximately 3 inches from the nearest wall, and shall be bushed. Cap for protection during construction.
- i. Provide sleeves for building penetrations. Patch and firestop around the sleeve and provide the appropriate bushings on each end. Split bushings are not acceptable or permissible. Firestop the interior of the sleeve after cabling is installed.

B. Accessories:

- 1. Provide a No. 6 locate conductor inside a duct along each pathway; leave 10 feet coiled at each end.
 - a. Place outside the innerduct system in the primary pathway.
- 2. Provide a 1/4-inch nylon pull rope in each conduit segment with 5-foot minimum slack at each end; coil slack and anchor to enclosure side. Provide pull rope in all innerducts.
- 3. Provide warning tape above pathway runs.
 - a. Slice into ground below the surface over each pathway, and provide a 4-inch wide "Buried Cable Below" warning tape at a 6-inch depth along the underground pathway where the pathway is not covered by pavement or concrete. Provide one per pathway (not one per duct).
- 4. Provide plugs in duct(s) entering a building.

- a. Install plugs in conduits entering a building below grade or below the level of the next/last hand hole.
 - b. Install plugs in unused conduits opening into a ceiling cavity from a transition box. Plug conduits/sleeves with cables installed with a removable barrier.
- C. Documentation: Update site plan to indicate actual field conditions. Document labeling used and record on the site plan.

3.4 GROUNDING AND BONDING

- A. Ground electrical systems and equipment as required by code, utility, local ordinances, AHJ and requirements herein, including referenced Standards.

3.5 IDENTIFICATION

- A. Identify system components and cabling in compliance with TIA/EIA-606-B, or most current version.
- B. Label each cable, space, pathway, enclosure and termination.
- C. Below Grade Pathways:
 - 1. Below-Grade Conduit Markers:
 - a. Install underground warning tape 6 inches (152 mm) below grade directly above conduit ducts.
 - b. Install underground warning tape on top of the surface over which concrete is poured (e.g., driveways, sidewalks, slabs) and directly above ducts or buried conduits.
 - c. Select a tape featuring a warning message that most accurately describes the pathway usage below.

3.6 RESTORATION

- A. Restore affected areas to how they existed before construction.
 - 1. Where trenching has been performed, restoration shall include additional trench fill after settlement of original fill has completely subsided and reseeding as necessary for complete restoration.
 - 2. Where existing surface is removed, repair by backfilling with material equal in composition and density to the surrounding areas and replace removed surface such as asphalt pavement and concrete riprap with like material to equivalent condition.
- B. Provide erosion control, including bailed hay and sediment control fencing, as identified in the referenced Standards.

END OF SECTION 27 05 43

SECTION 27 05 50 - FIRESTOPPING FOR COMMUNICATIONS**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM).
 - 2. Product Datasheets.
 - 3. Material Safety Data Sheets (MSDS).
- B. Closeout Submittal:
 - 1. Product Datasheets.
 - 2. Material Safety Data Sheets (MSDS).
 - 3. Schedule of opening locations and sizes, penetrating items, and required listed design numbers to seal openings to maintain fire resistance ratings.
 - 4. Product certificates signed by firestop system manufacturer certifying material compliance with applicable code and specified performance characteristics.

1.2 REFERENCES

- A. Definitions:
 - 1. Firestop: A fire-rated material, device, or assembly of parts installed in a penetration of a fire-rated barrier.
 - 2. Firestop system: A specific construction consisting of the material(s) (firestop penetration seals) that fill the opening in the wall or floor assembly and any items that penetrate the wall or floor, such as cables, cable tray, conduit, ducts, pipes, and any termination devices, such as electrical outlet boxes, along with their means of support.
 - 3. Firestopping: The process of installing listed, fire-rated materials into penetrations in fire-rated barriers to reestablish the fire-resistance rating of the barrier.
 - 4. Intumescent firestop: A firestopping material that expands under the influence of heat.
- B. Reference Standards:
 - 1. ASTM E 84, "Surface Burning Characteristics of Building Materials."
 - 2. ASTM E 119, "Fire Tests of Building Construction and Materials."
 - 3. ASTM E 814, "Fire Tests of Penetration Firestop Systems."
 - 4. ANSI/UL 263, "Fire Tests of Building Construction and Materials."
 - 5. ANSI/UL 723, "Surface Burning Characteristics of Building Materials."
 - 6. ANSI/UL 1479, "Fire Tests of Through Penetration Firestops."
 - 7. Underwriters Laboratories Inc. (UL) – Fire Resistance Directory.
 - 8. National Fire Protection Association (NFPA) – NFPA 70: National Electrical Code.
 - 9. National Fire Protection Association (NFPA) – NFPA 101: Life Safety Code.
 - 10. TIA-569-B, Annex A, "Firestopping."

11. The most current published edition of the “Telecommunications Distribution Methods Manual (TDMM)” published by the Building Industry Consulting Services International (BICSI), “Firestopping.”

1.3 QUALITY ASSURANCE

- A. Where the local jurisdiction requires additional training, licensing, permits and certifications to perform firestopping, the entity and individuals performing the work shall comply with such requirements.

1.4 SYSTEM DESCRIPTION

- A. All penetrations through floors, ceilings, and walls shall be sleeved. All sleeves through floors and walls shall be firestopped.
 1. The firestopping system shall resist and limit the spread of fire, heat, smoke and gasses through otherwise unprotected openings in rated assemblies, including walls, partitions, floors, ceilings/roof and similar locations, restoring the integrity of the fire rated construction to its original fire rating, in accordance with applicable codes, standards, and as directed by the AHJ.
 2. All sleeves into spaces containing pressurized fire suppression systems shall be self-sealing sleeve assemblies.
- B. Firestopping shall be manufacturer installed in a re-usable sleeve assembly or may be removable/ re-usable material(s) inserted within and around a sleeve assembly to provide the required protection.
 1. Sleeves shall be mechanically fastened.
 2. Provide re-usable (re-enterable) firestopping system(s) and materials in backbone and horizontal cabling pathways to accommodate cabling changes.
- C. Firestopping requirements and locations are not specifically indicated on the Drawings. Review the architectural and other related Drawings to determine fire- and smoke-rated walls and floors, including minimum rating requirements. Provide firestopping Work associated with Division 27 and Division 28 (where applicable) per the requirements of the Contract Documents.
 1. At a minimum, firestopping shall equal or exceed the rating of the wall or floor and with a minimum UL classification for 1-hour fire and cold side temperature ratings.
 2. Firestopping systems shall be listed for the specific combination of fire-rated construction, type of penetrating item, annular space requirements, and fire rating, including the following criteria:
 - a. F-Rating: Where applicable, provide products that meet the intent of the F-rating classification for passage of flame per ANSI/UL 1479 or ASTM E814 for through penetrations. Rating shall be equal to or greater than the fire-resistance rating of the assembly in which the firestopping will be installed.
 - b. T-Rating: Where applicable, provide products that meet the intent of the T-rating classification for the transfer of temperature per ANSI/UL 1479 or ASTM E814 for through penetrations. In habitable areas where penetrating items are exposed to potential contact with materials on fire side(s) of rated assembly, T-rating must equal F-rating

- c. L-Rating: Provide products that meet the intent of the L-rating classification for the movement of smoke per ANSI/UL 1479 or ASTM E814 for through penetrations.
 - d. W-Rating: Where applicable, provide products that meet the intent of the W-rating classification for passage of water per ANSI/UL 1479 or ASTM E814 for through penetrations. Shall meet UL Water Leakage Test, W-Rating – Class 1 requirements for systems tested and listed in accordance with ANSI/UL 1479 or ASTM E814.
 - e. Wall Penetrations: Through penetration systems shall be symmetrical, with the same rating from both sides of the wall.
3. Firestopping shall be installed within the interior cavity of conduit sleeves, raceway, cable tray and other cable conveyances where the interior volume of the conveyance is open and exposed in one space while the opposite end of the conveyance is open and exposed within another.
 4. Firestopping shall be installed where preparations for, or installation of equipment (e.g., cabling, devices) cause the fire or smoke rating of a building component or assembly to be reduced as a result of some action taken.
 5. Fire-resistive joint sealants: Provide joint sealants with fire-resistance ratings as determined per ASTM E 119, but not less than that equaling or exceeding the fire-resistance rating of the construction in which the joint occurs.
 6. Firestopping products shall be compatible with each other, with the substrates forming openings, and with the items, if any, penetrating the firestopping, under the conditions represented by the Project, based on testing and field performance demonstrated by the firestopping products/system manufacturer.
 7. Firestopping system and products exposed to view, traffic, moisture, and physical contact shall not deteriorate when exposed to these conditions.
 8. Firestopping systems for floor penetrations with annular spaces exceeding 4 inches (100 mm) or more in width and exposed to possible loading and traffic shall be capable of supporting the floor loads involved by installing floor plates or by other means.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 MANUFACTURERS

- A. To maintain control and integrity of the firestopping applications, utilize a single manufacturer. Specific UL or approved listing agencies systems applicable to each type of firestop condition shall be supplied by a single manufacturer.
- B. Subject to compliance with requirements, provide products by one of the following:
 1. Specified Technologies, Inc. (STI).
 2. 3M Fire Protection Products (3M).

3. Hilti Corporation (Hilti).
4. Unique Fire Stop Products.
5. Nelson Firestop Products.
6. Unifrax Corporation.

2.3 MATERIALS

- A. Firestopping products shall be tested and Listed for specific fire resistance rated construction conditions and shall conform to construction assembly type, penetrating item type, annular space requirements, and fire rating involved for each separate instance.
- B. Component Types – Utilize as required to meet Project requirements
 1. Intumescent sealants: Single component intumescent latex formulations containing no water soluble intumescent ingredients.
 - a. Basis of Design shall be Specified Technologies Inc. (STI) SpecSeal Series SSS Intumescent Sealant and SpecSeal Series LCI Intumescent Sealant.
 2. Endothermic sealants: Single component latex formulations that upon cure do not re-emulsify during exposure to moisture.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series LC Endothermic Sealant.
 3. Firestop devices: Factory-assembled steel collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSC Firestop Collars and SpecSeal LCC Firestop Collars.
 4. Wall opening protective materials: Intumescent, non-curing pads or inserts for protection of device boxes to reduce horizontal separation to less than 24 inches (610 mm).
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSP Firestop Putty Pads or SpecSeal Series EP PowerShield Insert Pads.
 5. Firestop putty: Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSP Putty.
 6. Intumescent wrap strips: Single component intumescent elastomeric strips faced on both sides.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSW Wrap Strip.
 7. Firestop pillows: Re-enterable, non-curing, mineral fiber core encapsulated with an intumescent coating on all six sides contained in a flame retardant poly bag.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSB Pillows.
 8. Mortar: Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar:
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSM Firestop Mortar.
 9. Silicone sealants: Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces (pourable or non-sag) or vertical surface (non-sag).

- a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal SIL300 Silicone Firestop Sealant or SpecSeal SIL300 SL Self-Leveling Silicone Firestop Sealant.
 - 10. Composite sheet: Intumescent material sandwiched between a galvanized steel sheet and steel wire mesh protected with aluminum foil:
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal CS Composite Sheet.
 - 11. Firestop plugs: Re-enterable, foam rubber plug impregnated with intumescent material for use in blank openings and cable sleeves.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series FP Firestop Plug.
 - 12. Intumescent collar devices: Steel collar system with intumescent inserts.
 - a. Basis of Design: Specified Technologies Inc. (STI) SpecSeal Series SSC and LCC.
 - 13. Horizontal wall penetrations in Gypsum Board
 - a. Fire-rated cable grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing individual or small, multi-cable bundle penetrations.
 - 1) Basis of Design: Specified Technologies Inc. (STI) Ready Firestop Grommet.
 - 14. Ceiling and ceiling tile penetrations
 - a. Fire-rated cable grommet: Molded two-piece grommet made from plenum grade polymer with a foam inner core for sealing individual or small, multi-cable bundle penetrations.
 - 1) Basis of Design: Specified Technologies Inc. (STI) Ready Firestop Grommet.
- C. Firestop sleeve assembly kit:
 - 1. Sized to accommodate cable quantities indicated in the Contract Documents plus 20 -percent additional capacity for growth.
 - 2. Includes steel escutcheon plates and intumescent firestop gaskets sized to fit the specific outside diameter of the sleeve and sandwich the barrier to lock the sleeve in place.
 - 3. Includes sufficient thickness of intumescent firestop putty to seal the ends of the sleeve to restrict the passage of fire, smoke and superheated gases.
 - 4. Basis of Design shall be Specified Technologies Inc. (STI) SpecSeal READY SLEEVE and SpecSeal READY SPLIT SLEEVE (for existing cable penetrations).]
 - 5. Fire rated cable pathways: Gangable device modules comprised of steel raceway with intumescent foam pads allowing 0 to 100 percent cable fill and requiring no additional action in the form of plugs, twisting closure, putty, pillow, or sealant to achieve fire and leakage rating. Shall include cable radius control modules that snap onto the ends of devices.
 - a. Basis of Design: Specified Technologies Inc. (STI) EZ-PATH Fire Rated Pathway with EZRCM44S for Series 44+ radius control modules (RCM). Radius Control Modules are to be used for wall penetrations only.
- D. Accessories:
 - 1. Provide components for each firestopping system required to install fill materials and to comply with the system performance requirements. Use only components specified by the firestopping manufacturer and approved by the qualified testing and inspecting agency for the designated fire-resistance-rated systems.

Firestopping materials shall be asbestos-free and shall not contain flammable solvents. Accessories include but are not limited to the following:

- a. Permanent forming, damming, backing materials, including the following:
 - 1) Semi-refractory fiber (mineral wool) insulation.
 - 2) Ceramic fiber.
 - 3) Sealants used in combination with other forming/damming materials to prevent leakage of fill materials in liquid state.
 - 4) Fire-rated form-board.
 - 5) Joint fillers for joint sealants.
- b. Temporary forming materials.
- c. Substrate primers.
- d. Collars.
- e. Steel sleeves.
- f. Warning labels.

2.4 COMBUSTIBLES IN PLENUM SPACES

- A. Passive combustibles installed within plenum spaces that are not UL listed for installation within plenum spaces shall be encased within high-temperature plenum insulation, the purpose of which is to prevent flame propagation and smoke development in the plenum areas. Passive combustibles include such items as non-plenum cables, pipe, low-voltage connector housings.
 1. Plenum insulation shall be UL listed for the application.
 2. Basis of Design: UniFrax FyreWrap 0.5.

PART 3 - EXECUTION

3.1 GENERAL

- A. Consult and comply with the AHJ concerning local firestopping requirements.
 1. Where no NRTL tested firestop application exists, manufacturer's engineering judgment derived from similar listed system designs or other tests shall be submitted to the AHJ for review and approval prior to installation.
 2. It is the sole responsibility of the firestopping provider to install tested and approved systems that comply with applicable codes, standards and/or agencies and authorities having jurisdiction.
- B. Comply with TIA-569-B, Annex A, "Firestopping."
- C. Comply with the most current published edition of the "Telecommunications Distribution Methods Manual (TDMM)" published by the Building Industry Consulting Services International (BICSI), including the "Firestopping" article.
- D. Through-penetration firestop systems and construction gap fire resistive systems shall be supplied and installed with approved methods using materials that have been tested and classified to produce a listed and approved assembly.

- E. Provide products that upon curing do not re-emulsify, dissolve, leach, break down or otherwise deteriorate over time from exposure to atmospheric moisture, sweating pipes, ponding water or other forms of moisture characteristic during or after construction.
- F. Openings within floors and walls designed to accommodate cabling shall be provided with re-enterable products that do not cure or dry.
- G. Damaged or expired materials shall be removed from the site and shall not be used in the Work.
- H. Do not use materials that contain flammable solvents.
- I. Sleeves shall be mechanically fastened to the wall, floor, ceiling or roof assembly.

3.2 DELIVERY, STORAGE AND HANDLING

- A. Deliver firestopping products to the Project site in original, unopened containers or packages with intact and legible manufacturer labels identifying product and manufacturer, date of manufacture, lot number, shelf life, if applicable, qualified testing and inspecting agency's classification marking applicable to Project, curing time, and mixing instructions for multi-component materials.
 - 1. Coordinate the delivery date of firestopping materials with the scheduled date of installation to minimize the amount of storage time required at the Project site.
 - 2. Store with a copy of the manufacturer MSDS sheet. Submit a copy of each sheet to the Owner's project manager upon delivery to the site.
- B. Store and handle firestopping materials to prevent deterioration or damage due to moisture, temperature changes, contaminants or other causes. Handle, store and protect products and materials according to the manufacturer's printed recommendations and guidelines.
- C. Do not deliver or install product(s) in conditions that jeopardize the performance of the product.

3.3 INSTALLATION

- A. Install firestopping products in compliance with manufacturer's printed instructions, recommendations and technical information.
- B. Coordinate construction of openings and penetrating items to ensure that through-penetration firestop systems are installed according to manufacturer's requirements. Coordinate sizing of sleeves, openings, core drilled holes or cut openings to accommodate through-penetration firestop systems.
- C. Environmental conditions:
 - 1. Install firestopping products when ambient or substrate temperatures are within the requirements recommended by the firestopping manufacturer. Do not install firestopping when ambient or substrate temperatures are outside the limits

- permitted by the manufacturer or when substrates are wet due to rain, frost, condensation or other causes.
2. Maintain temperatures and environmental conditions within limits recommended or required by manufacturer's printed instructions or technical information for any required periods of time before, during and after installation of materials.
- D. Ventilation: Provide ventilation as required by firestopping manufacturer, including mechanical ventilation if required.
- E. Examine substrates and conditions for compliance with requirements for opening configurations, penetrating items, substrates, and other conditions affecting performance of firestopping. Do not proceed with installation until unsatisfactory conditions have been corrected.
- F. Surfaces shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellants and any other substances that may inhibit optimum adhesion.
- G. Clean openings and joints immediately before installation of firestopping to comply with firestopping manufacturer's printed guidelines and recommendations and the following requirements:
1. Remove foreign materials from surfaces of opening and joint substrates and from penetrating items that could interfere with adhesion of firestopping.
 2. Clean opening and joint substrates and penetrating items to produce clean, sound surfaces capable of developing optimum bond with firestopping. Remove loose particles remaining from cleaning operation.
 3. Remove laitance and form-release agents from concrete.
- H. Provide masking and temporary covering to protect adjacent surfaces and prevent contact with the following:
1. Adjoining surfaces that will remain exposed upon completion of the Work.
 2. Surfaces that would otherwise be permanently stained or damaged by such contact or cleaning methods used to remove smears from firestopping materials.
 3. Remove masking and temporary covering as soon as possible to do so without disturbing firestopping seal with substrates.
- I. Install fire stop materials, including forming, packing, and other accessory materials, to fill openings around services penetrating floors, walls, ceilings and roofs, to provide fire-resistance ratings indicated for the assembly in which the penetration occurs. Comply with installation requirements established by the manufacturer and testing and inspecting agency.
- J. Install forming/damming materials and other accessories of types required to support fill materials during application and in the position needed to produce the cross-sectional shapes and depths required to achieve fire ratings of designated firestop systems. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop systems.
- K. Install fill materials for through-penetration firestop systems by proven techniques to produce the following results:
1. Fill voids and cavities formed by openings, forming materials, accessories, and penetrating items.

2. Apply materials so they contact and adhere to substrates formed by openings and penetrating items.
- L. Seal between sleeves and pipes and other through-penetration pathway devices with firestop material. Material shall meet applicable fire ratings required.
- M. Firestop systems shall not hamper the performance of fire dampers in ductwork or other safety systems.
- N. Tool non-sag sealants immediately after sealant application and before skinning or curing begins. Form smooth, uniform beads of configuration required to produce fire-resistance rating, as well as to eliminate air pockets, and to ensure contact and adhesion of sealants with sides of joint. Remove excess sealant from surfaces adjacent to the joint. Do not use tooling agents that discolor sealants or adjacent surfaces or that are not approved by the sealant manufacturer.
- O. Firestopping for discrete cable pathways (J-hooks):
 1. Discrete cable pathways shall terminate at each barrier and resume on the opposite side such that cables pass independently through fire-rated pathway devices.
- P. Firestopping for cable trays:
 1. Cable trays shall terminate at each barrier and resume on the opposite side such that cables pass independently through fire-rated pathway devices. Cable tray shall be rigidly supported independent from fire-rated pathway devices on each side of barrier.
 - a. Openings for cable trays shall be sealed using re-enterable firestopping pillows.

3.4 FIELD QUALITY CONTROL

- A. Components used in firestop systems shall be the same as the products used in fire qualification tests, must be prepared and installed using established quality control procedures, and verified periodically by an independent quality auditor at the manufacturer's facility. The final field installation shall be reviewed and validated by the AHJ.
- B. Do not enclose firestopping with other construction until examinations are completed. Area of Work shall be accessible until inspections are completed by the AHJ.
- C. Where deficiencies are found, repair or replace firestopping at no additional expense to the Owner so that Work complies with requirements.

3.5 CLEANING

- A. Clean all surfaces adjacent to sealed openings to be free of excess firestopping materials and soiling as work progresses.

- B. Remove excess fill materials and sealants adjacent to openings and joints as Work progresses. Use methods and cleaning materials approved by manufacturers of firestopping products and products in which openings and joints occur. Return surfaces to the original condition.
- C. During and after the curing period, protect firestopping from contact with contaminating substances and from damage resulting from construction operations or other causes so that they are without deterioration or damage at time of Substantial Completion.
 - 1. If damage or deterioration occurs, remove damaged or deteriorated firestopping immediately, and install new materials to produce firestopping complying with specified requirements.

3.6 IDENTIFICATION

- A. Label firestopping locations. Install a label on each side of the wall indicating the following information:
 - 1. Firestop manufacturer.
 - 2. Name of product and UL system number/designation.
 - 3. Name of installation contractor.
 - 4. Date of installation.
 - 5. Rating of the wall/system.

END OF SECTION 27 05 50

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 SUBMITTALS

- A. Product datasheets.
- B. Labeling schemas.
- C. [Shop Drawings
 - 1. Communications Plan Key Drawings:
 - a. Two complete set of full-size drawings representing the Key Plan Drawings that will be posted within the Communications Rooms.]

1.2 SUMMARY

- A. Section Includes:
 - 1. Labeling of cabling and termination devices.
 - 2. Labeling of equipment.
 - 3. Labeling of Communications Rooms.
- B. Requirements of this Section apply to all Work of this Division and Work Division 28 (where applicable).

1.3 REFERENCE STANDARDS

- A. Definitions:
 - 1. Component Identifier / Component ID: See Device ID
 - 2. Device.ID: The unique identifier given to a specific instance of a product, module and assembly. Identifiers are unique within the context of the system and product in which it is used.

1.4 SYSTEM DESCRIPTION

- A. The identification system shall be a coordinated system of permanently affixed labels of specified types that are used to uniquely identify each instance of a product and the space in which it is located. The following items shall be identified:
 - 1. Cables.
 - a. All cables shall have cable ID on the jacket at each end 4-6 inches from termination.
 - 2. Telecommunications cabling cross-connect Blocks, including 66-blocks and 110-blocks.
 - 3. Patch Panels.
 - 4. Faceplates.
 - 5. Individual connection jacks, receptacles and terminals.

- 6. Remote Equipment enclosures/cabinets not within telecommunications rooms.
 - 7. Equipment racks and cabinets within telecommunications rooms.
 - 8. Telecommunications Backboards.
 - 9. Rooms containing communications or security products.
 - 10. Device boxes, junction boxes, pull boxes, floor boxes, wall boxes, ceiling boxes and other forms of boxes used for passage, splicing, or termination of cables.
 - 11. Equipment power cord plugs.
- B. The labeling schema used for horizontal and backbone structured cabling systems shall be TIA/EIA-606-A, or most current version, compliant.
- C. Label Type Schedule

LABEL TYPE SCHEDULE		
APPLICATION	TYPE	NOTES
EQUIPMENT RACK - FRONT	DB	
EQUIPMENT RACK - REAR	DB	
PATCH PANELS – BACKBONE CABLES	CB	
PATCH PANELS – HORIZONTAL CABLES	CB	
FACEPLATES – HORIZONTAL	CB	CLEAR BACK
FACEPLATES - CUSTOM	DE	ENGRAVED; SCREENED
FACEPLATES – MULTISERVICE	CB	CLEAR BACK; ENGRAVED
OUTLETS – HORIZONTAL	CB	
OUTLETS – CUSTOM FACEPLATE	DB	
CABLES - HORIZONTAL	CA	
CABLES - BACKBONE	CA	
AV CABLES	CA	
COMMUNICATIONS BACKBOARDS	DC	
CONNECTING BLOCKS	PI	WITH PLASTIC COVER
FIBER OPTIC PANEL	PI	
ABBREVIATED DEFINITIONS CA=SELF LAMINATING WRAP-AROUND), CB=SELF LAMINATING DA = LAMACOID, DB=TAPE TYPE, DC=IMPRINTED/ETCHED; DE=ENGRAVED PI=PRINTED INTEGRAL LABEL; RA=LAMACOID SEE SECTION 270553 FOR SPECIFICATIONS OF VARIOUS LABEL TYPES		

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 MANUFACTURERS

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Brady
 - 2. Brother
 - 3. Casio
 - 4. Hubbell
 - 5. Panduit
 - 6. Hellerman/Tyton
 - 7. Thomas and Betts

2.3 PERFORMANCE

- A. Labels shall be designed to remain permanently affixed under typical environmental conditions for the life of the product identified.
- B. Nomenclature shall be permanent and non-fading under typical environmental conditions.
- C. Adhesive labels shall remain attached to the affixed product in continuous conditions of 90% relative humidity and temperatures of 100-degrees Fahrenheit (38-degrees Celsius).

2.4 CABLE INFRASTRUCTURE LABELS

- A. Type CA:
 - 1. Self-laminating type.
 - 2. Adhesive backed.
 - 3. Opaque solid-color background area, color for nomenclature: White.
 - 4. Clear self-laminating wrap-around cover for protection of nomenclature.
 - 5. Available in a variety of heights and widths to suit the cable being labeled.
 - 6. Printing area of the label available in a wide variety of sizes to accommodate the specific nomenclature to be applied.
 - 7. Overall label width: Minimum 1 inch (25 mm); Maximum 2 inches (50 mm).
 - 8. Opaque printing area length: Minimum 1/2 inch (12 mm); Maximum 1-1/4 times the cable circumference.
 - 9. Self-laminating wrap length: 1-1/2 to 2-1/2 times the cable circumference.

10. Bold computer-generated and commercial printer applied high-contrast project and system specific nomenclature.
- B. Type CB – Tape Type:
1. Self-laminating type.
 2. Adhesive backed.
 3. Opaque solid-color background area, color for nomenclature: White.
 4. Available in a variety of heights and widths to suit the termination being labeled.
 5. Printing area of the label available in a wide variety of sizes to accommodate the specific nomenclature to be applied.
 6. Overall label width: Minimum 1 inch (25 mm); Maximum 2 inches (50 mm).
 7. Opaque printing area length: Minimum 1/2 inch (12 mm); Maximum 1-1/4 times the cable circumference.
 8. Bold computer-generated and commercial printer applied high-contrast project and system specific nomenclature.
- C. Type PI – Tape Type:
1. Integral card type.
 2. Opaque solid-color background area, color for nomenclature: White.
 3. Heights and widths to suit the termination being labeled.
 4. Printing area of the label to accommodate the specific nomenclature to be applied.
 5. Bold computer-generated and commercial printer applied high-contrast project and system specific nomenclature.
 6. Provide with clear plastic covers to protect label.

2.5 DEVICE LABELS

- A. Type DB – Tape Type:
1. Tape-type construction.
 2. Material: Polyester.
 3. Working temperature range: -40 to 248 degrees Fahrenheit (-40 to 120 degrees Celsius)
 4. Opaque solid-color background over which nomenclature is applied.
 5. Self-adhesive backing for adhesion to labeled item.
 6. Designed for thermal-transfer based machine imprinting of nomenclature.
 7. Available in a wide-variety of manufacturer sizes.
 8. Available with a wide-variety of background colors.
 9. Available with a variety of different nomenclature colors.

2.6 CABLE LABEL HEATSHRINK

- A. Should any condition arise in which cable labels are used that are neither self-laminating nor permanent, then properly sized clear heat-shrink shall be applied over the label to make it permanent.

PART 3 - EXECUTION**3.1 INSTALLATION****A. General:**

1. Label each instance of each product.
2. Label each connector of each product.
3. Install labels so that they are legible after installation.
4. Install labels so they are parallel to the dominant visual lines of the product identified.
5. Install labels of the appropriate size for the application.
6. Maintain consistency in label sizes that are used for labeling similar applications.
7. Install secondary labels on the rear of products that are mounted within racks, within equipment enclosures/cabinets, within furniture or casework, and in any application where the rear of the product is accessed for termination, installation, service, operation or adjustment.
8. Coordinate "final" room numbers or identifiers with the Owner prior to performing work; all labeling shall perform to operational room identifiers. If actual room numbers differ from architectural room numbers both shall be included on the as-built floorplans.
9. Campus environments with multiple buildings shall add a building identifier to the labeling in each building.

B. Cables:

1. General:
 - a. Uniquely identify each cable so that no two cables serving a single system utilize the same identifier.
 - b. Cables that terminate within different architectural spaces shall include both the source and destination space identifiers on the label in addition to a unique cable identifier
 - c. Install a primary label near the end of cable.
 - d. Install a secondary label (with identical nomenclature as the primary label) near the ends of the cable at such point that the label is viewable and readable when the cable is in its final dressed position.
 - e. Utilize specified labeling schemas. Substitute schema may be considered if submitted to, reviewed and returned by the Designer without exceptions.
2. Horizontal Cables:
 - a. Label in accordance with TIA/EIA-606-A, or most current version.
 - b. Horizontal labeling schema:
 - 1) "Communication Room Identifier"–"Outlet Room Number"–"Rack, Patch Panel and Patch Panel Port Number."
3. Backbone Cables:
 - a. Label in accordance with TIA/EIA-606-A, or most current version.
 - b. In addition to labels at each end, apply a label at each junction/pull point to identify the cable.
 - c. Cabling labeling schema:
 - 1) Service designation and number: CB = Copper Backbone, FB = Fiber Backbone, VB = Video Backbone (e.g., CB.01, FB.01, FB.02, VB.01)
 - 2) Interconnected Communication Room designations (e.g., ER01–TR04)

- 3) Composite Examples:
 - a) Example: CB.01–ER01–TR02.
 - b) Example: CB.01–ER01–TR03.
 - d.
 4. Patch Cables:
 - a. Label with the same unique identifier at each end.
 5. Multi-Cable Assemblies and Tethers:
 - a. Label the overall assembly, sleeve, or jacket (as applicable) at both ends.
 - b. Label each individual cable member at both ends.
 - c. If the cable assembly features connectors on the end of any cable member, affix labels also on the connector. Use user-friendly nomenclature that identifies the use of the connector and the port to which it mates.
 - d. See illustrations at the end of this Section.
- C. Faceplates and Outlets:
1. Faceplates – General:
 - a. Label each faceplate with a Device.ID label.
 - 1) Exception: Faceplates used exclusively for Horizontal cables do not need to feature a Device.ID label.
 - 2) Exception: Blank faceplates are not required to have a Device.ID label, except where noted.
 - b. Use labels with a clear background or a background color that matches the plate. On custom fabricated faceplates, label shall be integral to the plate by means of engraving or screening or other approved means.
 - c. See illustrations at the end of this Section.
 2. Faceplates – with Horizontal Cables:
 - a. Label modular outlet frame(s) with a label identifying origination and destination rooms of the horizontal cable(s) present at the faceplate. When non-modular faceplates are used, affix the label to the plate.
 3. Outlets/Connectors – General:
 - a. Label each outlet.
 4. Outlets/Connectors – Horizontal Cables:
 - a. Identify the specific patch panel and port to which the opposite end of the cable is connected.
 5. Use .35” tape with 9 pt Arial font.
- D. Cross-Connect Blocks:
1. 110-Style:
 - a. Label the front of the block directly above or below (as indicated by the manufacturer) each position in the block.
 - b. Label connections in numerical order and corresponding to the faceplate outlet schema (horizontal cabling) or the opposite end labeling schema (backbone cabling), dependent upon use.
 - c. Label the upper left corner of each block designating the service of that particular block.
 2. 66-Style:
 - a. Label the front of the block directly above or below (as indicated by the manufacturer) each position in the block.
 - b. Label connections in numerical order and corresponding to the faceplate outlet schema (horizontal cabling) or the opposite end labeling schema (backbone cabling), dependent upon use.

- c. Label the upper left corner of each block designating the service of that particular block.
- E. Patch Panel:
- 1. Chassis – General:
 - a. Label each panel chassis with a Device.ID.
 - b. Affix chassis labels aligned with the left or right edge of the product. Locate consistently across chassis in the rack and throughout the project.
 - 2. Chassis – for Horizontal Cabling:
 - a. In lieu of or in addition to the Device.ID uniquely label the chassis for each panel within each Communication Room in accordance with the following schema:
 - 1) “Letter” or “Letter Letter” where letters A-Z or dual letter assemblies AA-ZZ are valid.
 - 3. Individual Connectors – for Horizontal Cabling:
 - a. Label each connector on each panel in order from Left to Right and Top to Bottom 1 to “X,” where “X” is the number of connector spaces on the panel.
 - b. In addition, the connector label nomenclature shall clearly identify the room number in which the opposite end of the cable is terminated.
 - 4. Individual Connectors – Others:
 - a. Label each connector.
 - b. Use color-coded nomenclature acceptable to the Designer.
- F. Patch Bays (e.g., Audio, Video):
- 1. Label each patch bay with a Device.ID.
 - 2. Label each connector on the patch bay.
 - 3. Use color-coded nomenclature acceptable to the Designer.
 - 4. Where the patch bay features an integral labeling strip, label the connectors using the strip following the techniques recommended by the manufacturer.
 - 5. Where the Drawings depict additional means of labeling, provide additional labels with designer reviewed nomenclature.
- G. Equipment Racks:
- 1. Label each equipment rack with a unique identifier.
 - 2. Accurately record the nomenclature on the project as-built documentation.
 - 3. Affix a primary label to the front of the rack.
 - 4. Affix a secondary label to the rear of the rack.
 - 5. Locate labels on the upper-most part of the rack, typically the frame, in an area that is clearly visible if doors are installed and closed.
 - 6. Label each equipment rack to match the designation indicated on the floor plans
 - 7. Labels shall be black text on white background.
- H. Equipment Cabinets/Enclosures (e.g., NEMA Enclosures):
- 1. Label each equipment cabinet/enclosure with a unique identifier.
 - 2. Accurately record the nomenclature on the project as-built documentation.
 - 3. Affix a primary label on the dominant front-most outer surface.
 - 4. Affix a secondary label on the dominant interior surface if the product is equipped with a removable cover or door.
 - 5. Use Lamacoid label for the primary label.
 - 6. Use Tape-type labels for the secondary label.

3.2 LABEL PROTECTION

- A. Cable Labels: If at any time during the course of the project a condition arises for which cable labels are used that are neither self-laminating nor permanent, then such labels shall be protected with properly sized clear heat-shrink to protect the label and to make it permanent.

3.3 RECORD DRAWINGS

- A. Accurately record the labels used for identifying items within the project as-built documentation.

END OF SECTION 27 05 53

SECTION 27 08 10 - VERIFICATION TESTING OF STRUCTURED CABLING**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM):
 - a. Make, Model, Serial Number.
 - b. Description of the test instrument.
 - c. Tests for which the instrument will be used.
 - 2. Product Datasheets: For each test instrument to be used.
 - 3. Product Calibration Certificate for each test instrument: Certificate shall document the date of calibration and the name of the calibration organization.

- B. Closeout Submittal:
 - 1. UTP Cable Test Result Documentation:
 - a. Make, model, serial number and date of last calibration of each piece of test equipment used.
 - b. Summary Test Reports: Paper copy of the summary test results shall be provided that lists the links that have been tested with the summary information as set forth in Part 3.
 - c. Detailed Test Reports: Detailed test results data to be provided in the electronic database for each tested link must contain the information as set forth in Part 3.
 - 1) The database for the completed job as stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports.
 - 2. Fiber Optic Test Result Documentation:
 - a. Make, model, serial number and date of last calibration of each piece of test equipment used.
 - b. Summary Test Reports: Paper copy of the summary test results shall be provided that lists the links that have been tested with the test summary information as set forth in Part 3.
 - 1) Fiber tests from the same cable between the same 2 points shall not vary over .25db from each other.
 - c. Detailed Test Reports: Detailed test results data to be provided in the electronic database for each tested fiber link must contain the information as set forth in Part 3.
 - 1) The database for the completed job as stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports.
 - 3. Coaxial Cabling Test Result Documentation:
 - a. Make, model, serial number and date of last calibration of each piece of test equipment used.
 - b. Summary Test Reports: Paper copy of the summary test results shall be provided that list links that have been tested with the summary information as set forth in Part 3.

- c. Detailed Test Reports: Detailed test results data to be provided in the electronic database for each tested link must contain the information as set forth in Part 3.
 - 1) The database for the completed job as stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports.

1.2 REFERENCES

A. Definitions:

1. IDC: Insulation displacement connector.
2. Margin: Designates the difference between the measured value and the corresponding test limit value. For passing links, 'worst case margin' identifies the smallest margin over the entire frequency range; the point at which the measured performance is "closest" to the test limit.
3. NVP: Nominal Velocity of Propagation expresses the speed of the electrical signals along the cabling link in relation to the speed of light in a vacuum. Insulation characteristics and twist rate of the wire pair influence NVP in minor ways. Typically, an 'average' value for NVP is published for four wire-pairs in a cable.
4. OLTS: Optical loss test set.
5. OTDR: Optical time domain reflectometer.

B. Reference Standards:

1. ANSI/TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises.
2. ANSI/TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard.
3. ANSI/TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard.
4. ANSI/TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
5. ANSI Z136.2, ANS For Safe Use Of Optical Fiber Communication Systems Utilizing Laser Diode And LED Sources.
6. ANSI/EIA/TIA-455-50B, Light Launch Conditions For Long-Length Graded-Index Optical Fiber Spectral Attenuation Measurements.
7. ANSI/TIA/EIA-455-59A, Measurement of Fiber Point Discontinuities Using an OTDR.
8. ANSI/TIA/EIA-455-60A, Measurement of Fiber or Cable Length Using an OTDR.
9. ANSI/TIA/EIA-455-61A, Measurement of Fiber or Cable Attenuation Using an OTDR.
10. ANSI/TIA/EIA-526-7, Optical Power Loss Measurements of Installed Singlemode Fiber Cable Plant.
11. ANSI/TIA/EIA-526-14-A, Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
12. TIA/EIA TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems.
13. The most current published edition of the "TELECOMMUNICATIONS DISTRIBUTION METHODS MANUAL" published by the Building Industry Consulting Services International (BICSI).

1.3 COORDINATION

- A. The Owner or the Owner's representative shall be invited to witness and review field testing and procedures. The representative shall be notified of the start date of the testing phase a minimum of five (5) business days before testing commences.

1.4 QUALITY ASSURANCE

- A. Testing shall be supervised by an individual certified by BICSI as an RCDD.
- B. Individuals performing tests shall have attended and have successfully completed an appropriate training program and have obtained a certificate as proof thereof. Appropriate training programs include but are not limited to installation certification programs furnished by BICSI or the ACP (Association of Cabling Professionals).
- C. Test equipment shall perform in accordance with the manufacturer's published specifications and shall have been calibrated by either the manufacturer or a recognized independent test equipment calibration organization within the 365 day period prior to its use.

1.5 SYSTEM DESCRIPTION

- A. Outlets, cables, patch panels and associated components shall be fully assembled and labeled prior to field-testing. Any testing performed on incomplete systems shall be redone on completion of the work.
- B. Perform testing on each cabling link (connector to connector), including copper twisted pair, fiber optic (multi-mode and single-mode) and coaxial cabling.
 - 1. Fiber optic Intra-Building Links shall be tested as Tier 1.
 - 2. Fiber optic Inter-Building Links shall be tested as Tier 2.
 - 3. All fiber optic links including more than one segment shall be tested as Tier 2 whether involving fusion splicing or mechanical connection.
- C. Testing shall not include any active devices or passive devices within the link other than cable, connectors, and splices.
 - 1. Link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
- D. In addition to the tests identified in this document, contractor shall notify the Owner or Owner's representative of any additional tests that are deemed necessary to guarantee a fully functional system. These tests shall be implemented with additional measurement results recorded at no additional costs.

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT REQUIREMENTS

- A. Subject to compliance with requirements, available test equipment manufacturers that may be used for testing include, but are not limited to the following:
1. Fluke Corporation.
 2. Ideal
 3. Softing
 4. Viavi
- B. UTP Cable Test Equipment:
1. Category 5e, 6 and 6A (Augmented Category 6) Compliance: Coordinate with the Drawings and related Sections for project requirements.
 - a. The test equipment (tester) shall comply with the accuracy requirements for field testers as defined in ANSI/TIA-1152. The tester, including the appropriate interface adapter, must meet the specified accuracy requirements. The accuracy requirements for the permanent link test configuration (baseline accuracy plus adapter contribution) are specified in Table 2 of ANSI/TIA-1152.
 - 1) Level IIe – Category 5e (100MHz)
 - 2) Level III – Category 6 (250 MHz)
 - 3) Level IV – Category 6A (500MHz)
 - b. The test plug shall fall within the values specified in ANSI/TIA-568-C Annex C for NEXT, FEXT and Return Loss.
 - c. The tester shall be within the calibration period recommended by the vendor in order to achieve the vendor-specified measurement accuracy.
 - d. The tester interface adapters must be of high quality and the cable shall not show any twisting or kinking resulting from coiling and storing of the tester interface adapters. In order to deliver optimum accuracy, preference is given to a permanent link interface adapter for the tester that can be calibrated to extend the reference plane of the Return Loss measurement to the permanent link interface. The contractor shall provide proof that the interface has been calibrated within the period recommended by the vendor. To ensure that normal handling on the job does not cause measurable Return Loss change, the adapter cord cable shall not be of twisted-pair construction.
 - e. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests (detailed in Section 4.2.2 of ANSI/TIA-1152). Any Fail or Fail* result yields a Fail for the link-under-test. In order to achieve an overall Pass condition, the results for each individual test parameter must Pass or Pass*.
 - f. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter. The test result of a parameter shall be marked with an asterisk (*) when the result is closer to the test limit than the accuracy of the field tester. The field tester manufacturer must provide documentation as an aid to interpret results marked with asterisks.
 2. Measurement Capabilities
 - a. Wire Map
 - b. Length

- c. Propagation Delay
- d. Delay Skew
- e. DC Loop Resistance
- f. DC Resistance Unbalance within a pair
- g. DC Resistance Unbalance between pairs
- h. Insertion Loss
- i. NEXT (Near-End Crosstalk)
- j. PS NEXT (Power Sum Near-End Crosstalk)
- k. ACR-N (Attenuation to Crosstalk Ratio Near-End)
- l. PS ACR-N (Power Sum Attenuation to Crosstalk Ratio Near-End)
- m. ACR-F (Attenuation to Crosstalk Ratio Far-End)
- n. PS ACR-F (Power Sum Attenuation to Crosstalk Ratio Far-End)
- o. Return Loss
- p. TCL (Transverse Conversion Loss)
- q. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
- r. Time Domain Reflectometer
- s. Time Domain Xtalk Analyzer
- t. PS ANEXT (Power Sum Alien Near-End Crosstalk)
- u. Average PS ANEXT (Average Power Sum Alien Near-End Crosstalk)
- v. PS AACR-F (Power Sum Alien Attenuation to Crosstalk Ratio Far-End)
- w. Average PS AACR-F (Average Power Sum Alien Attenuation to Crosstalk Ratio Far-End)

C. Fiber Optic Cable Test Equipment:

1. The test equipment shall be within the calibration period recommended by the manufacturer.
2. Fiber optic test jumpers and adapters shall be of high quality and shall not show excessive wear.
3. Optical Loss Test Set (OLTS):
 - a. An OLTS is comprised of two components: an optical light source and an optical power meter. After making a reference measurement, the source and meter are located at opposite ends of the fiber under test. A source and meter may be contained within the same package to enable bi-directional testing without swapping end test equipment.
 - b. Multimode optical fiber light source:
 - 1) Dual LED light sources with central wavelengths of 850nm (± 30 nm) and 1300nm (± 20 nm).
 - 2) Output power of -20dB minimum.
 - 3) The light source shall meet the launch requirements of ANSI/EIA/TIA-455-50B, Method A. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap (as described in clause E.7 of ANSI/TIA-568-C.0) with a Category 1 light source.
 - c. Singlemode optical fiber light source:
 - 1) Dual laser light sources with central wavelengths of 1310nm (± 20 nm) and 1550nm (± 20 nm).
 - 2) Output power of -10dB minimum.
 - d. Power Meter:
 - 1) 850 nm, 1300/1310 nm, and 1550 nm wavelength test capability.
 - 2) Power measurement uncertainty of ± 0.25 dB.

- 3) Store reference power measurement.
 - 4) Save at least 100 results in internal memory.
 - 5) PC interface (serial or USB).
 - 4. Optical Time Domain Reflectometer (OTDR):
 - a. Internal non-volatile memory and removable memory device with at least 16MB capacity for results storage.
 - b. Serial and USB ports to transfer data to a PC.
 - c. Multimode OTDR:
 - 1) Wavelengths of 850nm (± 20 nm) and 1300nm (± 20 nm).
 - 2) Event deadzones of 3.7 m maximum at 850 nm and 1300 nm.
 - 3) Attenuation deadzones of 10m maximum at 850nm and 13m maximum at 1300nm.
 - 4) Distance range at least 2,000m.
 - 5) Dynamic range at least 10dB at 850nm and 1300nm.
 - d. Singlemode OTDR:
 - 1) Wavelengths of 1310 nm (± 20 nm) and 1550 nm (± 20 nm).
 - 2) Event dead zones of 3.5 m maximum at 1310 nm and 1550 nm.
 - 3) Attenuation dead zones of 10 m maximum at 1310 nm and 12 m maximum at 1550 nm.
 - 4) Distance range not less than 10,000 m.
 - 5) Dynamic range at least 10 dB at 1310 nm and 1550 nm
 - 5. Fiber Microscope:
 - a. Magnification of 200X or 400X for endface inspection
 - b. Optional requirements:
 - 1) Video camera systems are preferred.
 - 2) Camera probe tips that permit inspection through adapters are preferred.
 - 3) It is preferable to use test equipment capable of saving and reporting the end face image.
 - 6. Integrated OLTS, OTDR and fiber microscope:
 - a. Test equipment that combines into one instrument an OLTS, an OTDR and a fiber microscope may be used.
- D. Coaxial Cable Test Equipment:
- 1. Capacitance Meter:
 - a. Range: 1 nanofarad to 9,999 microfarads.
 - b. Accuracy: $\pm 1.5\%$ or better.
 - 2. DCR Ohms Meter:
 - a. Range: .01 ohms to 40 megaohms.
 - b. Resolution: $\geq .1$ ohm.
 - c. Accuracy: $\pm .4\%$ or better.
 - 3. Cable Loss Meter:
 - a. RF Signal Generation:
 - 1) Range: 1-2000 megahertz.
 - 2) Resolution: 1 megahertz or better.
 - 3) Output level capability: 1dBmV to ≥ 20 dBmV.
 - b. Spectrum Analysis:
 - 1) Range: 1-2000 megahertz.
 - 2) Resolution: 1 megahertz or better.
 - c. Loss Measurement Resolution:
 - 1) .1dBmV or better.

- d. Data Storage & Recall:
 - 1) Capable of storing test results from ≥ 100 individual cables.
 - 2) Serial and USB ports to transfer data to a PC.
4. Copper Time-Domain Reflectometer (TDR):
 - a. Adjustable Pulse Width Settings.
 - b. Programmable nominal velocity of propagation (NVOP) to match cable under test.
 - c. NVOP Range: .30 to .99, in .01 increments
 - d. Measurement Accuracy: 1% or better.
 - e. Measurement Range: $\geq 30,000$ -feet @ 64% NVOP.

PART 3 - EXECUTION

3.1 UTP CABLE TESTING

A. General:

1. Field test UTP cabling upon completion of the installation.
2. Every cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA-568-C.2 "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard."
3. The installed twisted-pair horizontal links shall be tested from the MDF/IDF (ER/TR) in the telecommunications room to the telecommunication wall outlet in the work area against the "Permanent Link" performance specification.
4. One hundred percent of the installed cabling links must be tested and must pass the requirements of the standards mentioned above and as further detailed in Part 3. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for links shall be provided in the test results documentation (below).
5. Field-test instruments shall have the latest software and firmware installed.
6. Link test results from the Test Equipment shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
7. Testing shall be performed on each cabling segment (panel to panel, panel to connector or connector to connector).
8. Testing of the cabling shall be performed using high-quality test cords of the same Category and manufacturer as the cabling under test.

B. Performance Test Parameters – Category 5e, Category 6 and Category 6A (Augmented Category 6):

1. The field test specifications are defined in ANSI/TIA-568-C.2 "Commercial Balanced Twisted-Pair Telecommunications Cabling and Components Standard."
2. The test of each link shall contain the following parameters as detailed below.
 - a. Category 5e: In order to pass the test, measurements at each frequency in the range from 1 MHz through 100 MHz must meet or exceed the limit value determined in the above-mentioned standard.
 - b. Category 6: In order to pass the test, measurements at each frequency in the range from 1 MHz through 250 MHz must meet or exceed the limit value determined in the above-mentioned standard.

- c. Category 6A (Augmented Category 6): In order to pass the test, measurements at each frequency in the range from 1 MHz through 500 MHz must meet or exceed the limit value determined in the above-mentioned standard.
3. Wire Map:
 - a. The wire map test is intended to verify pin-to-pin termination at each end and check for installation connectivity errors. For each of the 8 conductors in the cabling, the wire map indicates:
 - 1) Continuity to the remote end
 - 2) Shorts between any two or more conductors
 - 3) Reversed pairs
 - 4) Split pairs
 - 5) Transposed pairs
 - 6) Distance to open on shield
 - 7) Any other miss-wiring
 - b. The correct connectivity of telecommunications outlets/connectors is defined in ANSI/TIA-568-C.2. Two color schemes are permitted. The user shall define which scheme is to be used. The field tester shall document which color scheme was used.
4. Length:
 - a. The length of each balanced twisted pair shall be recorded.
 - b. Since physical length is determined from electrical length, the physical length of the link calculated using the pair with the shortest electrical delay shall be reported and used for making the pass or fail determination.
 - c. The pass or fail criteria is based on the maximum length allowed for the Permanent Link as specified in ANSI/TIA-568-C.2 plus the nominal velocity of propagation (NVP) uncertainty of 10%. For a Permanent Link, the length measurement can be 325 ft. (99 m) before a fail is reported.
5. Propagation Delay:
 - a. Is the time it takes for a signal to reach the end of the link.
 - b. The measurement shall be made at 10 MHz per ANSI/TIA-1152.
 - c. The propagation delay of each balanced twisted pair shall be recorded.
 - d. Is not to exceed 498 ns per ANSI/TIA-568-C.
 - e. This measurement is to be performed for each of the four wire pairs.
 - f. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay. The report shall include the propagation delay value measured as well as the test limit value.
6. Delay Skew
 - a. Is the difference in propagation delay @ 10 MHz between the shortest delay and the delays of the other wire pairs.
 - b. The delay skew of each balanced twisted pair shall be recorded.
 - c. Is not to exceed 44 ns per ANSI/TIA-568-C.2.
 - d. This parameter shows the difference in propagation delay between the four wire pairs. The pair with the shortest propagation delay is the reference pair with a delay skew value of zero.
 - e. Minimum test results documentation (summary results): Identify the wire pair with the worst-case propagation delay (the longest propagation delay). The report shall include the delay skew value measured as well as the test limit value.
7. DC Resistance

- a. Often reported as Resistance, is the loop resistance of both conductors in the pair.
 - b. Cat 5e and Cat 6
 - 1) Is not specified in ANSI/TIA-1152, but shall be recorded for all four pairs.
 - c. Cat 6A
 - 1) The DC Resistance shall be reported for all four pairs.
 - 2) Is not to exceed 21 Ω for all four pairs per ANSI/TIA-568-C.2.
8. DC Resistance Unbalance within a pair
- a. Often reported as Resistance Unbalance, is the difference in resistance of the two wires within the pair.
 - b. Cat 5e and Cat 6
 - 1) Is not specified in ANSI/TIA-1152 for a Permanent Link, but shall be recorded for all four pairs.
 - c. Cat 6A
 - 1) The DC Resistance Unbalance within a pair shall be reported for all four pairs.
 - 2) Is not to exceed 200 mΩ or 3%, whichever is the greatest per ANSI/TIA-568-C.2.
9. DC Resistance Unbalance between pairs (Cat 6A)
- a. Is the difference in DC parallel resistance of the conductors of a pair compared to the DC parallel resistance of another pair, given in the formula below:
- $$Resistance_Unbalance_{Between_pairs} = \left(\frac{|R_{P1} - R_{P2}|}{R_{P1} + R_{P2}} \right) 100\%$$
- Where:
- R_{P1} is the DC parallel resistance of the conductors of a pair.
 - R_{P2} is the DC parallel resistance of the conductors of another pair.
- b. The DC Resistance Unbalance shall be reported for the following pairs
 - 1) 1,2-3,6
 - 2) 1,2-4,5
 - 3) 1,2-7,8
 - 4) 3,6-4,5
 - 5) 3,6-7,8
 - 6) 4,5-7,8
 - c. Is not to exceed 200 mΩ or 7.5%, whichever is the greatest.
10. Insertion Loss (Attenuation):
- a. Insertion Loss is a measure of signal loss in the permanent link or channel. The term “Attenuation” has been used to designate “Insertion Loss.” Insertion Loss shall be tested from 1 MHz through the frequency range identified above for the category-rating requirements, in maximum step size of 1 MHz. Measure insertion loss at the same frequency intervals as NEXT Loss in order to provide a more accurate calculation of the Attenuation-to-Crosstalk ratio (ACR) parameter.
 - b. Minimum test results documentation (summary results): Identify the worst wire pair (1 of 4 possible). The test results for the worst wire pair must show the highest attenuation value measured (worst case), the frequency at which this worst case value occurs, and the test limit value at this frequency.
11. NEXT Loss:
- a. Pair-to-pair near-end crosstalk loss (abbreviated as NEXT Loss) shall be tested for each wire pair combination from each end of the link (a total of 12

pair combinations). This parameter is to be measured from 1 through the frequency range identified above for the category-rating requirements. NEXT Loss measures the crosstalk disturbance on a wire pair at the end from which the disturbance signal is transmitted (near-end) on the disturbing pair. The maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the Standard as shown in Table 1.

- b. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst case NEXT margin and the wire pair combination that exhibits the worst value of NEXT (worst case). NEXT is to be measured from each end of the link-under-test. These wire pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
- c. Table 1 – Maximum frequency step size as defined in ANSI/TIA-1152

Frequency Range (MHz)	Maximum Step size (MHz)
1 – 31.25	0.15
31.26 – 100	0.25
100 – 250	0.50
250 – 500	1.00

- d.
- 12. PS NEXT Loss:
 - a. Power Sum NEXT Loss shall be evaluated and reported for each wire pair from both ends of the link under-test (a total of eight results). PS NEXT Loss captures the combined near-end crosstalk effect (statistical) on a wire pair when other pairs actively transmit signals. Like NEXT this test parameter must be evaluated from 1 through the frequency range identified above for the category-rating requirements, and the step size may not exceed the maximum step size defined in the Standard as shown in Table 1.
 - b. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for PS NEXT. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
- 13. ACR-N Loss, pair-to-pair:
 - a. Attenuation Crosstalk Ratio Near-end is calculated from the pair-to-pair NEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. NEXT Loss measures the crosstalk disturbance on a wire pair at the close end (near-end) from which the transmitter emits the disturbing signal on the disturbing pair. NEXT is measured to compute ACR-N Loss that must be evaluated and reported in the test results. ACR-N measures the relative strength of the near-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-N is to be measured from 1 through the frequency range identified above for the category-rating requirements, and the maximum step size for NEXT Loss measurements shall not exceed the maximum step size defined in the Standard as shown in Table 1.
 - b. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case margin and the wire pair

combination that exhibits the worst value for ACR-N. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.

14. PS ACR-N Loss:
 - a. Power Sum Attenuation Crosstalk Ratio Near-end is a calculated parameter that combines the effect of the NEXT disturbance from three wire pairs on the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through the frequency range identified above for the category-rating requirements, in frequency increments that do not exceed the maximum step size defined in the Standard as shown in Table 1.
 - b. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
15. ACR-F Loss, pair-to-pair:
 - a. Attenuation Crosstalk Ratio Far-end is calculated from the pair-to-pair FEXT Loss. It shall be measured for each wire-pair combination from both ends of the link under-test. FEXT Loss measures the crosstalk disturbance on a wire pair at the opposite end (far-end) from which the transmitter emits the disturbing signal on the disturbing pair. FEXT is measured to compute ACR-F Loss that must be evaluated and reported in the test results. ACR-F measures the relative strength of the far-end crosstalk disturbance relative to the attenuated signal that arrives at the end of the link. This test yields 24 wire pair combinations. ACR-F is to be measured from 1 through the frequency range identified above for the category-rating requirements, and the maximum step size for FEXT Loss measurements shall not exceed the maximum step size defined in the Standard as shown in Table 1.
 - b. Minimum test results documentation (summary results): Identify the wire pair combination that exhibits the worst-case margin and the wire pair combination that exhibits the worst value for ACR-F. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
16. PS ACR-F Loss:
 - a. Power Sum Attenuation Crosstalk Ratio Far-end is a calculated parameter that combines the effect of the FEXT disturbance from three wire pairs on the fourth one. This test yields eight wire-pair combinations. Each wire-pair is evaluated from 1 through the frequency range identified above for the category-rating requirements, in frequency increments that do not exceed the maximum step size defined in the Standard as shown in Table 1.
 - b. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst pair combinations must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
17. Return Loss:
 - a. Return Loss (RL) measures the total energy reflected on each wire pair. Return Loss is to be measured from both ends of the link-under-test for each wire pair. This parameter is also to be measured from 1 through the frequency range identified above for the category-rating requirements, in

- frequency increments that do not exceed the maximum step size defined in the Standard as shown in Table 1.
- b. Minimum test results documentation (summary results): Identify the wire pair that exhibits the worst-case margin and the wire pair that exhibits the worst value for Return Loss. These wire pairs must be identified for the tests performed from each end. Each reported case should include the frequency at which it occurs as well as the test limit value at this frequency.
18. TCL (Transverse Conversion Loss)
- a. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the near-end on the same wire pair.
 - b. This parameter is also to be measured from 1 through the frequency range identified above for the category-rating requirements, in frequency increments that do not exceed the maximum step size defined in the Standard as shown in Table 1.
 - c. Both worst case and worst margins shall be reported in both directions for all four pairs.
 - d. Cat 5e and Cat 6
 - 1) Is not specified in ANSI/TIA-1152, but shall be recorded for all four pairs.
 - e. Cat 6A
 - 1) Is not to exceed the Category 6A limits found ANSI/TIA-568-C.2.
19. ELTCTL (Equal Level Transverse Conversion Transfer Loss)
- a. Is the ratio (in dB) between a differential mode signal inject at the near-end and the common-mode signal measured at the far end on the same wire pair minus the Insertion Loss of that pair.
 - b. This parameter is also to be measured from 1 through the frequency range identified above for the category-rating requirements, in frequency increments that do not exceed the maximum step size defined in the Standard as shown in Table 1.
 - c. Both worst case and worst margins shall be reported in both directions for all four pairs.
 - d. Cat 5e and Cat 6
 - 1) Is not specified in ANSI/TIA-1152, but shall be recorded for all four pairs.
 - e. Cat 6A
 - 1) Is not to exceed the Category 6A limits found ANSI/TIA-568-C.2.
- C. UTP Cable Test Result Documentation:
- 1. The test results/measurements shall be transferred into a database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee must be made that the measurement results are transferred unaltered, i.e., "as saved in the tester" at the end of each test and that these results cannot be modified at a later time.
 - 2. The database for the completed job shall be stored and delivered on CD-ROM or DVD including the software tools required to view, inspect, and print any selection of test reports.
 - 3. A paper copy of the summary test results shall be provided that lists the links that have been tested with the following summary information:
 - a. The identification of the link in accordance with the naming convention defined in the overall system documentation.

- b. The overall Pass/Fail evaluation of the link-under-test including the NEXT Headroom (overall worst case) number.
- c. The date and time the test results were saved in the memory of the tester.
4. General Information to be provided in the electronic data base with the test results information for each link:
 - a. The identification of the customer site as specified by the end-user.
 - b. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - c. The overall Pass/Fail evaluation of the link-under-test.
 - d. The name of the standard selected to execute the stored test results.
 - e. The cable type and the value of NVP used for length calculations.
 - f. The date and time the test results were saved in the memory of the tester.
 - g. The brand name, model and serial number of the tester.
 - h. The identification of the tester interface.
 - i. The revision of the tester software and the revision of the test standards database in the tester.
 - j. The test results information must contain information on each of the required test parameters that are listed and detailed above.
5. In-Link (In-Channel) Test Results Data. The detailed test results data to be provided in the electronic database must contain the following information:
 - a. For each of the frequency-dependent test parameters, the value measured at every frequency during the test is stored. The database program must be able to process the stored results to display and print a color graph of the measured parameters. Software must also provide a summary numeric format in which some critical information is provided numerically as defined by the summary results (minimum numeric test results documentation) as outlined above for each of the test parameters.
 - 1) Length: Identify the wire-pair with the shortest electrical length, the value of the length rounded to the nearest 0.1 m and the test limit value.
 - 2) Propagation delay: Identify the pair with the shortest propagation delay, the value measured in nanoseconds (ns) and the test limit value.
 - 3) Delay Skew: Identify the pair with the largest value for delay skew, the value calculated in nanoseconds (ns) and the test limit value.
 - 4) Insertion Loss (Attenuation): Minimum test results documentation as identified above for the worst pair.
 - 5) Return Loss: Minimum test results documentation as identified above for the worst pair as measured from each end of the link.
 - 6) NEXT, ACR-F: Minimum test results documentation as identified above for the worst pair combination as measured from each end of the link.
 - 7) PS NEXT and PS ACR-F: Minimum test results documentation as identified above for the worst pair as measured from each end of the link.

3.2 OPTICAL FIBER CABLE TESTING

A. General

1. Testing Tiers requirements are as described below, unless indicated otherwise or otherwise required by the Owner.

2. Every fiber optic cabling link in the installation shall be tested in accordance with the field test specifications defined in ANSI/TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises.
3. One hundred percent of the installed cabling links must be tested and must pass the requirements as specified within this document. Any failing link must be diagnosed and corrected. The corrective action shall be followed with a new test to prove that the corrected link meets the performance requirements. The final and passing result of the tests for links shall be provided in the test results documentation (below).
4. The Pass or Fail condition for the link-under-test is determined by the results of the required individual tests.
5. A Pass or Fail result for each parameter is determined by comparing the measured values with the specified test limits for that parameter.
 - a. Loss shall not exceed calculated link loss.
6. Tests shall be documented, including OLTS dual wavelength attenuation measurements for multimode and singlemode links and channels and OTDR traces and event tables for multimode and singlemode links and channels.
7. Tests performed on optical fiber cabling that use a laser or LED in a test set shall be carried out with safety precautions in accordance with ANSI Z136.2.
8. Field-test instruments shall have the latest software and firmware installed.
9. Link and channel test results from the OLTS and OTDR shall be recorded in the test instrument upon completion of each test for subsequent uploading to a PC in which the administrative documentation (reports) may be generated.
10. Fiber end faces shall be inspected at 200X or 400X magnification. 200X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers. Scratched, pitted or dirty connectors shall be diagnosed and corrected.
 - a. End face images shall be recorded in the memory of the test instrument for subsequent uploading to a PC and reporting.
11. Testing shall be performed on each cabling segment (connector to connector).
12. Testing shall be performed on each cabling channel (equipment to equipment) that is planned for use per the owner's instructions.
13. Testing of the cabling shall be performed using high-quality test cords of the same fiber type as the cabling under test. The test cords for OLTS testing shall be between 1 m and 5 m in length. The test cords for OTDR testing shall be approximately 100 m for the launch cable and at least 25 m for the receive cable.

B. Performance Test Parameters:

1. Three tiers of certification are available that vary in thoroughness of infrastructure analysis.
 - a. Tier 1: optical loss testing
 - b. Tier 2: optical loss and OTDR testing
 - c. Tier 3: optical loss and OTDR testing and magnified endface inspection
2. Optical loss testing (Tiers 1, 2 and 3):
 - a. Backbone link:
 - 1) Multimode backbone links shall be tested at 850 nm and 1300 nm in accordance with ANSI/EIA/TIA-526-14A, Method B, One Reference Jumper or the equivalent method.
 - 2) Singlemode backbone links shall be tested at 1310 nm and 1550 nm in accordance with ANSI/TIA/EIA-526-7, Method A.1, One Reference Jumper or the equivalent method.

- 3) Link attenuation does not include any active devices or passive devices other than cable, connectors, and splices, i.e. link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
 - 4) Use the One Reference Jumper Method specified by ANSI/TIA/EIA-526-14A, Method B and ANSI/TIA/EIA-526-7, Method A.1 or the equivalent method. Follow the procedures established by these standards or application notes to accurately conduct performance testing.
 - 5) Fiber tests from the same cable between the same 2 points shall not vary over .25db from each other.
3. OTDR Testing (Tiers 2 and 3):
 - a. Fiber links shall be tested at the appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss..
 - 1) Multimode: 850nm and 1300nm
 - 2) Singlemode: 1310nm and 1550nm
 - b. Each fiber link and channel shall be tested in both directions.
 - c. A launch cable shall be installed between the OTDR and the first link connection.
 - d. A receive cable shall be installed after the last link connection.
 4. Magnified Endface Inspection (Tier 3):
 - a. Fibers shall be inspected at 200X or 400X magnification. 200X magnification is suitable for inspecting multimode and singlemode fibers. 400X magnification may be used for detailed examination of singlemode fibers.
 - b. Scratched, pitted or dirty connectors shall be diagnosed and corrected.
 - c. The end face images shall be saved and included in the test documentation package.
 5. Length Measurement:
 - a. The length of each fiber shall be recorded.
 - b. It is preferable that the optical length be measured using an OLTS or OTDR.
 6. Polarity Testing:
 - a. Paired duplex fibers in multi-fiber cables shall be tested to verify polarity in accordance with Clause E.5.3 of ANSI/TIA-568-C.0. The polarity of the paired duplex fibers shall be verified using an OLTS.
- C. Fiber Optic Cable Test Result Documentation:
1. The OLTS and OTDR test result information for each link shall be recorded in the memory of the field tester upon completion of the test.
 2. The test result records saved by the tester shall be transferred into a database utility that allows for the maintenance, inspection and archiving of these test records. A guarantee shall be made that these results are transferred to the PC unaltered (i.e., as saved in the tester at the end of each test). The popular 'csv' format (comma separated value format) does not provide adequate protection and shall not be acceptable unless specified by the end user.
 3. The database for the completed job shall be stored and delivered on CD-ROM. This CD-ROM shall include the software tools required to view, inspect, and print any selection of test reports.
 4. Circuit IDs reported by the test instrument shall match the specified label ID.
 5. Summary Test Reports: A copy of the test results shall be provided listing links that have been tested, including the following summary information.

- a. The identification of the link in accordance with the naming convention defined in the overall system documentation.
 - b. The overall Pass/Fail evaluation of the link-under-test
 - c. The date and time the test results were saved in the memory of the tester.
6. General Information to be provided in the electronic data base containing the test result information for each link:
- a. The identification of the customer site as identified by the end-user.
 - b. The operator responsible for testing.
 - c. The overall Pass/Fail evaluation of the link-under-test.
 - d. The name of the standard selected to execute the stored test results.
 - e. The value of the NVP of the cable installed (used for length calculations).
 - f. The date and time the test results were saved in the memory of the tester.
 - g. The brand name, model and serial number of the tester.
 - h. The tester software version and the revision of the test standards database in the tester.
7. Detailed Test Reports: Detailed test results data to be provided in the electronic database for each tested optical fiber must contain the following information.
- a. The identification of the link/fiber in accordance with the naming convention defined in the overall system documentation.
 - b. Tier 1:
 - 1) The insertion loss (attenuation) measured at each wavelength, the test limit calculated for the corresponding wavelength and the margin (difference between the measured attenuation and the test limit value).
 - 2) The link length shall be reported for each optical fiber for which the test limit was calculated based on the formulas above.
 - c. Tier 2:
 - 1) Tier 1 test results.
 - 2) The overall OTDR loss (attenuation) and length.
 - 3) The OTDR event loss at each wavelength and event location.
 - 4) The OTDR trace at each wavelength.
 - d. Tier 3:
 - 1) Tier 1 and 2 test results.
 - 2) A picture of the magnified connector endface.
 - 3) The pass status based upon visual inspection.

3.3 COAXIAL CABLE TESTING

- A. Test every cable individually. The following tests shall be conducted and the results recorded and submitted:
1. Visual Inspections:
 - a. Conduct a visual inspection of the center conductor at each end of each cable. Verify that the center conductor does not have any visible nicks.
 2. Mechanical retention of connectors:
 - a. Verify F-Connectors each can withstand at least 35 pounds of direct pulling force for 2-seconds.
 - b. Verify hardline connectors shall be verified to withstand at least 100 pounds of direct pulling force for 2-seconds.
 - c. Verify that other connector types used withstand 90% of their manufacturer rated retention strength for 2-seconds.
 3. Cable measurements:

- a. Length of cable. Determine length through the use of physical cable markings and through the use of a TDR calibrated for the cable under test.
 - b. DC Loop Resistance: Short the center conductor and shield at the station outlet end of the cable using a premade thread on 0-ohm shunt. Measure and record the loop resistance of the cable at the opposite end of the cable.
 - c. DC Resistance to Ground. Measure and record the DCR between each cable conductor (center and shield) and the nearest telecommunications grounding bus bar. This measurement shall occur after the telecommunications grounding system has been tested.
 - d. Attenuation by Frequency: Sweep the cable from 1 MHz to 1 GHz and record the attenuation results. Quantify the results in table-form in at least the following frequencies: 1, 5, 10, 50 megahertz, and 100 to 2000 megahertz in 50 megahertz increments.
 - e. Cable capacitance. With no load connected at one end of the cable connect a capacitance meter to the opposite end. Measure and record the total center- conductor- to-shield capacitance.
- B. Conduct, coordinate and supply cable test data to parties supplying or installing products that will connect to and use the coaxial cabling. Timing is critical as these parties may need to perform calculations based on test values prior to procurement and installation of certain products.

3.4 ACCEPTANCE OF TEST RESULTS

- A. A representative of the end-user may at their discretion select a random sample of five percent of the installed links. The representative (or his authorized delegate) shall test these randomly selected links, and the results shall be stored in accordance with this Section. The results obtained shall be compared to the data provided by the installation contractor. If more than two percent of the sample results differ in terms of the pass/fail determination, the installation contractor under supervision of the end-user representative shall repeat 100-percent testing at no cost to the Owner.
- B. Installed cabling links and channels shall be field-tested and pass the test requirements and analysis as described in this Section. Any link or channel that fails these requirements shall be diagnosed and corrected. Any corrective action shall be documented and followed with a new test to prove that the corrected link or channel meets performance requirements. The final and passing result of the tests for links and channels shall be provided in the test results documentation in accordance with this Section.
- C. Acceptance of the test results shall be given in writing after the project is fully completed and tested in accordance with Contract Documents and to the satisfaction of the Owner.

END OF SECTION 27 08 10

SECTION 27 11 10 - WALL LININGS FOR COMMUNICATION ROOMS**PART 1 - GENERAL****1.1 DEFINITIONS**

- A. Communications Backboard: Finished plywood surface (wall lining) installed over a finished wall and used for the purpose of wall attachment/mounting of a wide-variety of communications and electronic security products.

1.2 SYSTEM DESCRIPTION

- A. Wall lining shall be installed around the entire perimeter of each communication room, except where otherwise detailed on the Drawings.
 - 1. Wall lining materials shall be installed behind wall-mounted Communications, Audio Visual and Security products, except as otherwise approved in advance by the Designer.
 - 2. Wall linings shall provide a solid reusable and fire-retardant surface for mounting of active and passive electronic products.
 - 3. Linings shall be attached to and supported by a wall structure in such manner as to be capable of fully supporting the load of products attached to it.
 - 4. Linings shall be applied over the standard painted drywall, brick and/or block wall materials as may be present within the space.
 - 5. Linings shall be installed in addition to and shall not take the place of standard wall-finish materials.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated in the Work include, but are not limited to:
 - 1. Georgia-Pacific.
 - 2. Weyerhaeuser.
 - 3. Sherwin-Williams.
 - 4. PPG Industries, Inc.
 - 5. Benjamin Moore.
 - 6. Hy-Tech Thermal Solutions.
 - 7. Hilti Corporation.
 - 8. Red Head.

2.2 WALL LININGS

- A. Plywood:
 - 1. ¾" AC-grade plywood.

2. 4-foot wide x 8-foot tall x 3/4-inch thick.

2.3 FINISHES:

- A. Paint:
 1. Color: White.
 2. Self-priming design.
 3. 30-Year manufacturer warranty.
 4. ASTM E-84/UL 723 Class A-B fire-retardant.

2.4 HARDWARE:

- A. Anchoring Hardware:
 1. Material: Steel.
 2. Finish: Rust preventative permanent outer coating.
 3. Lag-type hex-head bolts for attachment to wood framed walls.
 4. Lag-type hex-head bolts with expandable metal anchors for attachment to CMU construction.
 5. Machine-thread hex-head bolts and expandable machine threaded concrete anchors for attachment to concrete walls.
 6. Molly bolt or similar type all-metal machine threaded permanent anchor assembly for anchoring to metal stud framing.
 7. Steel washers and lock washers between bolt head and wall lining.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Wall Linings:
 1. Install plywood directly over and against the finished wall surfaces, without use of standoffs, and without leaving a gap between the plywood and wall.
 2. Line the entire interior surface of each communication room, starting each wall with a full-size sheet at the left edge of each wall and progressing to the right, unless otherwise detailed on the drawings.
 3. Utilize full standard-size sheets. Where the sheets need to be cut down to fit within the available mounting space, cut a single sheet down to fit the opening. Do not use multiple partial-size sheets where a full-size sheet, or where a single sheet cut down from a full-size sheet shall suffice.
 4. Mount sheet with the highest grade side (e.g., A-side) outward facing into the space.
 5. Attach sheets securely to the walls using horizontally arrayed columns of (at least) three bolts (top, middle, and bottom). Spacing of bolt columns shall be such as to secure the backboard directly to wall studs or other structural wall members. Each full-size sheet shall be supported by not less than two (2) columns of bolts. Horizontal spacing between bolts used for a single sheet shall not exceed 24 inches. The minimum number of bolts per sheet shall not be less than one (1) bolt for every 5.33sq/ft of plywood surface area, but not less than four (4) bolts.

6. Set mounting hardware flush and smooth with the finished surface of the plywood.
 7. Install plywood plumb and level.
 8. Install the bottom of edge of the plywood beginning at 1/2 inch above the baseboard or 6 inches above the finished floor (whichever is lower).
 9. Where plywood must mount over devices such as AC switches, outlets, fire-alarm devices and the like, the backboard shall be cut to permit the entire device to be revealed plus an additional margin of 1/4 inch on each side of the device. Openings shall be plumb and level.
- B. Painting:
1. Paint the front and rear surfaces of the wall linings using fire-retardant paint.
 2. Paint the edges of lining, including edges of the lining that abut other segments of the lining or another surface.
 3. Paint the edges of the lining that result from cutouts around obstacles.
 4. Paint the hardware used to secure the lining to the wall. Use the same color used to paint the lining.
 5. Apply minimum of two coats of fire-retardant paint. Apply additional coats as recommended by the paint manufacturer to achieve specified fire-retardant rating.

END OF SECTION 27 11 10

SECTION 27 11 16 - CABINETS, RACKS, FRAMES AND ENCLOSURES**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Product Datasheets.
 - 2. Bill of Materials (BOM):
 - a. At the top of each BOM list, identify the following:
 - 1) Rack Device.ID.
 - 2) Name and number of the space where the rack is located.
 - 3) Name of the systems the rack supports.
 - 4) Rack type.
 - b. Enumerate the quantity, brand, model and description of the rack and each option and accessory being furnished with the rack (e.g., sides, casters and fans).
- B. Shop Drawings:
 - a. Enlarged plans of the spaces housing equipment racks.
 - 1) Plans shall call out the Type and Device ID of the rack.
- C. Closeout Submittals:
 - 1. Product data.
 - 2. As-built drawings:
 - a. Enlarged plan depicting the as-installed locations of the racks.

1.2 REFERENCES

- A. Definitions:
 - 1. Where the term “equipment rack” or “rack” is used, in either the singular or plural form, it refers generically to products that are designed for and normally used to house and/or mount 19-inch, 23-inch and 25-inch EIA standard rack mounted equipment. Racks come in multiple forms, sizes, finishes and styles including commonly called cabinets.
 - 2. Where asterisks (*) are used in part numbers, they represent alphanumeric variables. These variables typically represent that portion of a model or product number that must be established when ordering product based upon the size, color, accessories and other information specified.

1.3 COORDINATION

- A. Review and coordinate the sizes, quantity, and location of racks/cabinets/enclosures to ensure they will adequately support the work of this Division and Division 28 Systems (where applicable).

1. Coordinate requirements of all systems to provide a coordinated and usable installation.

1.4 SYSTEM DESCRIPTION

- A. Furnish and install all Equipment Racks (see "Definitions"), accessories and products identified in this section, and as shown on the Drawings, and as additionally required to support the installation of systems and equipment specified in other related sections.
 1. Mount securely as specified and shown.
- B. Provide all rack hardware and accessories as specified.
 1. Provide in quantities as shown on the Drawings and as specified.
- C. Provide Rack Bus Bar (RBB) on each Rack.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.
- B. Accessories furnished for equipment racks shall be as manufactured from the same manufacturer as the rack served, except where otherwise indicated.
- C. Black shall be the default color for racks. Provide alternate colors where specified.
- D. Racks that are located adjacent to one another shall be matching size, color, fit and finish except where otherwise indicated.
- E. Rack sizes. Unless another size of rack is identified in a schedule or indicated on the Drawings, provide the largest RU rack size option available of the Type specified, if another RU size is not defined as the default size.
- F. Additional rack accessories:
 1. Refer to the Drawings for additional requirements for rack assemblies.
 2. Provide additional manufacturer recommended accessories for installation of products specified.
- G. Rack Side Panels:
 1. Where equipment racks utilize accessory side panels, and where such racks are detailed on the Drawings to be ganged together, only one set of side panels is required per model group that is installed adjacent.
 - a. Where more than one depth of enclosed cabinet is utilized in a row, side panels shall be provided between the different depths.

2.2 SUBSTITUTION LIMITATIONS

- A. Approved qualifying manufacturer status notwithstanding, substitute equipment racks may not differ in exterior physical dimensions as compared to the specified equipment racks by more than $\pm 3/4$ inch in any dimension, without pre-bid model-specific review and approval. Substitute racks with dimensions that differ greater than this shall not be considered after award of the Contract.

2.3 EQUIPMENT RACKS

A. Cabinet Types, Floor:

1. Manufacturers: Subject to compliance with the requirements, provide the basis of design product or a comparable product by one of the following manufacturers:
 - a. Middle Atlantic Products.
 - b. Chatsworth Products.
 - c. APC.
2. Type C2:
 - a. Free-standing vertical multi-bay, gangable design.
 - b. Construction: Steel, fully welded. 14-gauge top and bottom, 16-gauge vertical structure.
 - c. Finish: Durable powder coat.
 - d. UL Listed.
 - e. Depth: 36.00 inches.
 - f. Width: 22.00 inches, without side panels.
 - g. Width: 23.31 inches, with side panels.
 - h. Height: 76.13 inches to 83.13 inches, RU dependent.
 - i. Rack mounting width: 19-inch EIA horizontal rack rail spacing.
 - j. Moveable front and rear rack rails, EIA vertical mounting-hole spacing.
 - k. Drilled and tapped #10-32 rack mounting rails.
 - l. Removable side panels (SPN-**-36).
 - m. Removable top kit for fan (MW-10FT).
 - n. Front door: Plexiglas, vented, removable, and locking (PVFD-**).
 - o. Rear door: Steel, solid, removable, and locking.
 - p. Provide Top fan (FAN-10) with thermostatic control
 - q. Leveling feet.
 - r. Basis of Design:
 - 1) 44 RU (77 inch VMS): Middle Atlantic model MRK-4436, plus accessories.
3. Type C4: Cable Management Enclosure.
 - a. Free-standing vertical multi-bay, gangable design.
 - b. Construction: Steel, fully welded.
 - c. Finish: Durable powder coat.
 - d. UL Listed.
 - e. Depth: 36.00 inches.
 - f. Width: 30.00 inches, without side panels.
 - g. Width: 31.50 inches, with side panels.
 - h. Height: 83.49 inches.
 - i. Rack mounting width: 19-inch EIA horizontal rack rail spacing.
 - j. Moveable front and rear rack rails, EIA vertical mounting-hole spacing.
 - k. Cage-nut style rack rails, with full complement of cage nuts.

- l. Removable locking side panels (SPN-**-36).
 - m. Removable top panel for 10-inch fan.
 - n. Front door: Plexiglas, vented, removable, and locking (DPVFD-**).
 - o. Rear door: Steel, solid, removable, and locking.
 - p. Provide Top fan (FAN-10) with thermostatic control.
 - q. Leveling feet.
 - r. Dual (both sides) full length integral vertical cable management ducts located between rack rails and sides, featuring 16 square inches of usable area.
 - s. Basis of Design:
 - 1) 44 RU (77 inch VMS): Middle Atlantic model DRK19-44-36, plus accessories.
4. Type C15 Server Cabinet:
- a. Free-standing vertical multi-bay, gangable design.
 - b. Basis of Design:
 - 1) APC AR3300 plus accessories. SEE SECTION 27 11 17 FOR DETAILS
5. Type C16 Networking Cabinet:
- a. Free-standing vertical multi-compartment, gangable design.
 - b. Basis of Design:
 - 1) APC AR3340 plus accessories. SEE SECTION 27 11 17 FOR DETAILS
6. Type C17 CoLo Cabinet:
- a. Free-standing vertical multi-compartment, gangable design.
 - b. Construction: Steel, 12-gauge construction, 16-gauge doors.
 - c. Finish: Pretreated steel coated with RAL 9005 black textured, low-gloss polyester powder paint.
 - d. Depth: 35.34 inches.
 - e. Width: 23.94 inches
 - f. Height: 78.39 inches.
 - g. Single 42 RU or two independent compartments with 20 RU in each
 - h. Levelers included
 - i. Rack mounting width: 19-inch EIA horizontal rack rail spacing.
 - j. 19-in. adjustable square hole, L-shaped rack angles front and rear
 - k. Secure interior cable ducts with 2 compartment version.
 - l. Vented top panel. Provide with cooling fan.
 - m. Full Mesh front and rear doors.
 - n. 1 or 2 sets of front and rear doors with Mechanical 3 digit combination locks.
 - o. Provide barriers between cabinets to secure compartments; provide side panels at end of each row (or stand-alone cabinets).
 - p. Basis of Design:
 - 1) Hoffman Pentair PCLC2069B plus accessories.
- B. Open Frame Types:
- 1. Manufacturers: Subject to compliance with the requirements, provide the basis of design product or a comparable product by one of the following manufacturers:

- a. Middle Atlantic Products.
 - b. Ortronics/Legrand.
 - c. Panduit.
 - d. CPI Chatsworth Products
2. Type R9:
- a. Free standing, gangable, open frame, 4-post design.
 - b. Construction: Aluminum extrusion.
 - c. Finish: Epoxy-polyester hybrid powder coat.
 - d. Weight capacity: 1,000 lbs.
 - e. Depth: 41 inches – 29” between rails.
 - f. Width: 20.3 inches.
 - g. Height: 84 inches.
 - h. Usable Height 78.75”
 - i. Rack mounting width: 19-inch EIA horizontal rack rail spacing.
 - j. .375” Square punched rail, EIA-310-D hole pattern, including (100) cage nuts and screws.
 - k. Rack Mounting spaces marked and numbered.
 - l. Dual-sided (front and back) cable duct with pre-installed cable grommets and front door, required as indicated on the Drawings:
 - 1) 6-inch width: Chatsworth 30095-703
 - m. Basis of Design:
 - 1) 45RU (78.75 inch VMS): Chatsworth Products 15053-703, plus accessories.]
 - 2) Provide 100 cage nuts with 12-24 screws: Chatsworth 12639-001 (25pk)
- C. Wall Racks
1. Type W1:
- a. Welded steel construction for strength
 - b. 26” width provides extra space for cables and patching
 - c. Comes standard with adjustable wide-face rackrail
 - d. Locking swing open center section for front and rear access
 - e. Includes a locking/latching plexi front door for added security
 - f. Front door can be easily reversed for left or right hand swing
 - g. Engineered for passive thermal management; optional fan kit available
 - h. Bag of 50 mounting screws included
 - i. RU size: 26
 - j. Depth, usable: 24 inches.
 - k. Depth, overall: 26.67 inches.
 - l. Width: 26 inches.
 - m. Height: 45.5
 - n. Rack mounting width: 19-inch EIA horizontal rack rail spacing.
 - o. Fully adjustable rack rails.
 - p. Front rail rails: 11-gauge steel; drilled and tapped #12-24 mounting holes.
 - q. 12-inch x12-inch knockout in backpan for pull box access.
 - r. Front Door: Plexiglass.
 - s. Basis of Design: Middle Atlantic model CWR–26-26PD

2.4 RACK ACCESSORIES

- A. Manufacturers: Subject to compliance with the requirements, provide the basis of design product or a comparable product by one of the following manufacturers:
1. Middle Atlantic Products.
 2. Atlas Sound.
 3. Raxxess / Chief.
 4. Lowell Manufacturing.
 5. Hubbell.
 6. Hoffman.
 7. X-Mark.
 8. Chatsworth.
 9. Ortronics/Legrand.
 10. Panduit
- B. Vertically mounted metered PDU strips
1. 36 C13, 6 C19, 2 5-20
 2. 5.7kW 208v
 3. Standard of quality is AP8861, with L21-20P input plug
 4. Provide one cabinet or rack.
- C. Temperature Sensor
1. Standard of quality shall be APC AP9335T
 2. Provide one per cabinet
- D. Thermostatic Fan Control:
1. UL Listed.
 2. 120VAC Input voltage.
 3. Temperature probe with 48 to 60 inches of cable.
 4. Fan Receptacles: Four (4) separate AC fan receptacles.
 5. Regulates the speed of up to four rack ventilation fans based upon temperature range.
 6. Minimum of four (4) temperature/fan speed ranges:
 - a. Fan off: Less than 80 degrees Fahrenheit.
 - b. Fan low: 80 to 90 degrees Fahrenheit.
 - c. Fan medium: 90 to 100 degrees Fahrenheit.
 - d. Fan high: Greater than or equal to 100 degrees Fahrenheit.
 - 1) Quantity: One (1) per enclosed equipment rack or up to adjacent ganged racks; additional units where indicated.
 - e. Basis of Design Middle Atlantic FC-4-1CA
- E. Filler Panels:
1. General:
 - a. Panel mix: Provide mixture of vent and blank-type filler panels as required to ensure satisfactory air-flow and heat dissipation.
 - b. Sizes: Provide filler panels in sizes not exceeding two (2) RU, except where shown on the Drawings.
 - c. Quantity: Provide filler panels to occupy all unused mounting spaces of the front rack rail of racks.
 2. Vent-Type:
 - a. Construction: 16-gauge steel.

- b. Finish: Flat black powder coat.
 - c. Ventilation: Vertical vent slots.
 - d. Flanged upper and lower horizontal edges for rigidity.
 - e. Size: Available sizes from one (1) to two (2) RU.
 - f. Basis of Design: Middle Atlantic EVT-* Series.
3. Blank-Type:
- a. Construction: 16-gauge steel.
 - b. Finish: Flat black powder coat.
 - c. Ventilation: None, solid face.
 - d. Flanged upper and lower edges for rigidity.
 - e. Sizes: Available sizes from one (1) to six (6) RU.
 - f. Basis of Design: Middle Atlantic SB-* Series.
- F. Rack Mounting Screws:
- 1. Truss-type screw head.
 - 2. Black finish.
 - 3. Matching size and color nylon protective washer.
 - 4. For Racks with #10-32 threaded rack rails.
 - a. #10-32 thread.
 - b. Basis of Design: Middle-Atlantic model HP.
 - 1) Quantity: Three (3) Phillips-drive screw/per RU/per rack.
 - c. Basis of Design: Middle-Atlantic model HSK.
 - 1) Quantity: One (1) Square-post security drive/per RU/per rack.
 - 5. For Racks with #12-24 threaded rack rails.
 - a. Basis of Design: Middle Atlantic model HP-24.
 - b. Quantity: Four (4) Phillips-drive screw/per RU/per rack.
 - 6. For Racks with 6MM cage-nut rack rails.
 - a. Basis of Design: Middle-Atlantic model HP-6MM.
 - b. Quantity: Four (4) Phillips-drive screw/per RU/per rack.
- G. Rack Bonding Busbar Kits:
- 1. Optimized for installation on 19-inch racks or cabinets meeting EIA-310-D.
 - 2. Available pre-assembled with mounting screws.
 - 3. Electro-tin plated to inhibit corrosion.
 - 4. Provide quantities of busbars to handle a quantity of two-hole connectors equal to a minimum of one-half of the total rack units (RUs).
 - 5. Provide hole spacing to match Panduit LCC series two-hole lugs.
 - a. Basis of Design: Panduit RGRB19U (minimum) for threaded rail fasteners and Panduit RGRB19CN for cage nut rail fasteners.

2.5 CABLE MANAGEMENT

- A. Lacing Strips:
- 1. Vertically Mounted:
 - a. Available in various lengths to match the number of RUs of the rack served.
 - b. Perforated strip designed to accommodate types of wire ties, including hook-and-loop type.
 - c. Basis of Design: Middle Atlantic model LACE-**-OP, sized to match rack RU.
 - d. Quantity: Two (2) per rack, additional units where indicated.

- B. Wire Management Panels:
1. Manufacturers: Subject to compliance with the requirements, provide the basis of design product or a comparable product by one of the following manufacturers:
 - a. Middle Atlantic Products
 - b. Hubbell.
 - c. Leviton.
 - d. Ortronics/Legrand.
 - e. Panduit.
 2. Type A: Cable management panels shall be of this type unless specifically noted otherwise on the Drawings.
 - a. Rack mountable design.
 - b. Front and rear mounted horizontal metal slotted rings.
 - c. Basis of Design:
 - 1) 1 RU (1.75 inches): Middle Atlantic HCM-1DR
 - 2) 2 RU (3.50 inches): Middle Atlantic HCM-2DR
 3. Type B:
 - a. Rack mountable design.
 - b. Front mounted horizontal and vertical metal slotted rings.
 - c. Must be used with horizontal lacing bars.
 - d. Shall not be used with vertically mounted cable managers that may interfere with side rings.
 - e. Basis of Design:
 - 1) 1 RU (1.75 inches): Middle Atlantic HCM-1DV with vertical cable management rings (D-RING) on each side.
 - 2) 2 RU (3.50 inches): Middle Atlantic HCM-2DV with vertical cable management rings (D-RING) on each side.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate with each party providing product that will be housed within the racks. Review rack configurations to ensure they complement the systems being provided.
- B. Coordinate the delivery and installation to meet the workflow and schedules of parties reliant upon the product for their portion of the Work.

3.2 INSTALLATION

- A. Equipment Racks:
 1. General:
 - a. Secure fixed-position, non-portable racks using removable threaded fasteners to prevent from moving or tipping.
 - b. Secure racks without casters to the floor allowing a 36-inch minimum clearance between the rearmost part of the rack and the nearest obstruction. See the Drawings for additional and more stringent requirements.
 - c. Install doors, side panels and other accessories specified.
 - d. Install bushings or grommets at cable entry and exit points to protect cables.

- e. Clean, prep and paint visible conduits using oil-based paint that matches the color of the rack.
 - f. Comply with rack manufacturers' printed instructions and guidelines for rack installation.
 - 2. Cabinet Types, Floor:
 - a. Secure racks to floor to prevent movement and tipping.
 - b. Level the rack. Provide shimming and leveling feet as necessary.
 - c. Install rows of like-size racks that are located adjacent to one another level with one another.
 - 3. Open Frame/Relay Types:
 - a. Securely bolt rack to the floor.
 - b. Install lateral supports to nearby walls to ensure lateral stability.
- B. Rack Accessories:
- 1. Grounding Bus Bar:
 - a. Install grounding bus bars in the rear of racks.
 - b. Coordinate location with equipment being housed within the rack and for full adjustability of the rack rails.
 - 2. Filler Panels:
 - a. Install filler panels within each equipment rack.
 - b. The size, location and ratio of blank-to-vent filler panels shall be as required to assure proper ventilation of equipment.
 - c. Mount the filler panels using approved mounting hardware, ensuring that unused spaces within the equipment rack are covered.
 - 3. Rack Lights:
 - a. Mount lights in the rear of equipment racks. Locate where it will most effectively benefit installation and service personnel.
 - b. Where non-magnetic racks are provided, provide additional hardware to enable attachment of light in a position to benefit installation and service personnel.
 - 4. Ventilation Products:
 - a. Furnish and install ventilation products as specified and indicated on the Drawings. Test operation of ventilation products and adjust as necessary.
 - 5. Cable Management Products:
 - a. Install horizontal and vertical cable lacing bars in locations to optimize support and grouping of cables within the equipment racks.
 - b. Mount bars using hardware recommended by the product manufacturer. Mount securely.

3.3 GROUNDING AND BONDING

- A. Install a grounding busbar in each equipment rack and bond to equipment rack.

3.4 IDENTIFICATION

- A. Label each rack.

END OF SECTION 27 11 16

SECTION 27 11 23 - CABLE MANAGEMENT AND LADDER RACK**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Material.
 - 2. Product Datasheets for any of the following:
 - a. Horizontal ladder rack.
 - b. Vertical ladder rack.
 - c. Fittings.
 - d. Stand-offs.
 - e. Spillways/waterfalls.
 - f. D-rings.
 - g. Finger duct.

- B. Shop Drawings:
 - 1. Communications Room plan(s) depicting the following:
 - a. Size and locations of ladder rack.
 - b. Size and locations of other cable management products.
 - c. Backboards.
 - d. Pathway and cable entry and exit points.
 - 2. Communications Room wall elevation drawings depicting the following:
 - a. Sizes and locations of ladder rack.
 - b. Sizes and locations of other cable management products.
 - c. Backboards.
 - d. Pathway and cable entry and exit points.

- C. Closeout Submittal:
 - 1. Product Data.
 - 2. As-Built Drawings:
 - a. Enlarged floor plans.
 - b. Wall elevations.

1.2 SYSTEM DESCRIPTION

- A. The cable management and ladder rack pathway system shall accommodate the support and orderly routing of cabling within communication rooms.
 - 1. Communications systems served include but are not limited to:
 - a. Voice/telephone systems.
 - b. Network/data/information systems.
 - c. RF broadband video distribution systems.
 - d. Intercom and central sound systems.
 - e. Paging and sound masking systems.
 - f. Audio and video systems.
 - g. Teleconferencing systems.

2. Security systems served include but are not limited to:
 - a. Video surveillance and CCTV.
 - b. Access control.
 - c. Intrusion detection.

- B. The system shall consist of horizontal ladder rack used for support of cables that need to traverse horizontally overhead within the room.
 1. Within the restraints of the room, a perimeter layout with over-rack section is desired.
 2. Fill capacity (as designated by the manufacturer) shall not be exceeded;
 3. Utilize properly sized supports with adequate strength to exceed the maximum recommended weight capacity.
 4. Provide all manufacturer recommended hardware and accessories including, but not limited to, splice extension clamps, stand-off brackets, horizontal tee splice kits, corner support kits, adjustable vertical bend kits, adjustable vertical splice kits, runway drop-out at equipment racks, runway end caps, etc.

- C. The system shall consist of vertical ladder rack for support and dressing of cables that must traverse vertically between cable entry/exit points near the floor and entry/exit points near the ceiling of the room or ladder rack.

- D. The system shall consist of products to organize, dress and support cables that traverse the walls.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 COMPONENTS

- A. Ladder Rack:
 1. Manufacturers: Subject to compliance with requirements, provide products from one of the following manufacturers:
 - a. Chatsworth.
 - b. Cooper/B-Line.
 - c. Middle Atlantic
 2. Horizontally mounted:
 - a. 1-1/2 inch by 3/8 inch ASTM A513 compliant tubular steel construction.
 - b. Color: Black.
 - c. UL Classified for suitability as an equipment grounding conductor.
 - 1) Must remove paint or use ground straps.
 - d. Available in various widths from 12 to 24 inches wide.
 - e. Available in factory lengths of 10 feet (nominal) and longer.
 - f. Rung spacing shall be 9 to 12 inches on center.

- g. Minimum linear cable bearing surface of 1-1/2 inches per linear foot of run.
 - h. Basis of Design: Chatsworth 10250-712.
 - 3. Vertically mounted:
 - a. 1-1/2 inch by 3/8 inch ASTM A513 compliant tubular steel construction.
 - b. White in color. (Matching white backboard).
 - c. Available in various widths from 12 to 24 inches wide.
 - d. Available in factory lengths of 10-feet (nominal) and longer.
 - e. Rung spacing shall be 9 to 12 inches on center.
 - f. Minimum linear cable bearing surface of 1-1/2 inches per linear foot of run.
 - g. Basis of Design: Chatsworth 10250-212.
 - 4. Spillways, Waterfalls, Cable Drop-outs:
 - a. Basis of Design: Chatsworth 12100-***.
- B. D-Rings:
 - 1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into work include, but are not limited to:
 - a. Panduit.
 - b. Middle Atlantic Products.
 - c. Hubbell Premise Wiring (Hubbell).
 - d. Great Lakes.
 - e. Erico/Caddy.
 - 2. D-Shaped wall-mount loop designed for cable management.
 - 3. Continuous loop for pull-through cable installation, or open slot alternate insertion of cables.
 - 4. Size: Available in a variety of pre-manufactured sizes.
 - 5. Mounting holes for secure attachment with screws.
 - 6. Material: Rigid nylon, zinc covered steel.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Review and coordinate the final size requirements of cable management and ladder rack with the supplier and installer of the cabling. Each shall be sufficiently sized for the cables that are to be installed.
- B. Coordinate the locations and products being installed as work of this Section with each party supplying work within the same space. Coordinate to ensure adequate headroom, capacities, working clearances and accessibility of the installed products.

3.2 LADDER RACK UTILIZATION

- A. Horizontal Ladder Rack shall be provided as follows:
 - 1. Where specifically indicated on the Drawings.
 - 2. Within each ER, TR, IDF, and MDF, as follows:
 - a. 12 inch (minimum) horizontal ladder rack around the entire perimeter of the room.

- b. 12 inch (minimum) horizontal ladder rack directly above and parallel to floor mounted equipment racks below. This ladder rack shall intersect with and join to the perimeter ladder rack.
 - c. Target height for ladder rack is 96 inches above the finished floor (AFF), but not less than 12 inches below finished ceiling and not less than 86 inches above the finished floor. The installed height shall not interfere with doors, windows and other equipment within the room.
3. Utilize as an equipment grounding conductor for bonding within the room.
 - a. Must remove paint or use ground straps.
- B. Vertical Ladder Rack shall be provided as defined below:
1. Where specifically indicated on the Drawings.
 2. Within each ER, TR, IDF, and MDF, as follows:
 - a. 12 inch (minimum) vertical ladder rack on the wall at floor and ceiling cable penetrations. Ladder rack shall extend from the penetration to the perimeter ladder rack.
- C. Sizing:
1. Ladder rack sizes shall be the larger of the following:
 - a. Size indicated on the Drawings.
 - b. 12 inches wide.
 - c. As required by the National or Local electric code.
 - d. Ladder rack manufacturer recommendations.
 - e. Sufficient that cable fill does not exceed 40% of its rated capacity, regardless of manufacturer rated capacity greater than this.

3.3 INSTALLATION

- A. Ladder Rack:
1. General:
 - a. Install as a complete system in accordance with manufacturer's written installation instructions.
 - b. Install with sufficient support to carry the weight of the ladder rack system, fully loaded with cables, with a minimum safety factor of 5. In addition, each individual vertical support point above the floor shall be selected and installed to achieve a capacity to support not less than 200 lbs. of vertical load.
 - c. Furnish and install using manufacturer recommended hardware and accessories including, but not limited to: splice extension clamps; horizontal tee splice kits; corner support kits; adjustable vertical bend kits; adjustable vertical splice kits; runway support kits designed for ceiling support from all-thread rod; runway drop-out at equipment racks; and runway end caps.
 - d. Provide protective caps on the exposed ends of rungs and rails.
 - e. Paint accessories and fittings to maintain the aesthetic integrity of the installation using paint recommended and approved by the manufacturer.
 - f. Install the system free of sharp edges, burrs or projections that could harm cables or humans.
 - g. Install using such accessories, means and methods that ensure electrical continuity of the entire system.

- C. D-Rings:
1. Securely mount to communications room wall linings or other approved mounting surface.
 2. Space rings at intervals of 12 inches along the path of the cables served.
 3. Provide rings of sufficient size and quantity that no ring is utilized more than 40% of the rated capacity.
 4. Provide multiple sets of rings to form separate pathways for cables that require physical separation.
 5. Provide D-Rings for routing and management of cables on communication room walls, except where another type is identified for use on the Drawings.

3.4 GROUNDING AND BONDING

- A. Comply with Section 270526 "Grounding and Bonding for Communications."

END OF SECTION 27 11 23

SECTION 27 11 26 - RACK MOUNTED POWER PROTECTION AND POWER STRIPS**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials.
 - 2. Product Datasheets.
- B. Shop Drawings:
 - 1. Power Distribution Diagram(s):
 - a. Depict the power products and the AC power distribution configuration for each rack:
 - 1) Identify the Device.ID for each rack.
 - 2) Include a rack layout depicting the location of power products within the rack.
 - 3) Depict UPSs, PDUs, sequencers, receptacle strips, remote power modules, modular power strips and other distribution products.
 - 4) Identify the interconnectivity between sequencers and the products the sequencer controls.
 - 5) Identify the power up and power down sequence.
- C. Closeout Submittal:
 - 1. Product Data:
 - a. Bill of Materials.
 - b. Product Datasheets.
 - 2. As-Built Drawings:
 - a. Power Distribution Block Diagram(s).

1.2 SYSTEM DESCRIPTION

- A. General:
 - 1. Equipment racks, furniture, backboards and enclosures that house communications and security (where applicable) equipment shall be equipped with a functional local AC power distribution system for delivery of power from the building power system to the product(s) they house.
 - 2. Each distribution system shall be sufficient to support the powered products.
 - 3. Each distribution system shall feature sufficient connectivity to accommodate each powered product, plus an additional 20-percent spare receptacle count usable for future use. Each designated "spare" outlet shall be accessible and usable without the removal or movement of existing cables, plugs or other product.
 - 4. Selected distribution systems shall feature one or more locally installed uninterruptible power supplies for maintaining power to connected equipment in the event there is a loss of incoming building power.
 - a. UPS shall be provided with SNMP and web-based communications options to monitor and control the UPS from a network management station or any

- PC running Microsoft Internet Explorer. Coordinate with the Owner and provide network connectivity to the UPS.
5. Communications backboards, countertops/work-surfaces and other locations where insufficient building power receptacles are present shall be equipped with local power distribution equipment with sufficient outputs to serve the locally installed equipment.
- B. Provide UPS and power distribution equipment as shown on the detail drawings and as required to protect and power communications and security equipment.
1. Audio-Visual Systems
 2. Public Address and Intercom Systems
 3. Security Systems
 4. Equipment Racks for Undefined Use
 5. Telephone system

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 VERTICALLY MOUNTED RECEPTACLE STRIPS

- A. Manufacturers: Subject to compliance with requirements, provide products from one (1) of the following manufacturers:
1. APC
- B. Type VA:
1. 15 Amp capacity.
 2. 120VAC input.
 3. NEMA 5-15R receptacles (14 – 24 outlets).
 4. 45 to 72 inches lengths.
 5. 9-foot power cord with NEMA 5-15P plug.
 6. Manufacturer accessory mounting brackets.
 7. Basis of Design: Middle Atlantic Products PD-1415C-NS with PB-5A brackets.
- C. 120V Metered Vertically mounted metered PDU strips
1. 36 C13, 6 C19, 2 5-20
 2. 5.7kW 208v
 3. Standard of quality is AP8830, with L5-20P input plug
- D. 208V Metered Vertically mounted metered PDU strips
1. 24 NEMA 5-20R
 2. 1920VA
 3. Standard of quality is AP8861, with L21-20P input plug

- E. Temperature Sensor
 - 1. Standard of quality shall be APC AP9335T
- F. Accessories
 - 1. Provide manufacturer recommended accessories for mounting, termination and interconnectivity to achieve a complete and working installation.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Surge Suppression
 - 1. Where independent outboard surge suppression products are used, connect the surge-suppression products to incoming branch power first, then derive power for downstream power distribution products from the surge suppression device.
- B. Uninterruptible Power Supplies (UPS):
 - 1. Connect UPS units to un-switched AC building power.
 - 2. Rackmount power supply(s) and the accessory batteries that are designed for rack mounting.
- C. Vertical Receptacle Strips:
 - 1. In racks, mount vertical receptacle strips inside and in the rear of the rack in an accessible location that does not interfere with the mounting of the equipment served or with future mounting of equipment.
 - 2. When UPS products are present, derive power for the strips from the output receptacle(s) of the UPS.
 - 3. Mount receptacle strips securely.
 - 4. Mount strips using the accessories and hardware recommended by the manufacturer.

END OF SECTION 27 11 26

SECTION 27 13 13 - COPPER BACKBONE CABLING**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM).
 - 2. Product Datasheets.

- B. Quality Assurance
 - 1. Cable and connectivity manufacturers' certification of quality and performance, including:
 - a. List of manufacturers and products approved for use by the cabling and connectivity manufacturers to meet the required extended warranty and warranty registration procedures.
 - b. Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.

- C. Shop Drawings:
 - 1. Backbone System Diagram.
 - 2. Labeling Schema.

- D. Closeout Submittals:
 - 1. Product Datasheets.
 - 2. As-Built Drawings:
 - a. Labeling Schema.
 - b. Backbone System Diagram.
 - 3. Field Quality Control / Test Results.
 - 4. Cable and connectivity manufacturers' certification of quality and performance.
 - a. Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.
 - b. Executed warranty documentation: Site specific, supplied from the manufacturer.
 - 5. Provide additional closeout documentation as required in Division 01 and Division 27 "General Requirements for Communications."

1.2 REFERENCES

- A. Definitions:
 - 1. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

- B. Reference Standards:

1. TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
2. TIA/EIA-569-C, or most current version, Telecommunications Pathways and Spaces.
3. TIA/EIA-606-B, or most current version, Administration Standard for Commercial Telecommunications Infrastructure.
4. TIA/EIA-607-B, or most current version, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
5. The most current published version of the "Telecommunications Distribution Methods Manual (TDMM)" published by the Building Industry Consulting Services International (BICSI).
6. The most current published version of the "Information Transport Systems Installation Methods Manual (ITSIMM)" published by the Building Industry Consulting Services International (BICSI).

1.3 COORDINATION

- A. Review and coordinate the sizes, quantity, routing and spacing of pathways to ensure they will adequately support the Work of this Section.
 1. Confirm that cables to be installed will not exceed maximum fill capacities of raceways and shall meet the minimum requirements of Local, State and Federal laws and requirements.
 2. Confirm that cables to be installed within the pathways will not exceed the maximum standards-based distance limitations.
- B. Coordinate layout and installation of communications cabling with Owner's telecommunications, WAN and LAN equipment and service suppliers.

1.4 QUALITY ASSURANCE

- A. Prior to bid, Contractor shall be listed and shall maintain participation as part of the cabling and connectivity manufacturers' certified contractor programs. Provide documentation as outlined in Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials in conditions endorsed by the product manufacturer.
- B. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- C. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.

1.6 WARRANTY

- A. Additional requirements: Cabling and connectivity products manufacturers, including patch cords, shall have in place an agreement recognizing each other for execution of the warranty as specified. Performance and applications warranties shall be channel rated, including patch cords.
- B. The cable manufacturer and the connectivity products manufacturer shall have a partnership agreement established in order to provide the required warranty.
- C. Required warranty: The TIA/EIA-568-C compliant cable system shall include a minimum 15 year extended product warranty and performance/applications assurance program.

1.7 SYSTEM DESCRIPTION

- A. The copper backbone cabling system shall be a system of interconnections between communications rooms, main terminal spaces and entrance facilities as part of a complete communications cabling system infrastructure.
 - 1. The cabling system consists of cables, intermediate and main cross-connects, mechanical terminations, and patch cords or jumpers used for backbone-to-backbone cross-connection.
 - 2. Refer to Backbone Diagram for types, quantities of cables.
 - 3. Refer to detail drawings for terminations standards and positioning of termination devices.
 - 4. Refer to floor plans for termination locations.
- B. Provide TIA/EIA-568-C compliant multi-pair twisted pair backbone cabling system.
- C. Provide total connectivity for complete and permanent installed communications links.
- D. Backbone cabling cross-connects shall be located within communications rooms, entrance facilities and other locations as designated.
- E. Unless pre-approved by the Designer, provide a single, uniform and complete connectivity solution for this Section:
 - 1. Cabling for this Section, and related structured cabling Sections (as identified above in Related Requirements), shall be provided by a single manufacturer.
 - 2. Connectivity for this Section, and related structured cabling Sections (as identified above in Related Requirements), shall be provided by a single manufacturer.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 CABLING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CommScope, Inc. (CommScope).

- B. General:
 - 1. General Performance: Comply with transmission standards in TIA/EIA-568-C.2 when tested according to test procedures of this standard.
 - a. Twisted pair cable is required to have the appropriate Category classification as defined by TIA/EIA-568-C.2. Compliance with these electrical characteristics shall be third party verified by the manufacturer.
 - 2. System cables shall be code compliant and UL/NEC rated for the location, manner, and environmental conditions in which the cables are installed.
 - a. Within a building, cables that are not installed in a totally enclosed pathway system shall be UL plenum rated.
 - b. Cables used for below grade applications, and cables used in pathways that may reasonably end up with standing water within them, shall be manufacturer rated for continuous contact with water without performance degradation or compromise in warranty.
 - c. Cables used for direct burial, aerial, or other applications shall be manufacturer rated for the application.
 - 1) Also see "Inter-Building Cabling" Section for cable alternate construction.
 - d. Cables shall be Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
 - 1) Communications, Plenum Rated: Type CMP, complying with NFPA 262.
 - 2) Communications, Riser Rated: Type CMR, complying with UL 1666.
 - 3. Cables on this Project may be color-coded. See drawings for color code.

- C. Twisted Pair Cable
 - 1. Description: 100-ohm, multi-pair UTP as indicated on the Drawings, formed into 25-pair binder groups covered with a thermoplastic jacket.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-C for performance specifications.
 - c. Comply with TIA/EIA-568-C, Category 3
 - 1) Cable shall have two individual insulated 24 AWG solid copper conductors formed into a twisted pair.
 - 2) Cable must be constructed of one or more 25-pair bundles of individually insulated Unshielded Twisted Pairs (UTP).
 - 3) Cables shall range from 25 pair to 300 pair in 25 pair increments.
 - d. Basis of Design Commscope 107766057

2.3 CABLE TERMINATION HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
 - 1. CommScope, Inc. (CommScope)

2. Hubbell Premise Wiring (Hubbell).
 3. Leviton Mfg. Company, Inc. (Leviton).
 4. Ortronics; a subsidiary of Legrand (Ortronics).
 5. Panduit Corp. (Panduit).
- B. General Requirements for Cable Connecting Hardware:
1. Comply with TIA/EIA-568-C, IDC type, with modules designed for punch-down. Cables shall be terminated with connecting hardware of same Category or higher.
 2. Provide one single manufacturer for twisted pair termination hardware used together in a permanent link and whenever a Category certification is required.
 3. Cable hardware (i.e., connectivity) shall be part of the manufacturer's enterprise solution.
 4. Cable hardware shall be component rated with third-party verification for the specified Category-rated component compliance.
- C. Wall Mounted
1. Connecting Blocks: 110-style IDC for Category 5e. Provide blocks for the number of cables terminated on the block. Integral with connector bodies, include plug and jacks where indicated.
 - a. 110-style Wiring Block:
 - 1) Comply with TIA/EIA-568-C, Category 5e.
 - 2) Industry normal footprint available in 50-pair, 100-pair and 300-pair blocks.
 - 3) Labeling areas on front and available label kits.
 - 4) 110-style IDC termination system requiring 110C-x connecting clips.
 - 5) Optional jumper troughs available and designed to mount with base footprint.
 - 6) Available without legs for mounting on rack/cabinet mounted panels or on tower systems.
 - 7) Basis of Design: Commscope 569440-1.
 - b. 110-style Connecting Clips (110C-4 and 110C-5):
 - 1) Comply with TIA/EIA-568-C, Category 5e.
 - 2) 110-style IDC termination system.
 - 3) 110C-4 Clips (4-pair) used for termination of 4-pair cables or a combination of 4-pair and multi-pair cables.
 - 4) 110C-5 Clips (5-pair) used for termination of multi-pair cables.
 - 5) Basis of Design: Commscope 558401-1(4 pair) 558402-1 (5 pair)
- D. Rack Mounted.
1. Patch Panel:
 - a. Modular panels housing multiple-numbered in-line configured IDC terminations for permanent termination of pair groups of installed cables.
 - 1) Number of RJ-45 interfaces per panel: As shown in the Details.
 - a) Details will specify the number of pairs to be terminated per interface.
 - b) Supply panel interface quantities to terminate 1 pair per port unless otherwise noted.
 - 2) Comply with TIA/EIA-568-C, Category 5e.
 - a) Flat patch panel.
 - b) UL listed.
 - c) Black steel with PCB connection between interfaces.

- d) Labeling areas on front and rear.
- e) Mountable in EIA standard 19-inch rack/cabinet rails.
- f) 24-ports in 1.75 inches of rack space (1 RU); 48-ports in 3.5 inches of rack space (2RU).
- g) RJ45 (8P8C) jack interface on front and 110-style IDC connections on rear.
- h) Tested and verified to meet TIA component, permanent link and channel requirements.
- i) Provide accessory strain relief bars on the rear with hook and loop ties.
- j) Basis of Design: Commscope Systimax 760205278 PM-PS-48

2.4 SOURCE QUALITY CONTROL

- A. System components shall be tested and listed by one or more United States NRTL.

PART 3 - EXECUTION

3.1 GENERAL

- A. Review and coordinate cabling pathways prior to pathway and cabling installation.
 - 1. Coordinate to resolve deviations, defects or other problems with pathways prior to installation. Allow adequate time for corrections so as to avoid delays to the Project completion date.
 - 2. Provide additional or supplemental TIA/EIA-569-C, or most current version, compliant pathways and cable support where required. Provide additional sleeves through walls/floors/ceilings, as necessary to route cables within buildings.
- B. Project Conditions
 - 1. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.
 - 3. Delivery, Storage and Handling
 - a. Store materials in conditions endorsed by the product manufacturer.
- C. Compliance
 - 1. Comply with NECA 1.
 - 2. Comply with TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
 - 3. Monitor cable pull tensions, and comply with BICSI ITSIMM, Chapter "Pulling Cable."
 - 4. Comply with BICSI ITSIMM, Chapter "Cable Termination Practices."

5. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications."
 - a. Comply with TIA/EIA-569-C, or most current version, for pull-box sizing and length of conduit and number of bends between pull points.
 - b. Do not exceed the required fill capacity of raceways.
6. Provide the appropriate cable rated for the environmental conditions in which the cable is to be installed.

3.2 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by the communications service providers.

3.3 INSTALLATION OF CABLES

- A. Prior to procurement and installation, confirm that cables to be installed within the pathways will not exceed the maximum standards-based distance limitations for Category-rated cabling.
- B. Install cables within approved pathways. Install cables that are not otherwise required to be installed within raceway in such manner as to conceal them from view. Conceal conductors and cables in accessible ceilings, walls and floors.
- C. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
- D. Do not splice cable between terminations or junction points. Cable runs shall be continuous. Wiring shall be free from grounds, shorts, opens and reversals.
- E. Maintain complete protection of cabling. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades.
- F. Cable routing shall follow building structure lines (parallel and perpendicular).
- G. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- H. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- I. Open-Cable Installation:
 1. Install cabling with horizontal and vertical cable guides in communications spaces with terminating hardware and interconnection equipment.
 2. Suspend cable not in raceway, a minimum of 8 inches (200 mm) above ceilings by discrete cable supports not more than 60 inches (1524 mm) apart. Bridle rings are not permitted.
 3. Cable shall not be run through structural members or in contact with conduits, pipes, ducts or other similar or potentially damaging items.

- J. Provide conduit sleeves for penetrations.
1. Provide conduit sleeves for cables where cables pass through walls, floors and ceilings.
 2. Patch and firestop around sleeves.
 3. Firestop the interior of the sleeves after cable installation.
 4. Provide the appropriate bushings on each end. Split bushings shall not be used.
 5. Provide waterproof sealant for penetrations in humidity controlled areas.
- K. Installation of Cable Routed Exposed Under Raised Floors:
1. Install plenum-rated cable only.
 2. Install cabling after the flooring system has been installed in raised floor areas.
 3. Coil cable 6 feet (1800 mm) long not less than 12 inches (300 mm) in diameter below each feed point.
- L. Comply with requirements in Section 270502 "Basic Materials and Methods for Communications."
1. Bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
- M. Separation from EMI Sources:
1. Comply with BICSI TDMM and TIA/EIA-569-C, or most current version, recommendations for separating unshielded twisted pair (UTP) cable from potential EMI sources, including electrical power lines and equipment.
 2. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of 24 inches (610 mm).
 3. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of 12 inches (300 mm).
 4. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of 6 inches (150 mm).
 5. Separation between Communications Cables and Electrical Motors and Transformers: A minimum of 48 inches (1200 mm).

6. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- N. Separate cabling by service and type (i.e., voice, data, control, coaxial, fiber) prior to terminating.
1. Terminate cabling on specified termination hardware in alpha-numerical order.
 2. Group connecting hardware for cables into separate logical fields.
 3. Neatly dress and securely attach cabling to the backboard and/or cabinet/rack.
 4. Provide adequate cable lengths to reach any location on the backboard or within the cabinet/rack.
 5. Bundle and support cables of this System separately from the cables of other systems.
 6. Maintain separation between cables carrying different signal types and different signal levels.
 - a. Where cables from different systems or cables with different signal types are expressly permitted by the Designer to share a common pathway, each of these cable groups shall be kept segregated to the maximum degree physically possible. Cables from different systems shall not be mixed or intertwined.
- O. Provide a minimum service loop of 5 feet at each end and 10 feet at each junction point, unless noted otherwise.
- P. Maintain (do not violate) the minimum bend radius specified by the manufacturer of the cable.
- Q. At final termination, excess cable and the service loop shall be supported and stored neatly in the cable tray or ladder rack within the communications rooms.
1. Proper strain relief shall be applied to cables after installation to lessen the risk of physical damage and to provide proper aesthetic value.
- R. Cabling within Enclosures:
1. Bundle, lace, and train cables within enclosures.
 2. Connect to terminal points with no excess and without exceeding manufacturers' limitations on bending radii.
 3. Provide and use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- S. Cable Termination:
1. Terminate every conductor; no cable shall contain unterminated elements unless otherwise indicated. Make terminations only at indicated outlets, terminals, cross-connects and patch panels.
 2. Bridged taps and splitters shall not be installed as part of backbone cabling.
 3. Utilize standard positive identification color coding for multi-conductor cables.
 4. Provide 110-style IDC termination hardware unless otherwise indicated.
 - a. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.

3.4 IDENTIFICATION

- A. Label each end of the cable.
- B. Identify system components and cabling in compliance with TIA/EIA-606-B, or most current version.

3.5 FIELD QUALITY CONTROL

- A. Comply with Section 270810 "Verification Testing of Structured Cabling."
- B. Perform tests and inspections.
 - 1. Twisted pair cabling shall be factory tested according to TIA/EIA-568-C.
 - 2. Visually inspect twisted pair jacket materials for NRTL certification marking. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.
 - 3. Visually confirm Category rated marking of cabling and termination hardware, including connecting blocks and patch panels.
 - 4. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords and labeling of components.
 - 5. Test twisted pair copper cabling for DC loop resistance, shorts, opens, intermittent faults and polarity between conductors.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 - 6. Final Verification Tests: Perform verification tests for twisted pair systems after the complete communications cabling and workstation outlet/connectors are installed.
 - 7. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report for the cables as well as a detailed report for each cable tested.
 - 8. Remove and replace cabling where test results indicate they do not comply with specified requirements. Retest cabling and provide documentation.
 - 9. End-to-end cabling shall be considered defective if it does not pass tests and inspections.
 - 10. Prepare and submit test and inspection reports.
- C. The Owner reserves the right to have a representative present during testing procedures. Verification testing of copper and fiber may be performed at or near Project completion by the Consultant for quality assurance.
- D. Upon verification testing, if the Consultant finds the test results do not match the Contractor's results, the Consultant or a third party may at the Owner's request retest the cabling and submit those results to the Owner and deduct the verification testing costs from the Contractor's Contract amount.

END OF SECTION 27 13 13

SECTION 27 13 23 - FIBER OPTIC BACKBONE CABLING**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM).
 - 2. Product Datasheets.

- B. Quality Assurance
 - 1. Cable and connectivity manufacturers' certification of quality and performance, including:
 - a. List of manufacturers and products approved for use by the cabling and connectivity manufacturers to meet the required extended warranty registration procedures.
 - b. Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.

- C. Shop Drawings:
 - 1. Labeling Schema.
 - 2. Backbone System Diagram.

- D. Closeout Submittals:
 - 1. Product Datasheets.
 - 2. As-Built Drawings:
 - a. Labeling Schema.
 - b. Backbone System Diagram.
 - 3. Field Quality Control / Test Results.
 - 4. Cable and connectivity manufacturers' certification of quality and performance.
 - a. Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.
 - b. Executed warranty documentation: Site specific, supplied from the manufacturer.

1.2 REFERENCES

- A. Definitions:
 - 1. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.

- B. Reference Standards:
 - 1. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444, UL 1651 and NFPA 70 for the following types:
 - a. Plenum Rated, Nonconductive: Type OFNP, complying with UL 910.

- b. Riser Rated, Nonconductive: Type OFNR or OFNP, complying with UL 1666.
 - c. Plenum Rated, Conductive: Type OFCP or OFNP, complying with UL 910.
 - d. Riser Rated, Conductive: Type OFCR or OFNR, OFCP or OFNP, complying with UL 1666.
2. TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
 3. TIA/EIA-569-C, or most current version, Telecommunications Pathways and Spaces.
 4. TIA/EIA-606-B, or most current version, Administration Standard for Commercial Telecommunications Infrastructure.
 5. TIA/EIA-607-B, or most current version, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
 6. The most current published version of the "Telecommunications Distribution Methods Manual (TDMM)" published by the Building Industry Consulting Services International (BICSI).
 7. The most current published version of the "Information Transport Systems Installation Methods Manual (ITSIMM)" published by the Building Industry Consulting Services International (BICSI).

1.3 COORDINATION

- A. Review and coordinate the sizes, quantity, routing and spacing of pathways to ensure they will adequately support the work of this Section.
 1. Confirm that cables to be installed shall not exceed maximum fill capacities of raceways and shall meet the minimum requirements of Local, State and Federal laws and requirements.
- B. Coordinate layout and installation of communications cabling with Owner's telecommunications, WAN and LAN equipment and service suppliers.

1.4 QUALITY ASSURANCE

- A. Surface-Burning Characteristics: As determined by testing identical products according to ASTM E 84 by a qualified testing agency. Identify products with appropriate marking of applicable testing agency.
- B. Prior to bid, Contractor shall be listed and shall maintain participation as part of the cabling and connectivity manufacturers' certified contractor programs. Provide documentation as outlined in Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials in conditions endorsed by the product manufacturer.

- B. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- C. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.

1.6 WARRANTY

- A. Additional requirements: Cabling and connectivity products manufacturers, including patch cords, shall have in place an agreement recognizing each other for execution of the warranty as specified. Performance and applications warranties shall be channel rated, including patch cords.
- B. The cable manufacturer and the connectivity products manufacturer shall have a partnership agreement established in order to provide the required warranty.
- C. Required warranty: The TIA/EIA-568-C compliant cable system shall include a minimum 15 year extended product warranty and performance/applications assurance program.

1.7 SYSTEM DESCRIPTION

- A. The fiber optic backbone cabling system shall be a system of interconnections between communications rooms, main terminal spaces and entrance facilities as part of a complete communications cabling system infrastructure. The cabling system consists of cables, cross-connect enclosures, and terminations used for backbone-to-backbone cross-connection.
- B. Provide TIA/EIA-568-C compliant fiber optic backbone cabling system.
- C. Cabling
 1. Refer to the Drawings for types and quantities of backbone cables.
 2. Provide total connectivity for complete and permanent installed communications links.
 3. Backbone cabling cross-connects shall be located within communications rooms, entrance facilities and other locations as designated.
- D. Unless pre-approved by the Designer, provide a single, uniform and complete connectivity solution for this Section:
 1. Cabling and connectivity for this Section, and related structured cabling Sections (used to form a unified Structured Cabling System), shall be provided by a single manufacturer or a two manufacturer formal relationship.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 FIBER OPTIC CABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :
1. CommScope, Inc. (CommScope).

B. General:

1. General Performance: Comply with transmission standards in TIA/EIA-568-C when tested according to test procedures of this standard.
2. System cables shall be code compliant and UL/NEC rated for the location, manner, and environmental conditions in which the cables are installed.
 - a. Within a building, cables that are not installed in a totally enclosed pathway system shall be UL plenum rated.
 - b. Cables used for below grade applications, and cables used in pathways that may reasonably end up with standing water within them, shall be manufacturer rated for continuous contact with water without performance degradation or compromise in warranty.
 - c. Cables used for direct burial, aerial, or other applications shall be manufacturer rated for the application.
 - 1) Also see "Inter-Building Cabling" Section for cable alternate construction.
3. Fiber optic backbone cables on this Project shall utilize industry standard jacket color coding to identify fiber grade.

C. Cable Construction

1. Any fiber optic cable not of interlocking armored construction will be installed in a properly rated (plenum) inner-duct.
2. All fiber optic cable will be properly constructed for the environmental conditions and to meet all applicable codes.
3. Jacket:
 - a. Utilize industry standard color coding for multimode and singlemode fiber optic cable jacket colors.
 - b. Cable cordage jacket, fiber, unit and group color shall be according to TIA/EIA-568-C.
 - c. Imprinted with fiber count, fiber type and aggregate length at regular intervals not to exceed 40 inches (1000 mm).
4. The following basic construction types are recognized on this Project:
 - a. Tight buffer armored premise distribution cable
 - 1) Plenum (OFNP) rated construction unless otherwise specifically noted.
 - 2) Used in indoor pathways primarily as backbone cable.
 - 3) Fiber counts can range from 4 to 72 strands

- 4) Hybrid SM/MM strand mix is acceptable.
- 5) This cable construction will never be used in an outdoor or harsh environment.
- 6) OD shall range .49”-.59”
- 7) Basis of Design shall be Commscope P-###-DZ-8W-FSUYL (### = Strand Count.)

D. Optical Properties

E. Description: Multimode, 50/125-micrometer, OM4.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with EIA-455-41 and EIA-455-25 for crush resistance and impact resistance.
3. Comply with TIA/EIA-492AAAD for detailed specifications.
4. Comply with TIA/EIA-568-C for performance specifications.
5. Meet or exceed ISO/IEC 11801 OM4 Grade 6 optical characteristics:
 - a. Dual window of 850 nm and 1300 nm.
 - b. Minimum Overfill Launch Bandwidth: 1500 MHz/km at 850 nm; 500 MHz/km at 1300 nm.
 - c. Laser Launch Bandwidth: 4700 MHz/km.
 - d. Gigabit Ethernet (GbE) Distance (min.): 1000 m at 850 nm; 550 m at 1300 nm.
 - e. 10 Gigabit Ethernet (10 GbE) Distance (min.): 550 m at 850 nm.
 - f. Maximum attenuation: 3.0 dB/km at 850 nm; 1.0 dB/km at 1300 nm.

F. Description: Singlemode, OS2.

1. Comply with ICEA S-83-596 for mechanical properties.
2. Comply with EIA-455-41 and EIA-455-25 for crush resistance and impact resistance.
3. Comply with TIA/EIA-568-C for performance specifications.
4. Meet or exceed ISO/IEC 11801 Singlemode optical characteristics:
 - a. Dual window of 1310 nm and 1550 nm.
 - b. Guaranteed Gigabit Ethernet (GbE) Distance: 10,000 m at 1310 nm.
 - c. Guaranteed 10 Gigabit Ethernet (10 GbE) Distance: 5,000 m at 1310 nm; 30,000 m at 1550 nm.
 - d. Maximum attenuation: .7 dB/km at 1310 nm; .7 dB/km at 1550 nm.

2.3 FIBER OPTIC CABLE TERMINATIONS AND HARDWARE

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following :

1. CommScope, Inc. (CommScope).

B. General Requirements for Cable Connecting Hardware:

1. Cables shall be terminated with connecting hardware of same optical performance or higher.
2. Provide one single manufacturer for fiber optic cable termination hardware.
3. Cable hardware (i.e., connectivity) shall be part of the manufacturer's enterprise solution.

- C. Rack Mounted Fiber Optic Panel Enclosure: Modular enclosures housing multiple adapter plates, splice trays and MTP cassette modules:
1. TIA/EIA-568-C compliant.
 2. Steel: black powder coated finish.
 3. Front metal door or smoked polycarbonate door, removable.
 4. Rear metal cover/door, removable.
 5. Rear tray capacity for splice trays.
 6. Slack management spools included.
 7. Accepts standard fiber optic adapter plates and cassettes.
 8. EIA standard 19 inches rack rails.
 9. Available in 1RU (1.75 inches), 2RU (3.50 inches) or 4RU (7 inches) sizes.
 - a. 1RU: Capacity for up to (4) adapter plates; up to (3) splice trays.
 - b. 2RU: Capacity for up to (8) adapter plates; up to (6) splice trays.
 - c. 4RU: Capacity for up to (16) adapter plates; up to (12) splice trays.
 10. Basis of Design: Commscope HD-1U-SP (1 RU), HD-2U-SP (2 RU), HD-4U-SP (4 RU), size as indicated.
 - a. Include slide mounting kit for access, as required.
 - b. Include additional fiber management rings, as required.
 - c. Include Cable clamp kits.
- D. Wall Mounted Fiber Optic Panel Enclosure: Modular enclosures housing multiple adapter plates and splice trays:
1. TIA/EIA-568-C compliant.
 2. Steel: black powder coated finish.
 3. Wall mountable panel.
 4. Split metal door with lock on service side and lock on customer side.
 5. Slack management spools included.
 6. Accepts standard fiber optic adapter plates and splice trays, as required.
 7. Available capacities: four (4) adapter plates.
 8. Basis of Design: Commscope WBE-EMT-BK-4P-MOD size/quantities as required to terminate fiber quantities indicated on the Drawings.
- E. Fiber Optic Adapter Plates: Modular adapter plates for multiple fibers and connector types fitting within rack mounted and wall mounted fiber optic panel enclosures:
1. Multimode:
 - a. Individual couplers installed.
 - b. Mounts within fiber optic panel enclosures.
 - c. Six (6) duplex SC adapters accommodating twelve (12) fibers.
 - d. Provide adapter plate with couplers to match specified fiber performance.
 - 1) Provide phosphor bronze sleeves for multimode applications.
 - 2) Provide ceramic sleeves for 50/125-micrometer OM 4 and 4+ laser optimized applications.
 - 3) Utilize industry standard color coding.
 - e. Coordinate with fiber optic panel enclosure.
 - f. Provide adequate panels to terminate all fiber strands on rear of adapter plates.
 - g. Basis of Design Commscope G2-SP-12LCX-PT
 2. Singlemode:
 - a. Individual couplers installed.
 - b. Mounts within fiber optic panel enclosures.

- c. Six (6) duplex LC adapters with ceramic sleeves accommodating six (12) singlemode fibers.
 - d. Color code SM couplers blue; utilize industry standard color coding.
 - e. Coordinate with fiber optic panel enclosure.
 - f. Provide adequate panels to terminate all fiber strands on rear of adapter plates.
 - g. Basis of Design Commscope Systimax G2-SP-12LCG-PT
- F. Fusion Splice Tray: Splice trays mounting within fiber optic panel enclosures:
- 1. Each splice tray shall be of fusion type.
 - 2. Splices shall be enclosed in a splice tray mounted in a splice module housing or splice enclosure.
 - 3. Provide mounting hardware kits, holders and sleeves as required.
 - 4. Basis of Design Commscope RS-2AF-16SF (2 trays), RS-4AF-16SF (4 trays)
- G. Fiber Optic Break-Out (Fan-Out)/(Furcation) Kit:
- 1. Shall be used for fiber optic cable terminations.
 - 2. Shall include buffer tubing and heat shrink tubing for each strand to have 18 inches length from break-out.
 - 3. Basis of Design: Corning Cable Systems FAN-BT25-** (Indoor) or FAN-OD25-** (Outdoor).

2.4 SOURCE QUALITY CONTROL

- A. System components shall be tested and listed by one or more United States NRTL.

PART 3 - EXECUTION

3.1 GENERAL

- A. Review and coordinate cabling pathways prior to pathway and cabling installation.
 - 1. Coordinate to resolve deviations, defects or other problems with pathways prior to installation. Allow adequate time for corrections so as to avoid delays to the Project completion date.
 - 2. Provide additional or supplemental TIA/EIA-569-C, or most current version, compliant pathways and cable support where required. Provide additional sleeves through walls/floors/ceilings, as necessary to route cables within buildings.
- B. Project Conditions
 - 1. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.
 - 3. Delivery, Storage and Handling
 - a. Store materials in conditions endorsed by the product manufacturer.

- C. Compliance
 - 1. Comply with NECA 1.
 - 2. Comply with TIA/EIA-568-C., including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
 - 3. Monitor cable pull tensions, and comply with BICSI ITSIMM, Chapter "Pulling Cable."
 - 4. Comply with BICSI ITSIMM, Chapter "Cable Termination Practices."
 - 5. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications."
 - a. Comply with TIA/EIA-569-C, or most current version, for pull-box sizing and length of conduit and number of bends between pull points.
 - b. Do not exceed the required fill capacity of raceways.

3.2 ENTRANCE FACILITIES

- A. Coordinate backbone cabling with the protectors and demarcation point provided by the communications service providers.

3.3 INSTALLATION OF CABLES

- A. Install cables within approved pathways. Install cables that are not otherwise required to be installed within raceway in such manner as to conceal them from view. Conceal conductors and cables in accessible ceilings, walls and floors.
- B. Provide the appropriate cable rated for the environmental conditions in which the cable is to be installed.
- C. Fiber optic cable shall be installed in a protective barrier (innerduct) with the appropriate rating for the environmental conditions.
 - 1. Any fiber optic cable not of interlocking armored construction shall be installed in a properly rated (plenum) inner-duct.
 - 2. Exception: Fiber optic cabling with plenum rated interlocking armor jacket shall not require innerduct.
- D. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
- E. Do not splice cable between terminations or junction points. Cable runs shall be continuous.
- F. Maintain complete protection of cabling. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades.
- G. Cable routing shall follow building structure lines (parallel and perpendicular).

- H. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
- I. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
- J. Open-Cable Installation:
 - 1. Install cabling with horizontal and vertical cable guides in communications spaces with terminating hardware and interconnection equipment.
 - 2. Suspend cable not in a raceway, a minimum of 8 inches (200 mm) above ceilings by discrete cable supports not more than 60 inches (1524 mm) apart. Bridle rings are not permitted.
 - 3. Cable shall not be run through structural members or in contact with conduits, pipes, ducts or other similar or potentially damaging items.
- K. Provide conduit sleeves for penetrations.
 - 1. Provide conduit sleeves for cables where cables pass through walls, floors and ceilings.
 - 2. Patch and firestop around sleeves.
 - 3. Firestop the interior of the sleeves after cable installation.
 - 4. Provide the appropriate bushings on each end. Split bushings shall not be used.
 - 5. Provide waterproof sealant for penetrations in humidity controlled areas.
- L. Comply with requirements in Section 270502 "Basic Materials and Methods for Communications."
 - 1. Bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
- M. Separate cabling by service and type (i.e., voice, data, control, coaxial, fiber) prior to terminating.
 - 1. Terminate cabling on specified termination hardware in alpha-numerical order.
 - 2. Neatly dress and securely attach cabling to the backboard and/or cabinet/rack.
 - 3. Provide adequate cable lengths to reach any location on the backboard or within the cabinet/rack.
 - 4. Bundle and support cables of this System separately from the cables of other systems.
 - 5. Where cables from different systems or cables with different signal types are expressly permitted by the Designer to share a common pathway, each of these cable groups shall be kept segregated to the maximum degree physically possible. Cables from different systems shall not be mixed or intertwined.
- N. Provide a minimum service loop of 5 feet at each end and 10 feet at each junction point, unless noted otherwise.
- O. Maintain (do not violate) the minimum bend radius specified by the manufacturer of the cable.
- P. At final termination, excess cable and the service loop shall be supported and stored neatly in the cable tray or ladder rack within the communications rooms.

1. Proper strain relief shall be applied to cables after installation to lessen the risk of physical damage and to provide proper aesthetic value.

Q. Cabling within Enclosures:

1. Bundle, lace, and train cables within enclosures.
2. Connect to terminal points with no excess and without exceeding manufacturers' limitations on bending radii.
3. Provide and use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.

R. Cable Termination:

1. Terminate every conductor; no cable shall contain unterminated elements unless otherwise indicated. Make terminations only at indicated outlets, terminals, cross-connects and patch panels.
2. Fiber optic cabling shall be terminated using fusion-spliced, factory-polished pigtails.
3. Fiber optic cables shall utilize factory manufactured break-out kits to protect fiber strands within fiber optic enclosures.
 - a. Provide buffer tubing on fiber strands from the connector to the cable break-out (minimum 6 inches pigtails), and secure to the cable jacket for fiber optic cables that do not have a cladding.
4. Utilize standard positive identification color coding for multi-strand cables.

3.4 IDENTIFICATION

- A. Label each end of the cable.
- B. Identify system components and cabling in compliance with TIA/EIA-606-B, or most current version.

3.5 FIELD QUALITY CONTROL

- A. Perform tests and inspections.
 1. Visually inspect optical fiber cabling jacket materials for NRTL certification markings.
 2. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords and labeling of components.
 3. Optical fiber cable tests:
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
- B. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report for the cables as well as a detailed report for each cable tested.
- C. Remove and replace cabling where test results indicate they do not comply with specified requirements. Retest cabling and provide documentation.

- D. End-to-end cabling shall be considered defective if it does not pass tests and inspections.
- E. Prepare and submit test and inspection reports.
- F. The Owner reserves the right to have a representative present during testing procedures. Verification testing of copper and fiber may be performed at or near Project completion by the Consultant for quality assurance.
- G. Upon verification testing, if the Consultant finds the test results do not match the Contractor's results, the Consultant or a third party may at the Owner's request retest the cabling and submit those results to the Owner and deduct the verification testing costs from the Contractor's Contract amount.

END OF SECTION 27 13 23

SECTION 27 15 13 - COPPER HORIZONTAL CABLING**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Product Datasheets.
 - 2. Bill of Materials (BOM).
 - 3. Warranty documentation, including connectivity/cabling manufacturer product warranty data and certificates of complete connectivity solution provider status for the Contractor.

- B. Quality Assurance
 - a. Cable and connectivity manufacturers' certification of quality and performance, including:
 - 1) List of manufacturers and products approved for use by the cabling and connectivity manufacturers to meet the required extended warranty and warranty registration procedures.
 - 2) Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.
 - 3) The Telecommunications contractor must be an approved Commscope or other Certified Installer (CI) A copy of certification documents must be submitted with the quote in order for such quote to be valid. The Telecommunications contractor is responsible for workmanship and installation practices in accordance with Commscope or other pre-approved manufacturer's recommendations

- C. Shop Drawings:
 - a. Floor Plans
 - b. Labeling Schema.

- D. Closeout Submittals:
 - 1. Product Datasheets.
 - 2. As-Built Drawings:
 - a. Floorplans
 - b. Rack Elevations.
 - c. Wall Elevations.
 - d. Labeling Schema.
 - 3. Field Quality Control / Test Results.
 - 4. Cable and connectivity manufacturers' certification of quality and performance.
 - a. Warranty documentation, including cabling and connectivity manufacturers' current product warranty data and certificates of complete connectivity solution provider status for the Contractor.
 - b. Executed warranty documentation: Site specific, supplied from the manufacturer.

1.2 REFERENCES

A. Definitions:

1. Consolidation Point (CP): A location for interconnection between horizontal cables extending from Telecommunications Rooms and horizontal cables extending to the communications outlet/connector. Typically used to feed office furniture or similar re-configurable areas.
2. Cross-Connect: A facility enabling the termination of cable elements and their interconnection or cross-connection.
3. MUTOA: Multiuser telecommunications outlet assembly, a grouping in one location of several telecommunications outlet/connectors. Similar function as CP except the horizontal cables are terminated with RJ45 interfaces at both ends and the cable extends to the workstation as a station attachment cable.
4. Outlet/Connectors: A connecting device in the work area on which horizontal cable or outlet cable terminates.
5. Twisted-Pair: Two individually insulated copper wires physically twisted together to form a balanced pair.
6. Twisted-Pair Cable: A multi-conductor cable comprising two or more copper conductors twisted in a manner designed to cancel electrical interference. Also called balanced twisted-pair cable.

B. Reference Standards:

1. TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard Part 1: General Requirements; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunications Cabling and Components Standard; and TIA/EIA-568-C.3, Optical Fiber Cabling Components Standard.
2. TIA/EIA-569-C, or most current version, Telecommunications Pathways and Spaces.
3. TIA/EIA-606-B, or most current version, Administration Standard for Commercial Telecommunications Infrastructure.
4. TIA/EIA-607-B, or most current version, Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications.
5. The most current published version of the "Telecommunications Distribution Methods Manual (TDMM)" published by the Building Industry Consulting Services International (BICSI).
6. The most current published version of the "Information Transport Systems Installation Methods Manual (ITSIMM)" published by the Building Industry Consulting Services International (BICSI).

1.3 COORDINATION

A. Review and coordinate the sizes, quantity, routing and spacing of pathways to ensure they will adequately support the work of this Section.

1. Confirm that cables to be installed will not exceed maximum fill capacities of raceways and shall meet the minimum requirements of Local, State and Federal laws and requirements.
2. Confirm that cables to be installed within the pathways will not exceed the maximum standards-based distance limitations (90 meters (295 feet)) for horizontal cabling.

- B. Coordinate communications outlet/connector locations with the location of power receptacles at each work area. Coordinate so that power receptacles are immediately adjacent and same height.
- C. Coordinate layout and installation of communications cabling with telecommunications and LAN equipment and service suppliers.

1.4 QUALITY ASSURANCE

- A. Prior to bid, Contractor shall be listed and shall maintain participation as part of the cabling and connectivity manufacturers' certified contractor programs. Provide documentation as outlined in Submittals.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Store materials in conditions endorsed by the product manufacturer.
- B. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
- C. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.

1.6 WARRANTY

- A. Additional requirements: Cabling and connectivity products manufacturers, including patch cords, shall have in place an agreement recognizing each other for execution of the warranty as specified. Performance and applications warranties shall be channel rated, including patch cords.
- B. The cable manufacturer and the connectivity products manufacturer shall be the same manufacturer or shall have a partnership agreement established in order to provide the required warranty.
- C. Required warranty: The TIA/EIA-568-C Category 6 – 250 MHz and 6A - 500 MHz compliant cable system shall include a minimum 15 year extended product warranty and performance/applications assurance program to minimum of 5dB of crosstalk margin beyond the CAT 6 standard for NEXT, PSNEXT, ACR and PSACR.

1.7 SYSTEM DESCRIPTION

- A. Horizontal cabling and connecting hardware provide the means of transporting signals between the communications outlet/connector and the horizontal cross-connect located in the communications room or enclosure. The cabling and associated connecting hardware are called a "permanent link," a term that is used in the testing protocols.

- B. Provide TIA/EIA-568-C compliant 4-pair twisted pair horizontal cabling system.
1. Provide Category 6 compliant horizontal cabling system.
 2. Provide Category 6A (Augmented Category 6) compliant horizontal cabling system for Wireless Access Point (WAP) cabling.
- C. Cabling
1. Refer to the Drawings for types and quantities of horizontal cables.
 2. Provide total connectivity for complete and permanent installed communications links.
 3. The copper horizontal cabling system shall include provisions for voice/telephone, data/network, video surveillance, audio-visual, access control, building automation, control data and intrusion detection systems.
 - a. Cables may be color-coded by system. Reference the Drawings for requirements, and coordinate with the Owner for final verification.
 - 1) Cable and outlet color code
 - a) Wireless access point (AP) pulls are to be 1 category 6 grey in color.
 - b) Time clock pulls (if required) are to be done with category 6 cabling yellow in color.
 - c) Camera cables are to be done with category 6 cabling purple in color terminated on a separate patch panel in the telecommunications closet.
 - d) Work station voice cables are to be done with category 6 cabling blue in color
 - e) Work station Data cables are to be done with category 6 cabling Red in color for Primary outlet and White in color for the secondary outlet.
 - f) If colored conduit is required it should be White in color. • Outlet color should match cable color
 - g) All cable drops must have a minimum of 1 voice (category 6) and 2 data (category 6 or higher) unless specified differently by Network Services. The color of the cable and matching jacks should be as follows: 1 Red cat 6, 1 White Category 6, and 1 Blue category or 1 White and 1 Blue Category 6A cable.
 - b. Under slab conduits (i.e. floor boxes) shall require OSP rated cable. Splice to plenum rated cable in junction box at ceiling transition.
- D. Unless pre-approved by the Designer, provide a single, uniform and complete connectivity solution for this Section:
1. Cabling and connectivity for this Section, and related structured cabling Sections (used to form a unified Structured Cabling System), shall be provided by a single manufacturer or a two manufacturer formal relationship.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.

2.2 CABLING

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. CommScope, Inc. (Systimax).

B. General:

1. General Performance: Comply with transmission standards in TIA/EIA-568-C when tested according to test procedures of this standard.
 - a. Twisted pair cable is required to have the appropriate Category classification as defined by TIA/EIA-568-C. Compliance with these electrical characteristics shall be third party verified by the manufacturer.
2. System cables shall be code compliant and UL/NEC rated for the location, manner, and environmental conditions in which the cables are installed.
 - a. Within a building, cables that are not installed in a totally enclosed pathway system shall be UL plenum rated.
 - b. Cables used for below grade applications, and cables used in pathways that may reasonably end up with standing water within them, shall be manufacturer rated for continuous contact with water without performance degradation or compromise in warranty.
 - 1) Cables in conduit to a floorbox in a slab on grade application shall transition to OSP rated 4 pair cables.
 - c. Cables used for direct burial, aerial, or other applications shall be manufacturer rated for the application.
 - 1) Also see "Inter-Building Cabling" Section for cable alternate construction.
3. Cables on this Project may be color-coded. See drawings for color code.

C. Twisted Pair Cable

1. Description: 100-ohm, Indoor four-pair with a thermoplastic jacket.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-C for performance specifications.
 - c. Comply with TIA/EIA-568-C, Category 6.
 - 1) Cable shall have two individual insulated 23 AWG solid copper conductors formed into a twisted pair.
 - 2) Cable shall be constructed of one 4-pair bundle of individually insulated Unshielded Twisted Pairs (UTP).
 - 3) Minimum of 5dB of crosstalk margin beyond the CAT 6 standard for NEXT, PSNEXT, ACR and PSACR.
 - 4) Basis of design shall be: Systimax 2071E xxx C6 4/23 U/UTP (xxx = color)

- d. Comply with TIA/EIA-568-C, Category 6A (Augmented Category 6).
 - 1) Cable shall have two individual insulated 23 AWG solid copper conductors formed into a twisted pair.
 - 2) Cable must be constructed of one 4-pair bundle of individually insulated Unshielded Twisted Pairs (UTP).
 - 3) [Nominal cable OD shall not exceed 0.300 inches.]
 - 4) Basis of design shall be: Systimax 2091B xxx C6A 2/23 U/UTP (xxx = color)
- 2. Description: 100-ohm, four-pair OSP Rated UTP cable.
 - a. Comply with ICEA S-90-661 for mechanical properties.
 - b. Comply with TIA/EIA-568-C for performance specifications.
 - c. Utilized for wet environments.
 - d. Comply with TIA/EIA-568-C, Category 6.
 - 1) Cable shall have two individual insulated 23 AWG solid copper conductors formed into a twisted pair.
 - 2) Cable shall be constructed of one 4-pair bundle of individually insulated Unshielded Twisted Pairs (UTP).
 - 3) Cable shall be flooded to prevent moisture migration in underground or wet environments.
 - 4) Cable shall be performance guaranteed to 250 MHz.
 - e. Basis of design shall be: Systimax 1-1967222-1

2.3 CABLE TERMINATION HARDWARE

- A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
 - 1. CommScope, Inc. (Systimax).
- B. General Requirements for Cable Connecting Hardware:
 - 1. Comply with TIA/EIA-568-C, IDC type, with modules designed for punch-down.
 - 2. Cables shall be terminated with connecting hardware of same category or higher.
 - 3. Provide one single manufacturer for twisted pair termination hardware used together in a permanent link and whenever a Category certification is required.
 - 4. Cable hardware (i.e., connectivity) shall be part of the manufacturer's enterprise solution.
 - 5. Cable hardware shall be component rated with third-party verification for the specified Category-rated component compliance.
- A. Patch Panels
 - 1. Configurable Patch Panel: Modular panels housing rear-mounted UTP connector jack modules which snap in and out for easy moves, adds, and changes.
 - a. Number of Positions and Connector Jacks per Field: One (1) for each four-pair UTP cable required.
 - b. Comply with TIA/EIA-568-C.
 - 1) Flat modular patch panel, flush mount.
 - 2) Black steel.
 - 3) UL listed.
 - 4) Molded rear snap-in positions for category-rated modules for UTP. Refer to the Drawings for color coding requirements.
 - 5) Labeling.

- 6) Mountable in EIA standard 19-inch rack/cabinet rails.
- 7) 24-ports in 1.75 inches of rack space (1RU); 48-ports in 3.5 inches of rack space (2RU).
- 8) Provide accessory strain relief bars on the rear with hook and loop ties.
- 9) Basis of Design: Commscope Systimax 760187195 360-E-MOD-2U-48.

B. Connector Jacks, Jack Assemblies

1. Connector Jacks:
 - a. 100-ohm, balanced, twisted pair connector; four-pair, eight-position modular color-coded receptacle units with integral IDC-type terminals, component rated.
 - 1) [Category 6 Modular Jack: Basis of Design shall be Systimax MGS400-### - ### = Color Code
 - 2) [Category 6A (Augmented Category 6) Modular Jack: Basis of Design shall be Systimax MGS600-### - ### = Color Code
 - b. Connector jacks and jack assemblies shall be color coded by system.
 - 1) Color(s): As scheduled in the Contract Documents.

C. Cable transition splice

1. Shall only be utilized where transition is required to an environment requiring OSP rated cable.
2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. 3M.
3. Description: Cable transition splice shall comply with requirements for cable connecting hardware.
4. Electrical connections are made by metallic contact elements that displace the insulation creating a contact point between the conductor and contact element. This design provides a gas-tight connection.
5. Plastic sheath retention grip points known as “bat wings” and “cathedral windows” maintain retention on the conductor insulation. Load bearing is handled by the molded part as opposed to the metal contact element.
6. The metal, utilized for contact element fabrication, is resistant to various forms of localized corrosion, stress corrosion cracking and pitting. In addition, the contact elements will not produce significant galvanic corrosion in wet or humid conditions even if other metals are present.
7. Connectors may be used to splice conductors ranging in size between 22 to 26 AWG.
8. Utilize covers to avoid shorting hazard.
9. Utilize manufacturer pressing tool for termination.
10. Basis of design shall be:
 - a. 3M 710-BD1-5

2.4 SOURCE QUALITY CONTROL

- A. System components shall be tested and listed by one or more United States NRTL.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Review and coordinate cabling pathways prior to pathway and cabling installation.
 - 1. Coordinate to resolve deviations, defects or other problems with pathways prior to installation. Allow adequate time for corrections so as to avoid delays to the Project completion date.
 - 2. Provide additional or supplemental TIA/EIA-569-C compliant pathways and cable support where required. Provide additional sleeves through walls/floors/ceilings, as necessary to route cables within buildings.

- B. Project Conditions
 - 1. Environmental Limitations: Do not deliver or install cables and connecting materials until wet work in spaces is complete and dry, and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.
 - 2. Do not deliver or install product(s) in conditions that jeopardize the performance or manufacturer life expectancy and service life of the product.
 - 3. Delivery, Storage and Handling
 - a. Store materials in conditions endorsed by the product manufacturer.

- C. Compliance
 - 1. Comply with NECA 1.
 - 2. Comply with TIA/EIA-568-C, including TIA/EIA-568-C.0, Generic Telecommunications Cabling for Customer Premises; TIA/EIA-568-C.1, Commercial Building Telecommunications Cabling Standard; TIA/EIA-568-C.2, Balanced Twisted-Pair Telecommunication Cabling and Components Standard; and TIA/E7IA-568-C.3, Optical Fiber Cabling Components Standard.
 - 3. Monitor cable pull tensions, and comply with BICSI ITSIMM, Chapter "Pulling Cable."
 - 4. Comply with BICSI ITSIMM, Chapter "Cable Termination Practices."
 - 5. Comply with requirements for raceways and boxes specified in Section 270528 "Pathways for Communications."
 - a. Comply with TIA/EIA-569-C, or most current version, for pull-box sizing and length of conduit and number of bends between pull points.
 - b. Do not exceed the required fill capacity of raceways.
 - 6. Install faceplates and inserts furnished under Section 271543 "Faceplates and Connectors" and/or Section 271544 "Custom Faceplates, Panels and Connectors."
 - 7. Provide the appropriate cable rated for the environmental conditions in which the cable is to be installed.

3.2 INSTALLATION OF CABLES

- A. Prior to procurement and installation of the horizontal cabling system, coordinate and verify pathways provided and indicated on the Contract Documents.
 - 1. Coordinate and verify to ensure that horizontal cables will not exceed the maximum standards-based distance limitations (90 meters (295 feet)) for horizontal cabling.

- Any discrepancy shall be immediately brought to the attention of the Designer for direction.
2. The maximum allowable total channel distance is 328 feet (100m) between equipment in the communications room and station equipment, including cable service loops, patch cables and station attachment cables.
 3. If proactive steps are not taken prior to procurement or installation, the Contractor shall be responsible for costs associated with providing the horizontal cabling system within industry-standard distance limitation parameters, including, but not limited to, additional required cabling, pathways, rough-in, equipment, communications rooms or enclosures, power and cooling requirements.
- B. Horizontal cabling shall contain no more than one transition point or consolidation point between the horizontal cross-connect and the communications outlet/connector.
 - C. Bridged taps and splices shall not be installed as part of the horizontal cabling.
 - D. Install cables within approved pathways. Install cables that are not otherwise required to be installed within raceway in such manner as to conceal them from view. Conceal conductors and cables in accessible ceilings, walls and floors.
 - E. Do not install bruised, kinked, scored, deformed, or abraded cable. Remove and discard cable if damaged during installation and replace it with new cable.
 - F. Do not splice cable between terminations or junction points. Cable runs shall be continuous. Wiring shall be free from grounds, shorts, opens and reversals.
 - G. Maintain complete protection of cabling. Cabling shall not be left hanging or coiled where it potentially obstructs the Work of other trades.
 - H. Cable routing shall follow building structure lines (parallel and perpendicular).
 - I. Secure and support cables at intervals not exceeding 30 inches and not more than 6 inches from cabinets, boxes, fittings, outlets, racks, frames, and terminals.
 - J. Cold-Weather Installation: Bring cable to room temperature before de-reeling. Heat lamps shall not be used for heating.
 - K. Open-Cable Installation:
 1. Install cabling with horizontal and vertical cable guides in communications spaces with terminating hardware and interconnection equipment.
 2. Suspend cable not in a raceway, a minimum of 8 inches (200 mm) above ceilings by discrete cable supports not more than 60 inches (1524 mm) apart. Bridle rings are not permitted.
 3. Cable shall not be run through structural members or in contact with conduits, pipes, ducts or other similar or potentially damaging items.
 - L. Provide conduit sleeves for penetrations.
 1. Provide conduit sleeves for cables where cables pass through walls, floors and ceilings.
 2. Patch and firestop around sleeves.
 3. Firestop the interior of the sleeves after cable installation.

4. Provide the appropriate bushings on each end. Split bushings shall not be used.
 5. Provide waterproof sealant for penetrations in humidity controlled areas.
- M. Maintain (do not violate) the minimum bend radius specified by the manufacturer of the cable.
- N. At final termination, excess cable and the service loop shall be supported and stored neatly in the cable tray or ladder rack within the communications room and above the ceiling line at an accessible point at the station end.
- O. Proper strain relief shall be applied to cables after installation to lessen the risk of physical damage and to provide proper aesthetic value.
- P. Cabling within Enclosures:
1. Bundle, lace, and train cables within enclosures.
 2. Connect to terminal points with no excess and without exceeding manufacturers' limitations on bending radii.
 3. Provide and use lacing bars to restrain cables, to prevent straining connections, and to prevent bending cables to smaller radii than minimums recommended by manufacturer.
- Q. Comply with requirements in Section 270501 "Basic Materials and Methods for Communications."
1. Bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
- R. Separation from EMI Sources:
1. Outlet requirements where power and communications must be co-located, a voltage barrier shall be provided.
 2. Comply with BICSI TDMM and TIA/EIA-569-C recommendations for separating unshielded twisted pair (UTP) cable from potential EMI sources, including electrical power lines and equipment.
 3. Separation between open communications cables or cables in nonmetallic raceways and unshielded power conductors and electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: A minimum of 5 inches (127 mm).
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 12 inches (300 mm).
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of 24 inches (610 mm).
 4. Separation between communications cables in grounded metallic raceways and unshielded power lines or electrical equipment shall be as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: A minimum of 2-1/2 inches (64 mm).
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 6 inches (150 mm).
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of 12 inches (300 mm).

5. Separation between communications cables in grounded metallic raceways and power lines and electrical equipment located in grounded metallic conduits or enclosures shall be as follows:
 - a. Electrical Equipment Rating Less Than 2kVA: No requirement.
 - b. Electrical Equipment Rating between 2 and 5kVA: A minimum of 3 inches (76 mm).
 - c. Electrical Equipment Rating More Than 5kVA: A minimum of 6 inches (150 mm).
 6. Separation between Communications Cables and Electrical Motors and Transformers: A minimum of 48 inches (1200 mm).
 7. Separation between Communications Cables and Fluorescent Fixtures: A minimum of 5 inches (127 mm).
- S. Separate cabling by service and type (i.e., voice, data, control, coaxial, fiber) prior to terminating.
1. Color coding of cable and termination devices shall be coordinated and approved prior to procurement and installation.
 2. Terminate cabling on specified termination hardware in alpha-numerical order.
 3. Group connecting hardware for cables into separate logical fields.
 4. Neatly dress and securely attach cabling to the backboard and/or cabinet/rack.
 5. Provide adequate cable lengths to reach any location on the backboard or within the cabinet/rack.
 6. Bundle and support cables of this System separately from the cables of other systems.
 7. Maintain separation between cables carrying different signal types and different signal levels.
 - a. Where cables from different systems or cables with different signal types are expressly permitted by the Designer to share a common pathway, each of these cable groups shall be kept segregated to the maximum degree physically possible. Cables from different systems shall not be mixed or intertwined.
- T. Service loop:
1. Within communications rooms, provide a minimum service loop of 15 feet , and spool the service loop in the ladder rack.
 2. At the outlet/connector, provide a minimum service loop of 1 foot , and spool and store within a discrete cable support (J-hook) above the accessible ceiling at the outlet/connector location.
- U. Cable Termination:
1. Terminate every conductor; no cable shall contain unterminated elements unless otherwise indicated. Make terminations only at indicated outlets, terminals, cross-connects and patch panels.
 2. Utilize standard positive identification color coding for multi-conductor cables.
 3. Provide 110-style IDC termination hardware unless otherwise indicated.
 - a. Do not untwist twisted pair cables more than 1/2 inch (12 mm) from the point of termination to maintain cable geometry.
 4. Cables from the same room/space shall be terminated adjacent on termination hardware. Cables from outlets/connectors shall be terminated in alpha-numeric, sequential order, based on final room numbers.

- a. If the communications room serves more than one floor, in addition to the requirements identified above, sequentially group the cables, by floor, on separate patch panels.
5. Separate patch panels shall be utilized for termination of horizontal voice and data, wireless access points, camera and security systems cabling, as indicated on the Drawings.
 - a. Label patch panels to identify system use with unique identifiers, as indicated on the Drawings.

3.3 IDENTIFICATION

- A. Label cables and other components in compliance with Section 270553 "Identification for Communications" for labeling requirements.
- B. Label each end of the cable.
- C. Identify system components and cabling in compliance with TIA/EIA-606-B, or most current version.

3.4 FIELD QUALITY CONTROL

- A. Comply with Section 270810 "Verification Testing of Structured Cabling".
- B. Perform tests and inspections.
 1. Twisted pair cabling shall be factory tested according to TIA/EIA-568-C.
 2. Visually inspect twisted pair jacket materials for NRTL certification marking. Inspect cabling terminations in communications equipment rooms for compliance with color-coding for pin assignments, and inspect cabling connections for compliance with TIA/EIA-568-C.
 3. Visually confirm the required Category-rated marking of cables, outlets, cover plates, outlets/connectors, patch panels and other termination hardware.
 4. Visually inspect cable placement, cable termination, grounding and bonding, equipment and patch cords and labeling of components.
 5. Test twisted pair copper cabling for DC loop resistance, shorts, opens, intermittent faults and polarity between conductors.
 - a. Test instruments shall meet or exceed applicable requirements in TIA/EIA-568-C. Perform tests with a tester that complies with performance requirements in "Test Instruments (Normative)" Annex, complying with measurement accuracy specified in "Measurement Accuracy (Informative)" Annex. Use only test cords and adapters that are qualified by test equipment manufacturer for channel or link test configuration.
 6. UTP Performance Tests:
 - a. Test for each outlet and MUTOA. Perform the following tests according to TIA/EIA-568-C and 270810 "Verification Testing of Structured Cabling."
 - b. Test cables through a Consolidation Point from workstation to patch panel.
 7. Final Verification Tests: Perform verification tests for twisted pair systems after the complete communications cabling and workstation outlet/connectors are installed.

8. Data for each measurement shall be documented. Data for submittals shall be printed in a summary report for the cables as well as a detailed report for each cable tested.
 9. Remove and replace cabling where test results indicate they do not comply with specified requirements. Retest cabling and provide documentation.
 10. End-to-end cabling shall be considered defective if it does not pass tests and inspections.
 11. Prepare and submit test and inspection reports.
- C. The Owner reserves the right to have a representative present during testing procedures. Verification testing of copper and fiber may be performed at or near Project completion by the Consultant for quality assurance.
- D. Upon verification testing, if the Consultant finds the test results do not match the Contractor's results, the Consultant or a third party may at the Owner's request retest the cabling and submit those results to the Owner and deduct the verification testing costs from the Contractor's Contract amount.

END OF SECTION 27 15 13

SECTION 27 15 43 - FACEPLATES AND MOUNTING**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Product Data Sheet: For each type of product.
 - 2. Finish/Color Schedule: Identifying finish and color of each type of product for the Project, coordinated with finish and color of faceplates specified in other specification Sections related to the Project, including Division 26 Electrical and Division 28 Security.
- B. Closeout Submittals:
 - 1. Product Data Sheet: For each type of product actually supplied.
 - 2. Finish/Color Schedule: Identifying the finish and color of each type of product by location on the Project.

1.2 COORDINATION

- A. Unless otherwise noted, faceplate style and colors shall match electrical devices.
 - 1. Coordinate with Electrical Contractor and Owner's Representative for faceplate style and color prior to ordering.

1.3 SYSTEM DESCRIPTION

- A. Provide faceplates for mounting wiring devices as required in the documents.
 - 1. Provide blank cover plates for all unused Telecommunications and Security rough-in boxes.
 - a. Provide for mounting of termination devices in related Sections as well as blank cover plates over boxes without immediate requirements on boxes installed for Communications and Security devices.

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Products furnished of each Type shall be manufactured by a single manufacturer, bear the same brand name, be the same finish color and texture, and be from the same product model series, except where otherwise indicated.
- B. Source Limitations:
 - 1. Obtain faceplates from the same manufacturer as the modular connectors intended to be housed within the faceplate.

- a. Faceplates or wiring device mounting frames are designed to precisely fit and hold wiring devices such as jacks and bulkhead fittings.
 - 1) Faceplates shall be from the Manufacturer of the device it is intended to hold to ensure proper fit and color.
2. Obtain modular wiring device mounting frames from the same manufacturer as the modular connectors housed within the modular device mounting frame.
 - a. Multiple manufacturer sources may be used only when specialty/custom faceplates are required and both the standard and specialty plates are not available from a single manufacturer source.
 - b. The size, shape, finish and color of faceplates furnished as work of this Section shall exactly match the appearance of faceplates furnished as work of other specification Sections of the Contract Documents. A consistent and professional appearance shall result.

2.2 FACEPLATES

A. Faceplate with Modular Jack Frame

1. Duplex Style:
 - a. NEMA 106 compatible.
 - b. Available in various configurations that shall accommodate 1, 2 and 4 individual modular connectors. Provide 4-port modular frame unless indicated otherwise.
 - c. Available in a variety of manufacturer standard colors, including color(s) that exactly match the corresponding faceplate.
 - d. Provide with color-matched blank connector inserts that occupy unused openings of the frame.
 - e. Provide color(s) as scheduled in the Contract Documents.
 - f. Basis of design shall be Systimax M106FR4-### (### = color)
2. Cover plate
 - a. Designed for mounting over standard electrical gang-box size openings.
 - b. Available in manufacturer standard sizes ranging from 1 to 6 gangs, in 1-gang increments, to suit the size and configurations required by the Contract Documents.
 - c. Mounting holes for securing the faceplate to the device mounting box and/or the mounted device.
 - d. Manufacturer supplied metal mounting screws featuring screw heads matching the color of the faceplate. Screws shall be custom painted when matching standard color screws are not available.
 - e. Available with both Designer style (e.g., Decora®) and standard duplex style openings for accommodating mounted devices.
 - 1) Size, style, and color(s) as scheduled in the Contract Documents.
 - f. Basis of design shall be Duplex style Leviton SG 84003-40 DG 84016-40

B. Wall Phone Faceplate:

1. Designed for mounting over NEMA standard 1-gang electrical opening.
2. Stainless steel plate construction.
3. Dual mounting posts in standard positions to accommodate standard wall telephone with recess for modular jack/connector.
4. Compatible with 8P8C RJ45 modular jacks/connectors. Provide jack.
5. Basis of Design shall be Systimax 630B8

- C. Floor Box Faceplate:
 - 1. Compatible with floor box.
 - 2. Openings for Designer Style devices.
 - 3. Faceplate shall be Brass unless otherwise specifically note.
 - 4. Shall utilize jack mounting frame to securely mount jacks.
 - 5. Shall have closeable protective doors.
 - 6. Color coordinated with electrical faceplates and custom faceplates mounted within the same box.
 - 7. Provide with color-matched blank inserts to occupy all unused openings of the faceplate or mounting frame.
 - 8. Basis of Design shall be Systimax 1-1479504-3
 - 9. Coordinate with Division 26 Contractor.

- D. Surface Mount Housing
 - 1. Available in various configurations that shall accommodate a minimum of one (1) or two (2) individual modular connectors.
 - 2. Termination and housing shall be UL/NEC rated for the location, manner, and environmental conditions in which the cables are installed (plenum and non-plenum).
 - 3. Basis of design shall be Commscope M102SMB-A-xxx

- E. Furniture Outlet:
 - 1. Adapt standard faceplate and jack frame to mount in furniture.
 - 2. Utilize data outlet hangar bracket by the manufacturer to secure the outlet in the furniture.
 - a. Data Outlet Hangar Bracket INDPMT-W
 - 3. Coordinate with furniture supplier.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Examination and Coordination:
 - 1. If colors of product are not specifically identified in the Contract Documents, coordinate color selection with the Designer/Architect prior to procurement of product.
 - 2. Examine pathways before installation. Provide written report to the Architect identifying any issues with pathway rough-in that will prevent faceplates from being installed plumb, level and square to the major building lines, or flush with the building finished surface.
 - 3. Provide faceplates featuring the finish and color to match other faceplates installed in the surrounding visible areas, except where otherwise expressly scheduled, detailed or noted.

- B. Installation:
 - 1. Provide faceplates over pathway boxes, box eliminators and individual device openings of multi-opening boxes (e.g., floor boxes), including those designated for future use.

2. Provide blank faceplates over openings that do not otherwise feature a device required by the Contract Documents.
3. Install faceplates flush with the finished surface over which the plate mounts.
4. Secure faceplates using screws and other mounting hardware specifically recommended by the faceplate manufacturer and the manufacturer of the device served.
5. Install faceplates so the plate is plumb, level and square.
6. Provide and tighten mounting screws.

3.2 LABELING

- A. Label faceplates and connectors.

END OF SECTION 27 15 43

SECTION 27 41 00 - AUDIO AND VIDEO SYSTEMS**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials (BOM).
 - a. Separate list for each system.
 - 2. Product Datasheets.
- B. Shop Drawings:
 - 1. System diagrams.
 - 2. Rack elevations.
 - 3. Floor plans.
 - 4. [Wall elevations.]
 - 5.
- C. Closeout Submittals:
 - 1. As-built drawings.
 - 2. Programmable-product configuration file(s):
 - a. Source code version of files necessary for changes to be made by qualified personnel.

1.2 SUMMARY

- A. Section Includes:
 - 1. Supply, installation and integration of complete and working audio and video systems.
- B. Related Requirements:
 - 1. Related Sections:
 - a. Section 271116 "Cabinets, Racks, Frames and Enclosures" for racks and accessories.
 - b. Section 271126 - Rack Mounted Power Protection and Power Strips for power distribution products.
 - c. Section 274101 "Audio and Video Systems Cabling" for cable and connectors used to interconnect AV system equipment.
 - d. Section 274103 "Audio and Video Systems Software Development" for custom software development guidelines.

1.3 QUALITY ASSURANCE

- A. Comply with Section 270002 "Quality Assurance for Communications."

1.4 WARRANTY

- A. Comply with Section 270001 “General Requirements for Communications.”
- B. The warranty period for individual systems shall not start until the system is complete and working for its intended purpose
- C. Poor execution of Work can lead to warranty obligations that extend beyond the termination date of the manufacturer’s warranty.

1.5 SYSTEM DESCRIPTION(S)

- A. See technology drawings for system description(s).

PART 2 - PRODUCTS

2.1 GENERAL

- A. The Contract Documents, including specifications in conjunction with the drawings, shall be used together to conclude the project requirements.

2.2 SUBSTITUTIONS

- A. Brands and models listed on the drawings represent the Basis-of-Design and standard of quality for the identified components. The use of any product other than a Basis-of-Design product in this Section is considered a substitution. These products must include the feature set and operational characteristics to achieve the design intent.
- B. Comply with “Substitutions” in Section 270001 “General Requirements for Communications.”
- C. Contractors shall generate and submit acoustic modeling data for review and approval (by system) if the contractor desires to use loudspeaker models other than those designated as the Basis-of-Design. Acoustic modeling data for products from pre-approved manufactures may be submitted as part of the submittal review process. Acoustic data for products from manufactures not pre-approved shall be submitted for review and written approval prior to bid. Only those loudspeaker models that, in the opinion of the consultant, provide equal or superior “system” performance will be considered.

2.3 EQUIPMENT

- A. System equipment shall be derived from the system diagrams. Provide all products necessary for a complete and working system including those not expressly identified on the documents.

- B. Products depicted on the drawings which are not identified by brand and model are the responsibility of the Contractor to furnish and install. The decision whether a Contractor selected product is acceptable remains with the Designer.
- C. Supply manufacturer recommended accessories where necessary.

2.4 MISCELLANEOUS

- A. Audio combining and balancing components:
 - 1. Manufacturers: Subject to compliance with requirements, provide products manufactured by the following:
 - a. Extron
 - b. Jenson
 - c. Op-Amp Labs
 - d. RDL
 - e. Whirlwind
- B. Custom Rack shelves:
 - 1. Manufacturers: Subject to compliance with requirements, provide products manufactured by the following:
 - a. Middle Atlantic
 - b. Lowell Manufacturing
 - c. Raxxess
 - 2. Basis-of-Design: Middle Atlantic RSH series.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Safety:
 - 1. Install products in such manner as to protect life and property.
 - 2. Furnish and install safety accessories recommended by the manufacturer.
- B. Grounding:
 - 1. Implement signal and safety grounding and bonding to ensure the safety and performance of the system, its operators and the facility in which it is located.
- C. Impedance and Level Matching:
 - 1. Provide impedance matching devices at points in the system where such devices are technically necessary to achieve proper gain staging, product and system performance.
 - 2. Provide passive isolation to eliminate ground loops between equipment.
- D. Audio Combining and Balancing:
 - 1. Where audio signal distance exceeds 15', a balanced signal must be used.
- E. Speakers:

1. Calculate loudspeaker aiming with the objective of achieving the most uniform direct-sound coverage that is possible in the target areas.
 2. Install speakers (other than ceiling-type speakers) using steel cable, wire rope, chain or rigid but field adjustable mounts that enable aiming of the speakers into the target coverage areas.
 3. Speakers destined for installation in suspended ceilings shall be installed using an accessory tile bridge that spans tiles and supports the speaker from the metal ceiling grid system. For secondary support, an accessory safety cable shall be provided to support the speaker from the structure.
 4. Install speakers in a secure manner to sound building structures capable of safely sustaining the load applied to it..
 5. Install speakers using materials and mounting methods that ensure that neither the speaker nor the mounting system emits extraneous audible noise when the speakers operate within design limits.
 6. Paint exposed mounting brackets, supports and hardware to match surrounding finish.
- F. Equipment Racks, Cabinets, Enclosures and Furniture:
1. Provide vertical and horizontal wire management products to secure and manage cables.
 2. Provide horizontal wire support bars. Secure bars in such locations as to achieve a professional balance between cable support, equipment accessibility, service and appearance.
 3. Install service loops. Service loop length shall be determined as follows:
 - a. Long enough that the cable can be relocated to a variety of other compatible ports on the product, sufficient to enable the cable to be landed on a different port if it is incorrectly landed.
 - b. Long enough that it can be moved aside without becoming unplugged, being damaged or stressed while attempting to access another nearby connection.
 - c. Long enough that no stress is applied to the cable itself, a conductor, any other cable, or connectors on the equipment.
 - d. Short enough not to hinder serviceability of an adjacent product.
 4. Power Distribution:
 - a. Install power distribution products to serve system equipment.
 - b. Install not less than 20 percent usable spare outlets that are free, clear, and available for future use.
 5. Install filler panels for unoccupied spaces. Provide a mixture of vent and blank type panels that enable manufacturer requisite airflow over equipment for cooling.
 6. Bundle cables carrying different signal formats and levels separately into independent bundles. Separate bundles with an air space sufficient to prevent interference that adversely affects performance.
- G. Connection Plates/Panels:
1. Comply with Section 271544 "Custom Faceplates, Panels and Connectors."
 2. In addition to locations identified on the drawings, provide connection plates/panels:
 - a. At wall, floor and ceiling equipment locations that accommodate interconnection of portable or movable equipment.
 - b. At video display equipment locations.
 - c. At surface mount devices that are not installed with a direct pathway connection.

- d. At wall, floor, and ceiling boxes where the cable terminates in a piece of equipment that does not mount in/over the box.
 3. Provide custom manufactured plates/panels when pre-manufactured standard plates/panels are not explicitly specified.
- H. Mounting and Support:
1. Provide professionally engineered and professionally manufactured mounts and supports for non-portable products.
 2. Provide final engineering mounting products.
 3. Utilize the services of a registered Professional Engineer (PE) to certify custom mount designs and mounting methods of products whose weight does not fully rest on the floor.
 4. Follow the recommendations of the manufacturer for installation of pre-engineered non-custom mounting assemblies. Consult and follow the recommendations of a mechanical Professional Engineer (PE) in those cases where the manufacturer does not publish specific recommendations for product installation for a specific application.
 5. Except where code or the Contract Documents require a higher rating, a minimum safety factor of (5) shall apply to the structural integrity of product mounting methods.
 6. Submit shop drawings of custom mounting assemblies and atypical installation of pre-manufactured mounts prior to fabrication or installation. Designer's review and related comment(s) shall be limited to matters of function and appearance.
 7. Designer reserves the right to reject any mount and mounting methodology that is not submitted for review prior to installation or that is submitted for review but contains exposed elements that do not satisfy the architectural and aesthetic objectives of the Project.
- I. Video Displays:
1. Install displays in locations identified on the drawings, and mount at the height(s) designated.
 2. If a mounting height is not designated in the Contract Documents, coordinate mounting height with the Designer prior to installation.
 3. Install display using mounts that are rigidly supported and braced from building structure.
 4. Install display so that it is securely attached to the mount. Furnish and install security straps and/or other security products recommended by the mounting hardware and display manufacturers.
- J. Cameras:
1. Install cameras at the locations and heights identified on the drawings. Coordinate with the Designer if these are not identified.
 2. Neatly bundle, dress and conceal cables from view.
 3. Adjust camera settings to achieve optimal performance following the manufacturer's recommendations
 4. Setup and store site specific user-beneficial presets in cameras and related control equipment.
- K. Portable equipment and accessories:
1. Install batteries in products that require battery power, including remote controls.
 2. Install a label on each remote identifying the component.

- L. Lighting:
 - 1. Provide physical interface and cabling to the lighting system(s). Coordinate with the lighting system products provider and equipment manufacturers to obtain control protocols.

- M. Rack Mounts:
 - 1. Provide rack mounts for securing products within equipment racks. Standard rack shelves are not permitted, except where expressly depicted on the drawings and/or otherwise authorized by the Designer.
 - 2. Provide accessory rack mounts from the product manufacturer, where available.
 - 3. Provide custom rack mounts from an approved manufacturer when the product manufacturer does not offer an accessory rack mount.

3.2 IDENTIFICATION

- A. Comply with Section 270553 "Identification for Communications."
- B. Label each system product.

3.3 SOFTWARE DEVELOPMENT

- A. Comply with Section 274103 "Audio and Video Systems Software Development."

3.4 ADJUSTING

- A. General:
 - 1. Upon completion of physical installation, each system shall be adjusted. Adjustments shall be as necessary to make the system usable for its intended purpose and to the satisfaction of the owner's representative and designer.
 - 2. Adjustments shall be performed as recommended by each product manufacturer, recommended as a best practice by a referenced standard or a recognized related trade organization, and where additionally directed by the Designer.
 - 3. Products featuring analog controls shall be marked with self-adhesive dots or arrows to indicate their final settings.

- B. Adjustments:
 - 1. Audio Subsystems:
 - a. Gain staging:
 - 1) Adjust equipment to achieve optimum signal-to-noise ratio and lowest possible distortion. Optimum settings will generally be achieved when points in the signal chain reach maximum level / clipping / distortion at the same time.
 - 2) Adjust input trim gain and pads on mixers.
 - 3) Adjust the gain of both analog and digital products.
 - 4) Record settings for future reference.
 - b. Loudspeaker Aiming:
 - 1) Fine-tune the aiming of loudspeaker components to achieve coverage uniformity within the target coverage areas while simultaneously

- minimizing sound energy directed towards walls, ceilings, and other areas not intended as listening areas.
- 2) Fine tune physical positioning of components to achieve minimum phase interaction, prior to implementing the use of any form of electronic phase or delay adjustments.
- c. Frequency crossovers and filters:
- 1) Adjust crossovers for minimum interaction between components throughout the crossover frequency region.
 - 2) Set crossover frequencies and filters according to recommendations of the loudspeaker manufacturers.
 - 3) Adjust crossover delays for maximum coherency and minimal acoustic comb-filtering.
 - 4) Record settings for future reference.
- d. Equalize individual speakers:
- 1) Adjust loudspeaker filters. This process shall result in the flattening of the frequency response of individual speakers or adjustment to a specific frequency response contour.
 - 2) Equalize speakers using band-pass filters in conjunction with parametric equalization in lieu of fixed-Q graphic equalization.
 - 3) Use subtractive (cut) rather than additive (boost) techniques for achieving target frequency response contours.
 - 4) Derive settings for speakers from loudspeaker manufacturers or using independent TEF™ analysis performed by a trained audio engineer.
 - 5) Record the final settings for future reference. Lock down equipment settings to prevent accidental changes where such capability exists.
- e. Equalize the complete electro-acoustic system:
- 1) Adjust filters that serve the entire electro-acoustic system to achieve the target frequency contour. Where system equipment capability allows, use separate filter sets upstream from the individual loudspeaker filters.
 - 2) Adjust filters to achieve tonal balance between areas covered by different models of loudspeakers.
 - 3) Adjust filters to achieve a balance between gain before feedback performance and tonality.
 - 4) Contact the Designer for target equalization curves prior to performing system equalization.
 - 5) Record settings for future reference.
- f. Audio delays:
- 1) Adjust delays that serve loudspeakers that are physically separated.
 - 2) Adjust delays to achieve aural localization with maximum achievable HASS Integration.
 - 3) If the space served is a multi-function space and the area of focus changes to suit different event types, establish separate recallable delay and level configurations for each configuration.
 - 4) Record settings for future reference.
- g. Voltage and power limits:
- 1) Adjust settings that allow the system to reach but not exceed maximum sound pressure level maximums established by the Designer or Owner.
 - 2) Adjust settings that limit the voltage and power delivered to loudspeakers to within the safe operating range as published by each

- individual loudspeaker manufacturer. These settings are generally independent of settings used to limit sound pressure levels.
- 3) Lock down, cover, and protect these settings from unauthorized change.
 - 4) Record settings for future reference.
- h. Miscellaneous:
- 1) Adjust manual and automatic audio mixers. Review and adjust settings available on the product; adjust to achieve performance that is acceptable to the Designer.
 - 2) Enable phantom power on inputs that are intended to accommodate direct connection of condenser microphones and disable phantom power on those inputs that are not intended to accommodate direct connection of condenser microphones.
 - 3) Adjust automatic gain controllers (AGC).
 - 4) Adjust expanders.
 - 5) Adjust compressors.
 - 6) Adjust limiters.
 - 7) Adjust noise gates.
 - 8) Adjust ambient level sensing.
 - 9) Adjust signal-processing equipment.
 - 10) Record settings for future reference.
- i. Audio Video Synchronization:
- 1) Adjust signal delays to achieve synchronization between associated audio and video signals.
2. Video Subsystems:
- a. Display Equipment:
 - 1) Adjust video display equipment following the guidelines set forth by the display equipment manufacturer.
 - 2) Adjust image size and position.
 - 3) Adjust color temperature and color settings.
 - 4) Color match display images that appear side-by-side.
 - 5) Adjust image brightness and contrast.
 - 6) Adjust limit switches on mechanized screens.
 - 7) Store settings for manual and automatic recall to satisfy operational requirements.
 - 8) Record settings for future reference.
 - b. Signal processing:
 - 1) Configure and store multi-image view settings.
 - 2) Adjust and store image scaling settings.
 - 3) Record settings for future reference.
 - c. Convergence:
 - 1) Adjust video transmission products in accordance with each individual manufacturer's instructions so that individual colors are aligned at the output of links.
 - d. Timing:
 - 1) Adjust video timing in systems that include video conferencing, broadcast, video production and recording capability.
 - e. Camera:
 - 1) Adjust cameras following the procedures recommended by the camera manufacturer.

- 2) Adjust cameras so that they each produce the same quality and appearance of image.
 - 3) Adjust and store presets (pan, tilt, zoom and focus) for memory locations supported by the camera.
 - 4) Adjust and store separate presets in control system memory for each mode of system operation.
3. Control Subsystems:
 - a. Adjust the communication speed between controlled products. Use the fastest speed available that results in consistent reliable communications.
 4. Lighting Subsystems:
 - a. Participate in the adjustment of the lighting system(s) that serve the spaces containing systems provided as Work of this Section.
 - b. Assist the lighting system provider through proactive coordination and supply of guiding input on the following:
 - 1) Aiming and cropping of fixtures that impact usability of the system. This includes but is not limited to fixtures that serve the stage or other presenter areas and areas that rely on specific lighting for highest quality camera performance. Special attention shall be given towards achieving presenter areas that are well lit for both on- and off-camera uses while achieving maximum contrast on video display screens.
 - 2) Establishment of usable lighting scenes that complement the configurations of the space and modes of system operation.

3.5 TESTING

A. General:

1. Tests shall be performed on the system to the degree necessary to confirm that the system is fully usable to the Owner for its intended purpose to the satisfaction of the Designer.
2. Tests shall be performed to confirm that the products are performing according to manufacturers' specifications.

B. Speaker Line Impedance Verification:

1. Prior to landing speaker circuits onto amplifiers, measure and record the impedance of each individual speaker circuit. Confirm that the measured impedance coincides with the calculated impedance conditions and that they are within the safe operating range of the amplifier used.

C. Sound Level Uniformity:

1. Conduct sound pressure level measurements to confirm that coverage is uniform throughout the target listener areas.

3.6 REMEDIAL ACTIONS

- A. Replace defective products, re-terminate defective connections, perform re-adjustments and re-test offending elements of the system should any deficiencies be found during execution of the Work.

3.7 TRAINING

- A. Provide training for each unique system.
- B. Train Owner designated end-user staff.
 - 1. Include hands-on demonstrations covering typical uses of the system in day-to-day operation.
 - 2. Include hands-on demonstration on how to change the modes of the system.
 - 3. Include training covering how to set up and use the system for each type of event.
 - 4. Include training on how to perform actions/operations available on the system user interfaces intended for end-user staff.
- C. Training Owner designated maintenance staff.
 - 1. Include same training as support staff and facilitators.
 - 2. Include training on preventative and routine maintenance measures that are important to long-term reliability and operation of the system.
- D. Training shall include techniques for making level adjustments, using and placing microphones, and operating individual pieces of equipment.
- E. Training shall include hands-on demonstrations based upon Owner projected real-world system use scenarios.
- F. Enlist and provide the services of manufacturer personnel or qualified third party personnel to conduct training on major system components on which the Contractor is not proficient.
- G. Provide (40) hours of system specific training.
 - 1. Provide 30 percent of training prior to the first official use of the system.
 - 2. Provide 20 percent of the training after 15 days of system use.
 - 3. Provide 20 percent of the training after 30 days of system use.
 - 4. Provide 20 percent of the training after 90 days of system use.
 - 5. Provide 10 percent of the training after 180 days of system use.
- H. Training that occurs prior to final system completion does not count towards the required training allowance unless training approval is requested of and granted by the Designer in advance of the training taking place.
- I. A sign-in sheet shall be used to record the signatures of persons attending each training session. The sign-in sheet shall include the start and end times of the session and shall have attached to it a copy of the associated training handouts. Only well documented training sessions apply towards the required training.

3.8 PROTECTION

- A. Protect products from damage and from environmental conditions and contaminants that could adversely affect performance, reliability, manufacturers' warranty or longevity.

- B. If physical protection must be removed for continuation of Work, protection shall be removed only for the duration and extent necessary. Product shall be cleaned prior to reinstallation of protection.

3.9 CLEANING

- A. Clean each system product after installation, immediately prior to substantial completion, and at additional times during performance of Work as recommended by the product manufacturer.
- B. Clean the interior of system racks, enclosures and furniture.
- C. At the start of the warranty period, system equipment shall feature manufacturer factory-fresh appearance.

END OF SECTION 27 41 00

SECTION 27 41 01 - AUDIO AND VIDEO SYSTEMS CABLING**PART 1 - GENERAL****1.1 SUBMITTALS**

- A. Product Data:
 - 1. Bill of Materials
 - a. Separate list for each system.
 - b. List to identify the signal format the cable will be used to transport.

1.2 SUMMARY

- A. Section Includes:
 - 1. Cables for the interconnection of audio and video equipment, and related control system products.
 - 2. Standards-of-practice by which products are to be installed and tested.
- B. Related requirements:
 - 1. Section 271313 "Copper Backbone Cabling" for multi-pair (greater than four-pair) twisted pair cabling and termination hardware (e.g., connecting blocks), including channel rated performance and applications warranty.
 - 2. Section 271323 "Fiber Optic Backbone Cabling" for intra-building fiber optic backbone cabling and termination hardware, including channel rated performance and applications warranty.
 - 3. Section 271513 "Copper Horizontal Cabling" for intra-building, four-pair twisted pair cabling and patch panel termination hardware, including channel rated performance and applications warranty.
 - 4. Section 274100 "Audio and Video Systems."

1.3 DEFINITIONS

- A. DVI: Digital Video Interface.
- B. HDMI: High Definition Media Interface.
- C. HDSDI: High Definition Serial Digital Interface.
- D. HDBaseT: Ultra-high-definition video & audio, Ethernet, controls, USB and up to 100W of power over a single Cat6 or above cable, for up to 100 m/328 ft.

1.4 QUALITY ASSURANCE

- A. Comply with Section 27 00 02 "Quality Assurance for Communications."

PART 2 - PRODUCTS**2.1 GENERAL**

- A. Refer to the related drawings and specifications to determine the quantity, quality, and performance of products to be furnished. The cables provided as work of this section are fully dependent upon them.
- B. Consult with the manufacturers of the equipment to be interconnected to further determine the quantity, quality, and performance of cable required.
- C. Where the manufacturer of the product being interconnected requires cable featuring more stringent requirements than those identified in this Section, provide cable meeting the more stringent requirements.
- D. Brands and models listed represent the Basis-of-Design and standard of quality for the identified cables. The use of any product other than a Basis-of-Design product in this Section is considered a substitution. These products must include the operational characteristics equal to or greater than the Basis-of-Design.

2.2 FIXED INSTALLATION CABLES

- A. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturers:
 - 1. Belden
 - 2. Canare Cable.
 - 3. Crestron.
 - 4. Extron
 - 5. Liberty Wire and Cable.
 - 6. West Penn Wire.
 - 7. Windy City Wire
- B. General Requirements:
 - 1. Fixed installation cables shall be UL Listed and NEC type acceptable for the location, application and manner of installation.
 - 2. Cables shall meet NEC 300 volt rating, higher where otherwise specified.
 - 3. Cable supplied to satisfy the requirements of a specified cable type shall be as manufactured from a single manufacture except as otherwise approved by the Designer (e.g. all RG-6 non-plenum analog video cable shall be from single manufacturer).
 - 4. Within a building, cables that are not installed in a totally enclosed pathway system shall be UL plenum rated.
 - 5. Cables used for below grade applications, in-grade floor boxes, and cables used in pathways that may reasonably end up with standing water within them, shall be manufacturer rated for continuous contact with water without performance degradation or compromise in warranty.
- C. Video:

1. HDMI:
 - a. HDMI version 2.0 or greater.
 - b. Resolution and Refresh Rate: $\geq 4096 \times 2160 @ 60 \text{ Hz}$.
 - c. Chroma Sampling: 4:4:4.
 - d. Bit Depth per Color: $\geq 8 \text{ bit}$.
 - e. Data Rate: 18.0 Gbps.
 - f. Basis-of-Design:
 - 1) Length less than or equal to 12 feet: Extron HDMI Ultra series.
 - 2) Length greater than 12 feet: Extron HDMI Pro series.

2. DisplayPort:
 - a. DisplayPort version 1.4 or greater.
 - b. Resolution and Refresh Rate: $\geq 4096 \times 2160 @ 60 \text{ Hz}$.
 - c. Chroma Sampling: 4:4:4.
 - d. Bit Depth per Color: $\geq 8 \text{ bit}$.
 - e. Data Rate: 21.6 Gbps.
 - f. Basis-of-Design: Extron DisplayPort Ultra series.

3. USB:
 - a. USB 3.0 Compliant
 - b. Data Rate: 4.8 Gbps
 - c. Basis-of-Design: Liberty E-USB3 series.]

- D. Twisted Pair Cable
 1. Furnish cable compliant with Section 271513 "Copper Horizontal Cabling"
 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Manufacturers listed in 271513 "Copper Horizontal Cabling".
 - b. Crestron
 - c. Extron
 3. General:
 - a. General Performance: Comply with transmission standards in TIA/EIA-568-C when tested according to test procedures of this standard.
 - 1) Twisted pair cable is required to have the appropriate Category classification as defined by TIA/EIA-568-C. Compliance with these electrical characteristics shall be third party verified by the manufacturer.
 - b. Where applicable, provide the manufacturer recommended cable for the products being interconnected.
 - c. Basis-of-Design: Belden 2183P.]

- E. Audio, Speaker Level:
 1. General:
 - a. Where wire gauge is not specified on the drawings, calculate based on the following requirements:
 - 1) Line loss shall not exceed 2.00 dB.
 - 2) Equation used to calculate the data:
$$P_{loss} = 10 * \text{Log} (1 - ((2 * RL) / (2 * RL + (V_{line} \text{ squared} / Prated))))$$
$$RL = (R_{ref} / 1000) * D$$

Where:

D = length of wire used

Ploss = power loss in dB

Prated = power driven on line

RL = wire guage resistance

Vline = voltage on line

2. 10-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 10AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .302$ inches.
 - d. DCR @ 20 deg C: 1.07 Ohms/1000 feet.
 - e. Capacitance: ≤ 28 pF/ft.
 - f. Basis-of-Design: Belden 6T00UP.

3. 12-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 12AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .252$ inches.
 - d. DCR @ 20 deg C: ≤ 1.6 Ohms/1000 feet.
 - e. Capacitance: ≤ 36.0 pF/ft.
 - f. Basis-of-Design: Belden 6000UE.

4. 14-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 14AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .210$ inches.
 - d. DCR @ 20 deg C: ≤ 2.53 Ohms/1000 feet.
 - e. Capacitance: ≤ 36.0 pF/ft.
 - f. Basis-of-Design: Belden 6100UE.

5. 16-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 16AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .176$ inches.
 - d. DCR @ 20 deg C: ≤ 3.8 Ohms/1000 feet.
 - e. Capacitance: ≤ 36.5 pF/ft.
 - f. Basis-of-Design: Belden 6200UE.

6. 18-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 18AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .154$ inches.
 - d. DCR @ 20 deg C: ≤ 6.5 Ohms/1000 feet.
 - e. Capacitance: ≤ 34 pF/ft.
 - f. Basis-of-Design: Belden 6300UE.]

F. Audio, Mic/Line Level:

1. 22 AWG, 1 Pair, Shielded:
 - a. Single shielded pair cable with overall jacket.
 - b. Conductors: 22AWG (x 2), copper, stranded.
 - c. Shield: 100% aluminum polyester tape, 22AWG tinned copper drain wire.

- d. Nominal diameter: $\leq .128$ inches.
 - e. DCR @ 20 deg C: 16.4 Ohms/1000 feet.
 - f. Capacitance: ≤ 55 pF/ft.
 - g. Basis-of-Design: Belden 6500FE.
- 2. 22 AWG, 1 Pair, Shielded + 22 AWG, 2 Conductor:
 - a. Single shielded pair cable and single non-shielded pair with overall jacket.
 - b. Conductors: 22AWG (x 2), copper, stranded.
 - c. Shield: 100% aluminum polyester tape, 24AWG tinned copper drain wire.
 - d. Nominal diameter: $\leq .180$ inches.
 - e. DCR @ 20 deg C: 16.4 Ohms/1000 feet.
 - f. Capacitance: ≤ 55 pF/ft.
 - g. Basis-of-Design: Belden 6502GE.
 - 3. 22 AWG, 2 Pair, Individually Shielded:
 - a. Two individually shielded pairs cable with overall jacket.
 - b. Conductors: 22AWG (x 4), tinned copper, stranded.
 - c. Shield: 100% aluminum polyester tape, plus single 24AWG tinned copper drain wire.
 - d. Nominal diameter: $\leq .158$ inches.
 - e. DCR @ 20 deg C: ≤ 14.7 Ohms/1000 feet.
 - f. Capacitance: ≤ 34 pF/ft.
 - g. Basis-of-Design: Belden 1325A.]
- G. Data/Network/Control:
- 1. RS-232 / RS-422 / RS-485:
 - a. Single shielded pair cable and single non-shielded pair with overall jacket.
 - b. Conductors: 22AWG (x 2), copper, stranded.
 - c. Shield: 100% aluminum polyester tape, 24AWG tinned copper drain wire.
 - d. Nominal diameter: $\leq .180$ inches.
 - e. DCR @ 20 deg C: 16.4 Ohms/1000 feet.
 - f. Capacitance: ≤ 55 pF/ft.
 - g. Basis-of-Design: Belden 6502GE.
 - 2. RS-485 plus power (Specialized Media Control Networks):
 - a. Cable configuration: Shielded twisted data pair, plus one unshielded pair.
 - b. For use with products requiring combination power and RS485 data interconnections using a single jacketed cable solution. Sample applicable networks include: Crestron Cresnet™, Biamp Remote Control Bus, Lutron GRAFIK Eye® control bus, and similar RS485 based remote control networks.
 - c. Data conductors: 22AWG, tinned stranded copper, paired.
 - d. Power conductors: 18AWG, tinned stranded copper, paired.
 - e. Shield: 100% aluminum polyester tape, 24AWG tinned copper drain wire.
 - f. Nominal diameter: $\leq .205$ inches.
 - g. DCR – data conductors: ≤ 16.3 ohms per 1000 feet.
 - h. DCR – power conductors: ≤ 6.9 ohms per 1000 feet.
 - i. Capacitance – data conductors: ≤ 14.0 pF/ft.
 - j. Basis-of-Design: Belden 1392P.]
- H. Power Cables, Low Voltage:

1. Where wire gauge is not specified on the drawings, calculate based on the following requirements:
 - a. Voltage drop shall not exceed 5% of the circuit voltage.
2. 10-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 10AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .302$ inches.
 - d. DCR @ 20 deg C: 1.07 Ohms/1000 feet.
 - e. Capacitance: ≤ 28 pF/ft.
 - f. Basis-of-Design: Belden 6T00UP.
3. 12-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 12AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .252$ inches.
 - d. DCR @ 20 deg C: ≤ 1.6 Ohms/1000 feet.
 - e. Capacitance: ≤ 36.0 pF/ft.
 - f. Basis-of-Design: Belden 6000UE.
4. 14-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 14AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .210$ inches.
 - d. DCR @ 20 deg C: ≤ 2.53 Ohms/1000 feet.
 - e. Capacitance: ≤ 36.0 pF/ft.
 - f. Basis-of-Design: Belden 6100UE.
5. 16-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 16AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .176$ inches.
 - d. DCR @ 20 deg C: ≤ 3.8 Ohms/1000 feet.
 - e. Capacitance: ≤ 36.5 pF/ft.
 - f. Basis-of-Design: Belden 6200UE.
6. 18-Gauge:
 - a. Single pair cable with overall jacket.
 - b. Conductors: 18AWG (x 2), bare copper, stranded.
 - c. Nominal diameter: $\leq .154$ inches.
 - d. DCR @ 20 deg C: ≤ 6.5 Ohms/1000 feet.
 - e. Capacitance: ≤ 34 pF/ft.
 - f. Basis-of-Design: Belden 6300UE.

2.3 FLEXIBLE / PORTABLE CABLES

A. General Requirements:

1. Flexible / portable cables shall be derived from the system diagrams. Provide all products necessary for a complete and working system including those not expressly identified on the documents.

2. Cables designed and recommended by the cable manufacturer for portable and/or flexible applications shall be furnished for such applications.
3. Individual conductors shall be stranded in lieu of solid. Shields shall be braided in lieu of foil only, or foil and drain wire construction.
4. Flexible / portable cables shall be provided wherever cables are exposed to flexing as a natural by-product of their use. This includes cables furnished expressly for “portable” applications as well as furnished for permanent installation but are routinely exposed to flexing as an inherent consequence of their normal use. This overriding flexible requirement does not apply to cables used in tethers that are subject to flexing less than once per year and the flexing occurs to allow access for servicing of equipment.
5. Products depicted on the drawings which are not identified by brand and model are the responsibility of the Contractor to furnish and install. The decision whether a Contractor selected product is acceptable remains with the Designer.
- 6.

- B. Manufacturers: Subject to compliance with requirements, provide products by the following manufacturers:
1. Canare Cable.
 2. Crestron.
 3. Extron.
 4. Liberty Wire and Cable.
 5. Mogami Cable.
 6. Pro Co Sound.

2.4 CONNECTORS

- A. Video Connectors:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Belden.
 - b. Liberty Wire and Cable.
 - c. West Penn Wire.
 - d. Windy City Wire
- B. Audio Connectors:
1. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Canare Cable.
 - b. Liberty Wire and Cable.
 - c. Mogami Cable.
 - d. Neutrik.
 - e. Pro Co Sound.]
- C. Twisted pair Termination Devices:
1. Furnish cable compliant with Section 271513 “Copper Horizontal Cabling”
 2. Manufacturers: Subject to compliance with requirements, provide products by the following:
 - a. Manufacturers listed in 271513 “Copper Horizontal Cabling”.
 - b. Crestron

- c. Extron
- 3. General:
 - a. General Performance: Comply with transmission standards in TIA/EIA-568-C when tested according to test procedures of this standard.
 - 1) Twisted pair cable is required to have the appropriate Category classification as defined by TIA/EIA-568-C. Compliance with these electrical characteristics shall be third party verified by the manufacturer.
 - b. Provide the manufacturer recommended termination devices for the cable provided.

PART 3 - EXECUTION

3.1 CABLE UTILIZATION

- A. General:
 - 1. Where the Contract Documents identify only a general classification of product, the guidelines set forth in these specifications shall be used to determine the cable products to be provided.
 - 2. Where the Contract Documents, including the drawings and related specification do not identify a specific model or classification of product, the guidelines set forth within these specifications in conjunction with recommendations from the manufacturers of the interconnected equipment, and published industry standards and “best practices” shall be used to determine the appropriate product to be provided.
 - 3. Cable that is technically appropriate for the application shall be provided. Cables shall be classified by the manufacturer, in publicly available documents, for their intended use. For example, a cable used for RS232 signals shall be published as rated for RS232 applications. Furthermore, the model provided shall be technically sufficient for the length in which it is used.
 - 4. Provide cable models that are code compliant for the location, use, and method of installation. This includes, but is not limited to, providing plenum-rated cables wherever plenum cables are required by Code.
 - 5. Provide cable that is designed for portable use when the cable may be used in a portable application.
 - 6. Provide cable that is designed and manufactured to endure routine flexing when, by system design, the cable may be exposed to routine flexing.
 - 7. Provide cable models that are designed by the manufacturer for direct burial applications when the cable may come in contact with soil.
 - 8. Provide cable that allows required system performance to be achieved.

Speaker Cables:

- 9. Where the use of a specific cable is identified on the drawings, the identified cable shall be provided for the scope identified.
- 10. Where the use of a specific cable is not identified on the drawings, cables shall be chosen to achieve no more than 1dB of total power loss in the circuit.
- 11. The minimum gauge of speaker cable that may be used in any one-way “constant voltage” speaker circuit shall be 18AWG.

12. The minimum gauge of speaker cable that may be used in any one-way "low impedance" speaker circuit (2-16 ohms) shall be 16AWG.
13. Speaker cables used for bi-directional (i.e., two-way) intercommunications shall be shielded and twisted pair type cable.

B. Data, Serial, Parallel, and Control Cables:

1. Provide cables that are designed and rated by the manufacturer for the format of signal that the supplied cable will be used to transport.
2. The technical specifications of the cables shall be suitable for the length in which it is used, as well as capable of achieving error-free transmission of the signal at the fastest communication rate supported by the products ultimately being interconnected.

C. RF Communications:

1. Where RF frequencies are to be transported, provide cables that are designed by the cable manufacturer to transport the frequency range, the voltage and the current that is transported.
2. Provide cables that are sufficiently shielded to comply with FCC regulations, sufficient to prevent ingress and egress interference that adversely affects the system in which the cable is used, and sufficient to prevent egress interference that adversely affects other equipment and systems.

D. Low Voltage Power Cables:

1. Provided cables that are used for low-voltage power (≤ 70.7 RMS and ≤ 100 Peak) shall be of sufficient gauge to achieve each of the following:
 - a. $\leq 5\%$ maximum voltage drop between the power source and the load.
 - b. ≥ 18 AWG if the cable will transport > 500 ma or its length exceeds 20 feet.
 - c. ≥ 20 AWG if the cable will transport ≤ 500 ma and its length is than 20 feet.
 - d. Deliver voltage to the load that is not less than the minimum rated input voltage for the load.

E. Water blocked Cables:

1. Water blocked versions of cables shall be provided when:
 - a. The cable may be exposed to water.
 - b. The cable is installed outdoors.
 - c. The cable is installed below grade.
 - d. The cable is installed within conduit within a concrete slab that is above or below grade, and which there are one or more pull-boxes, junction boxes or other device boxes within the concrete slab along the path of the conduit.

3.2 INSTALLATION

A. Non-Plenum Cable in Plenum Areas:

1. Where non-plenum cable is supplied and code-compliant installation requires a plenum rating, provide a code-compliant pathway to enclose the cable.

B. Wiring Within Enclosures:

1. Provide adequate length of conductors. Bundle, lace, and train the conductors to terminal points and achieve clean service loops of appropriate length to the application.

2. Provide maximum possible physical isolation between cables of different operating levels to prevent crosstalk interference that degrades the performance or usability of the system.
 3. Replace, reroute, and redress cables that receive or cause negative interference of any form.
- C. Splices, Taps, and Terminations:
1. Install cables continuous and without splices, intermediate connections or terminations between products, except where expressly required by the Contract Documents.
 2. When required by the Contract Documents, splices, taps and terminations shall be made within an UL rated enclosure. In addition:
 - a. Cables shall be joined using standardized inline connectors of the type and rating compatible with, and approved by the Designer in advance for use with the cable and signal types being spliced.
 - b. Wire nuts are not permitted.
- D. Drain wire and shield preparation:
1. Non-insulated conductors (e.g., shields and drain wires) that are a part of a multi-conductor cable shall be individually insulated where the conductor exits the cable jacket. The conductor shall be covered with flexible high-temperature heat-shrinkable tubing of a size appropriate to the conductor.
 - a. Green color tubing shall be used except where it conflicts with another conductor's color within the same cable. Clear and white tubing (listed in order of preference) shall be used as necessary to maintain a non-conflicting conductor level color code.
 2. When a drain wire or shield conductor is insulated with tubing, as identified above, an additional piece of flexible high-temperature heat-shrinkable tubing shall also be installed over a portion of the cable jacket and the individual conductors where the individual conductors exit the cable jacket. This additional covering shall both insulate the remaining exposed portion of the shield/drain wire conductor and protect it to reduce the risk that this conductor can be bent easier than the manufacturer insulated conductors.
- E. Signal Cable Grounding and Bonding:
1. As a matter of practice, non-signal carrying and non-power passing shield and drain conductors shall be bonded to ground at one end only. The opposite end of the conductor shall be left floating. The shield shall be bonded at the signal sync (load, input) end of the cable. This practice shall be employed to reduce the risks of ground loops between the various interconnected audio components.
 2. Unterminated shields and drain wires shall not be cut off. Instead these conductors shall be insulated and prepped for termination and then folded back, protected and secured to the side of the cable jacket or stowed inside the connector shell (where space permits). These conductors shall remain intact and reserved for future and selective use when more challenging ground loop anomalies need to be remediated with the system.
 3. Alternate means of handling signal cable shield bonding may be considered when a well-documented grounding and bonding scheme has been submitted for review.
- F. Cable Separation:

1. Cables carrying different signal types shall be kept separate to prevent interference between cables.
2. Cables carrying similar signal types but at different nominal operating levels shall be kept separate to prevent interference between cables.
3. Cables from different systems shall be kept separate to better organize and identify systems as well as to prevent interference between systems.

G. Strain Relief:

1. Cables that are subject to changes in mechanical stress, and, especially those that are used in portable applications, shall be equipped with strain relief.
2. Cables that are probable to connect and disconnect more than once per year shall be equipped with strain relief at each end of the cable.
3. Conductors of cables shall not be exposed to any stress that could deteriorate either the mechanical or electrical integrity of the physical connection between the cable conductor and the connector to which it is attached.

H. Cable Management and Support:

1. Install cables in a neat and organized manner.
2. Route cables parallel to the product in which they are located.
3. Secure cables to wire management products using reusable hook-and-loop type fasteners.
4. Do not use nylon cable ties and other fasteners that pinch and stress cables.
5. Provide cable fasteners that are code compliant for the location and manner of installation.
6. Do not bend cables to a radius that is less than 8-times the cable diameter, nor less than the cable manufacturer's recommended minimum radius.

I. Flexible Cable Management and Support:

1. Provide expandable flexible sleeving:
 - a. Over bundles of two or more cables that have at least one end connected to movable / portable equipment.
2. Provide flexible strain relief:
 - a. Install strain relief products at each end of flexible cable assemblies so that no consequential strain is applied to a signal carrying component of the assembly nor to any connector or terminal to which the assembly interconnects. Size the strain relief to suite the assembly size. Provide an anchor for attachment of the strain relief and ensure that the anchor is attached to a sound structure that will not be damaged if strain is applied.

3.3 IDENTIFICATION

- A. Comply with Section 270553 "Identification for Communications."
- B. Provide identification of each end of cables. Nomenclature shall be clearly visible and accurately recorded on the as-built drawings.
- C. Use color-coded conductors, color-coded heat-shrink and color-coded permanent adhesive tape to designate individual conductors and cable unit. Record the color code on the as-built drawings.

3.4 TESTING

- A. Perform tests of cables after installation to confirm that each is performing effectively as an integral part of the system in which it is used. Test individual cable channels to confirm continued compliance with the Contract Documents and manufacturer's published specifications.

3.5 FIRESTOPPING

- A. Comply with Section 270550 "Firestopping for Communications."

END OF SECTION 27 41 01

SECTION 27 41 03 - AUDIO AND VIDEO SYSTEMS SOFTWARE DEVELOPMENT

PART 1 - GENERAL

1.1 SUBMITTALS

A. Control and DSP Programming:

1. Prior to the pre-construction meeting (described below), submit for review the initial DSP and control programs. Programs shall include the following at a minimum:
 - a. DSP
 - 1) Preliminary program structure including all expected blocks for the system.
 - 2) Speaker voicing based on manufacturer specifications.
 - 3) Appropriate Gain structure based on inputs as shown on plans.
 - 4) Control logic.
 - 5) Preliminary touch-panel layouts if DSP will be used for control.
 - b. Control System
 - 1) Preliminary program structure including all components for equipment that will be controlled by the system.
 - 2) Preliminary touch-panel layouts.

B. Quality Assurance:

1. Programmer qualifications (see Quality Assurance).

C. Closeout:

1. Electronic Documentation:
 - a. "Copyright, Ownership and Licensing Declaration" as described elsewhere in this Section, PDF version.
 - b. Storyboarding / flowcharting documentation, PDF version.
 - c. Software source code files.
 - d. Touch panel and other graphical user interface source code files.
 - e. Compiled graphics files.
 - f. Editable layered graphics files for Project specific custom graphics.
 - g. Current-version device drivers for controlled devices.
 - h. Controlled-device protocol documentation.

1.2 REVIEW MEETINGS

A. Pre-Construction Review

1. Prior to commencing on-site construction, the contractor shall attend a meeting at KLH Engineers to review the client expectations and system design considerations. The meeting shall not be scheduled without reviewed submittals including the reviewed program submittal described above. At a minimum, the

project manager and system programmer for the contractor shall be present. This meeting shall not exceed four (4) hours in length and will cover the following topics at a minimum:

- a. DSP structure and programming.
- b. Control panel design.
- c. Speaker aiming angles as designed and modeled by KLH.
- d. Staff qualifications.
- e. Testing and balancing materials and methods.

B. Post-Construction Review

1. Upon substantial completion of the system, the contractor shall meet on-site and demonstrate the operation of the system to KLH personnel for review. KLH will review the operation of the system based on the system drawings and the Pre-Construction meeting to ensure the system adheres to the design intent. The system should be fully tested and tuned prior to scheduling this review. This review shall not exceed four (4) hours in length.

1.3 PRICE AND PAYMENT PROCEDURES

A. Payment Procedures:

1. Requests for payment for Work will not be considered until Phases 1, 2 and 3 of the software development has been completed.
2. Progress payments for shall not be considered without electronic submission of Work progress. See also "Penalties for Non-Performance."

1.4 REFERENCES

- A. InfoComm International's publications: "Modern Approaches to Control Systems Design", <http://www.infocomm.org/>.

1.5 DEFINITIONS

- A. Controlled Device: A product with which the Software communicates. A controlled device is a physical or software-based product that receives commands/data from, or sends commands/messages/data to, the Software.
- B. IR: Infra-Red.
- C. GUI: Graphical User Interface.
- D. User Interface: Any physical or software-based product, custom or standard, that connects to and/or communicates with the control system and Software for the purpose of providing interactive interface between a system user and the Software.
- E. Software Developer: The entity responsible for performing Work of this Section.

1.6 QUALITY ASSURANCE

- A. Comply with Section 270002 “Quality Assurance for Communications.”
- B. Programmer Qualifications:
 - 1. Control Systems:
 - a. Manufacturer Certified Programmer. Certification shall be, at minimum, equivalent to Crestron Master Certified – Silver Level.
 - b. Resume of 20 programs or 5 years full-time computer programming experience.
 - 2. Shall be a full-time employee of the company providing the Division 27 41 00.00 work. Programing subcontractors are not permitted.

1.7 SOFTWARE LICENSING AND OWNERSHIP

- A. Supply a perpetual, irrevocable and royalty-free global license to use Software Work.
- B. Grant to the Owner the following number of licenses:
 - 1. One for each Audio and/or Video system identified in these Contract Documents.
- C. Source Code:
 - 1. Furnish fully editable source code for each processor, user interfaces and other control electronics.
 - 2. Layered electronic graphics files shall be furnished for user interface graphics.
- D. Rights to Modify Source Code:
 - 1. The Owner shall have the right to view and modify the source code and other files supplied. The Owner shall have the right to change the Software in any way it deems necessary, including but not limited to the right to evolve the Software to accommodate equipment changes, additions, deletions, or functional changes to the system.
- E. Payment of Licensing Fees:
 - 1. The Software Developer is responsible for properly licensing and making payment for any Software modules and graphics incorporated into Software Work, including license fees arising from the use of any part of software furnished by the Owner for the Software Developer’s benefit in creating Software Work.
- F. Copyright, Ownership and Licensing Declaration:
 - 1. In the event the Software Developer incorporates copyrighted work from any third-party entity into the Software Work, the Software Developer shall declare the lawful copyright holder and include valid contact information for the entity.
- G. Non-Disclosure:
 - 1. The name of the Owner may not be used in any advertisements, publications, lectures or any other public medium as it relates to the Software Developer’s role in creating this Software Work.
 - 2. The Software Developer may not reuse or demonstrate Software Work or any portion thereof that includes the name of the Owner, references to the Owner,

copyrighted material obtained from the Owner, or any other trade or service mark that could identify the Owner.

3. Should the Software Developer desire the right to publicly reference the Owner in any way, including demonstration of Software Work to others, the Software Developer shall obtain the express permission from the Owner, in writing.

1.8 WARRANTY

- A. Software furnished shall be warranted for a period of 365 days following final acceptance of the Software Work.
- B. During the warranty period, the resources necessary to resolve Software bugs shall be provided at no cost to the Owner. Software bugs that are catastrophic in nature shall be resolved within 3 business days following their report to the Software Developer by the Owner. Non-catastrophic bugs shall be resolved within 30 days.
- C. Software bugs are defined as:
 1. Any Software feature, operation, behavior, or mode that makes the system unstable or operationally unusable for the Owner's intended use of the system.
 2. The absence of any Software feature, operation, behavior, or mode determined necessary during the Software development phases that has not been implemented, not implemented completely, or not implemented reliably.
 3. Any Software feature that does not perform in the manner agreed to by the Owner's representative, or that otherwise performs in a manner that is counter-productive to the task to be performed by the Control System.
 4. The absence from the Software of any feature, operation, behavior, or mode expressly identified in the Contract Documents and not otherwise expressly removed from the Project scope in writing by the Designer.
 5. Incorrect labeling or misspelling of text on a programmable user interface.

1.9 MAINTENANCE

- A. Following final acceptance of the Software, the Software Developer shall return to the Project site at planned 30, 90 and 180-day intervals to make minor adjustments to the Software. The Software Developer shall contact the Owner at each interval to determine what, if any, Software adjustments are necessary. The Owner reserves the right to use these visits any time during the warranty period.

PART 2 - FUNCTIONALITY

2.1 GENERAL

- A. This Section is not a programming Manual. In general, this Section describes the capabilities and functionality expected of the Software product used to control related AV systems. The Software Developer shall be fluent in programming skills and well versed and experienced with the operational and programming needs of systems of the size, type, and complexity as those for which the Software is to be developed.

- B. This Section applies to multiple systems. Due to the presence of different equipment in each system, and the possible use of equipment with various capabilities, functionality described herein may not be completely possible with each system.
 - 1. Example: An AV system without remote controllable audio equipment shall not be required to have Software written with audio control capability unless express written direction to the contrary is identified.
- C. System functionality that is described in related Sections and Drawings that can only be achieved using custom Software are additive to the requirements of this Section. Review related Sections and Drawings.
- D. Due to the differences between products, including differences between products of like type, no attempt has been made to enumerate every remote-control function, operation and behavior that shall be accommodated by the Software.
- E. Functions described in the Contract Documents may not directly be available on the product being controlled. In such cases, functionality shall be achieved through development of suitable Software modules (e.g., intelligent macro) to achieve the desired effect. In select cases, the Designer or Owner may conclude the function is no longer required:
 - 1. Example: A motorized drapery or screen may not have an inherent "Preset" function. Therefore, a preset function may need to be emulated in the Software by timing the motor to run for a defined duration from a known position.
- F. Functionality and behaviors articulated in the Contract Documents are requirements of the Software Work until or unless otherwise modified and agreed to, in writing, with the Owner's Representative.

2.2 PERFORMANCE

- A. The Software performance shall be robust, predictable, reliable and stable.
- B. User interfaces shall accurately reflect the state of the system and controlled devices.
- C. Normal use of the system, including new-user encounters with the system, shall not result in a lock up of any portion of the system.
- D. System operation shall be restored to normal following a power failure to any controlled component or a control component. System and personnel-safe conditions shall be ensured by the Software following such conditions.
- E. The Software shall perform to the satisfaction of the Owner's representative.

2.3 SOFTWARE-AWARE PROGRAMMING

- A. The Software shall employ a coding methodology herein referred to as "Software-Aware programming."
 - 1. Software shall be aware of and locally buffer the status of the properties of a controlled device. This shall be true regardless of whether the settings of a

controlled device are changed by this Software via a device's local user interface, an external Software interface, a third-party software application, or by other means.

- a. Example 1: If a projector input is changed, the Software shall be aware of the current projector input change.
 - b. Example 2: If the program audio gain is changed using a third-party client application, the Software shall be aware of the current gain value.
 - c. Example 3: If a user presses play on a Blu-ray player, the Software shall be aware that the Blu-ray player is playing.
2. Software shall be aware of the current settings of controlled devices that are material to achieving accurate, responsive, and repeatable AV System performance under Software control.
 3. The Software shall leverage up-to-date information of the status of a device to achieve expedient and accurate logic decisions.
 4. Software user interface shall accurately represent the state of a device when the associated device status display is visible.
 5. Software decisions shall be made reliably, without having to routinely query a controlled device for a response immediately before taking the next logical step.
 6. Software Aware programming shall not rely on real-time on-demand polling for making routine logic decisions.
- B. In Software Aware programming, the Software shall not send commands to a controlled device to perform an action that the controlled device is already performing.
1. Example 1: If a video projector needs to be on Input 1 in order to display the most recent source selection, and if the projector is on Input 1 at the time the source selection is made, then the projector shall not be sent a command to change inputs, since it is already on the one it needs to be on. Conversely, if the projector had been changed to Input 2 (by the Software or other means), then the projector shall be switched to Input 1.
 - a. In this example, commanding the projector to switch to an input that is already active may cause video resynchronization which may result in a blank screen, flickering or other unnecessary and undesirable visual effects. It may also slow the responsiveness and performance of the system.
 2. Example 2: If a matrix already has Input 12 assigned to Output 14, the matrix shall not be sent a command to assign Input 12 to Output 14. Doing so may slow down the responsiveness and performance of the system.
- C. Software Aware programming requires a strategic mix of the following techniques:
1. Querying a controlled device to obtain critical device status properties.
 2. Querying controlled devices in the background, in a controlled manner, when the user is not actively making changes to the system.
 3. Monitoring and processing events and command acknowledgements of a controlled device software.
 4. Processing status messages received from controlled devices.
 5. Buffering device properties locally, within the control system hardware using arrays, objects, buffers, and modules.
 6. Highly modular, flexible and professional Software coding techniques.
- D. In Software Aware programming, a two-way touch panel shall accurately display settings of a selected device immediately when the device control page is activated. One second

(or longer) delays while the Software queries the device and then processes and reports the status to the user shall not be acceptable.

- E. Software Aware programming requires advanced programming skills and experience.
- F. Appropriately employed, Software Aware programming techniques shall result in Software performance that is robust, responsive, familiar, fast performing and does not result in Software induced, Software preventable aural or visual glitches.
- G. User interfaces that are part of a Software Aware programming solution shall be highly responsive to user stimulus to such an extent that users are not inclined to execute a command a second time because of a lack of user interface responsiveness.

2.4 USER INTERFACE FEEDBACK

A. General:

- 1. Implement controllable feedback on user interfaces (i.e., sound, lights and color change) as a means to achieve the following:
 - a. Supply an immediate acknowledgement to the user that the command has been received. Examples include the following:
 - 1) Changing the color of a button immediately in response to the user touching the button.
 - 2) Playing a sound in response to the user touching the button.
 - b. Supply immediate responses to the user to indicate the status of the command request. Examples include the following:
 - 1) Illuminating a power indicator "Green" when a device is powered up and ready for use.
 - 2) Illuminating a power indicator "Red" when a device is powered down and available to be power back on.
 - 3) Illuminating a power indicator "Flashing Red" when a device is in process of powering down.
 - 4) Illuminating a power indicator "Flashing Yellow" when an operation is in process.
 - 5) Displaying a progress bar while device is powering up and down and if this information is necessarily material to the user's next actions.
- 2. Where the user interface capability permits, supply separate means of achieving feedback to the user. Examples include the following:
 - a. Use a temporary button color change as an acknowledgement that the button has been pressed and was acknowledged by the system.
 - b. Use LED-like indicators to communicate device status.

B. Managed Feedback:

- 1. Feedback reporting shall be accurate and appropriate for the device(s) under control, including reporting of status changes that occur through direct interaction with a controlled device or other means.
 - a. Example 1: If the user makes a manual signal routing change via the control panel on a matrix, the Software shall monitor the matrix's events, or controlled background querying, to be aware of the change so it can be correctly reported to the user interface.

- b. Example 2: If the user hits play directly on a media player, the Software shall be aware of the change and correctly report that the media player is playing.
 - 2. When status information returned from a device to the Software is delivered slowly, (not fast enough to directly deliver an immediate response to the user) then a hybrid feedback solution shall be implemented. The hybrid solution shall result in immediate feedback to the user acknowledging their action, followed by command status feedback to advise the status of the request.
 - a. Example Situation: A lighting system takes 3 seconds to acknowledge a successful change from “Preset 1” to “Preset 3” following a user’s command to change.
 - 1) Example Solution:
 - a) Step 1: The “Preset 3” button immediately changes colors while it is being pressed as a means for the Software to acknowledge it has received the command. The button returns to normal color after the user’s finger is removed from the button.
 - b) Step 2: The Software initiates the request of the lighting system to change presets, and immediately begins to flash the “Preset 3” status indicator.
 - c) Step 3: The “Preset 3” status indicator illuminates solid on when the lighting system completes the transition to “Preset 3.”
 - b. Example Situation: A video projector takes 30 seconds to warm up, does not supply a warming-up status message, and does not acknowledge that it is On until after it is fully warmed up and ready for use:
 - 1) Example Solution 1:
 - a) Turn off the Power Off indicator and immediately begin flashing the projector Power On indicator.
 - b) Once the projector acknowledges that it is On, change the projector Power On indicator from flashing to constant.
 - 2) Example Solution 2:
 - a) Use a progress bar or similar control that communicates that the projector is warming up, incrementing the bar to emulate the warming process. Hide the progress bar, turn on the projector Power On indicator and turn off the projector Power Off indicator once the projector acknowledges it is On.
 - c. The manner in which hybrid solutions are deployed in the Software shall be as consistent as technically possible throughout the Software.

C. Infra-Red (IR) Controlled Devices:

- 1. Supply emulated status information for one-way controlled devices that do not otherwise supply status feedback. Review logic options with the Owner’s representative. In select cases, momentary feedback may be acceptable.

2.5 CONTROL METHODOLOGY

- A. To enhance overall Software performance, bi-directional communication control methods shall be used with controlled devices wherever possible in order to take advantage of device status information. Common bi-directional communication control methods include:

- 1. RS232.
- 2. RS485.

3. RS422.
 4. TCP/IP.
- B. Single direction communication control methods shall be used only where expressly specified or where it is the only method of control available on a specified product.
- C. Hybrid / Dual-Control communication methods shall be used when required functionality cannot be achieved through a single communication port. Such may be the case in a product that can achieve 98% of the desired functionality via its RS232 port, and the remaining functions are only available on an IR port. Hybrid methods shall be used as necessary to improve the stability and robustness of the Software application.

2.6 USE OF PRESETS OR MACROS

- A. The Software shall not use preset or macro functions of a controlled device if:
1. Use results in system performance that is slower than it would be if the applicable settings on the device were managed directly by the Software
 2. Use results in the loss of video or audio at any critical point in the system.
 3. Use results in any perceptible video or audio artifacts.
 4. Use results in negative effects on the system use or performance.
 5. Use results in any undesirable level or signal routing changes.
- B. Research the use of controlled-device presets or macros to obtain a thorough understanding of impact on the system performance. Use of presets and macros requires review and authorization of the Designer.

2.7 BEHAVIORS

- A. General:
1. The Software shall be written to include behaviors that would be considered familiar (i.e., intuitive) to the system users. Such familiarity may be derived from interaction with various other real-world interfaces such as personal computers, car radios, IPODs™, microwave ovens, home entertainment equipment or other products.
- B. User Interfaces:
1. User interface designs shall employ navigational schemes that limit the number of steps and interface layers that a user must navigate in order to perform a desired action. The more frequent a command must be executed in real-world use, the fewer actions the user shall be required to take in order to achieve the goal.
 2. One of the major objectives of Software user-interface design is to enable simple control of otherwise complex systems.
- C. Audio Breakaway and Audio-Lock:
1. Software shall incorporate functionality that permits the user to achieve the following:
 - a. Listen to audio from a multi-media (i.e., program) source without the necessity of having a video display powered on.
 - 1) Example: Listen to music or a lecture from audio-only media.

- b. Listen to audio from a multi-media (program) source, while viewing the video from a different source:
 - 1) Example: Listen to audio from a PC, while displaying video from a document camera.
 - 2. AV systems with two or more video displays (used for audience/participant viewing), Software shall include the ability to listen to the audio from either (but not both) of the visible multi-media sources.
 - 3. When changing the active multi-media source, audio switching shall function, by default, as an audio-follow-video switch, whereby a change in the video source, also results in a corresponding audio switch as well.
 - 4. In addition, an on-demand Audio-Lock feature shall be implemented to achieve the following:
 - a. Stop subsequent audio-follow-video switching.
 - b. Continued manual audio source assignment.
- D. Multi-Level Multi-Media Source Selection:
- 1. When user-interfaces featuring Graphical User Interface capability (i.e., touch panels) are used, and the user interface layout includes an approved two (or more) level approach to multi-media source selection, the Software shall include behavior that does not require the user to make a subsequent selection on the lowest level menu, unless the desired selection differs from the last selection.
 - a. Example: A level-one source select menu is implemented with the following choices: PC, Laptop, Doc Cam, Blu-ray, DVD, and Floor Pocket. The Floor Pocket has four (4) inputs. Touching the Floor Pocket source selection exposes a level-two source select menu that includes each of the four (4) floor pocket inputs. When the level-one Floor Pocket button is pressed, the level-two menu shall appear, the last used floor pocket input shall be active, and the signal associated with the last selected floor pocket input shall be routed to the associated display. The user shall not be required to make a level-two choice, unless it differs from the last selection. The act of pressing the Floor Pocket source select button therefore shall also have the effect of making active the last floor pocket input selection.
 - 2. At system initiation, default assignments shall be made for level-two source selection menus.
 - 3. This multi-level approach shall be employed similarly to other applicable controls. Deviation from this methodology shall occur only with written approval.
- E. Video Display Power Up:
- 1. Audience/Participant Video Display(s) shall, by default, power up under the following conditions:
 - a. The user assigns a video enabled multi-media source to the video display.
 - b. The user manually powers up the video display.
 - 2. Video displays shall not automatically power up when the System is powered up, unless this feature is deemed appropriate during the Software Development review with the Owner's representative.
- F. Video Swap:
- 1. A video swap feature shall be implemented in systems with two or more video displays serving the audience/participants. This feature is applicable when the AV system includes the inherent capability to route video signals to each display independently. The video swap function shall re-route/swap the video images

on the two displays. The swap shall be temporary. Subsequent video multi-media assignments made by the user shall route to and appear on the correct user-designated display.

2. When a video swap is performed, the system user interface(s) shall correctly reflect the assignment.

G. Audio Level Changes:

1. Audio level changes shall occur in real time. Audio level adjustments shall commence when a control is touched and shall cease immediately when the control is released. Audio changes shall not occur subsequent to the release of the control.
2. The rate of increase and decrease of audio settings shall be field adjusted to the satisfaction of the Owner's representative. Depending upon the product being controlled, this adjustment may require that the unit of change per cycle and/or the cycle/repetition rate (among others) be modified.
3. Bar graphs (and similar level reporting devices) shall accurately represent the relative gain of the device under control. This includes accurately displaying the gain settings anytime the bar graph is visible to the user, including immediately following a power up cycle, and following the recall of a preset or macro.
 - a. In the interest of performance, the Software Developer shall consider coding and control techniques that favor responsive control of a device by using a hybrid feedback solution while adjustments are being made. For example:
 - 1) If processing of gain status messages returned from a device causes delays in the speed at which commands to increase or decrease the level can occur, then locally emulating the level changes on the bar graph may be necessary. A subsequent release of the level control shall then be used to trigger an accurate refresh, or the bar-graph based upon the devices actual gain setting. The bar graph and actual device values shall match.
4. Use Software variables that are readily accessible to a technician and that do not require recompiling of Software.

H. Limited Range Controls:

1. User adjustments benefit from range limit settings. Where range limiting benefits the Owner, the Software Developer shall implement accordingly.
 - a. For example: The presenter microphone gain control may have a maximum gain that can be applied to it before acoustic feedback occurs. The same microphone may have minimum usable gain setting (e.g., one where the gain is not usable for a very loud-spoken presenter). The specific limits of the controls shall be determined in the field during system testing and demonstration with the Owner's representative.

I. Preset Status – Correct Reporting:

1. When a device is assigned a preset / scene by use of the Software, or by other means, the Software user interfaces shall correctly report the preset / scene currently active.
2. When either the Software user or an external user makes a manual change to a controlled device, and such change may mean that the device is no longer representing the preset / scene last selected, then the Software shall deactivate the user interface feedback that indicates the last scene selection.

- a. For Example: If a camera is instructed to go to Preset 1 and the camera complies, then the Preset 1 status indicator shall become active. If the user subsequently manually changes a camera position, the camera is no longer at Preset 1. Therefore, the act of manual repositioning shall result in the deactivation of the Preset 1 indicator.
- J. Disable Controls Not Applicable in Current Context:
1. The Software user interface shall expose only those controls that are applicable to the current context and operations. If a control has no purpose within the current context, the control shall either be hidden or systematically grayed out to indicate it is disabled, unusable and out of context.
 - a. Example 1: If an interface features three computer select buttons, and within the context of desired operation, one of the computers is in use by another room and it is (by design) not to be accessible locally, then the select button for the inaccessible computer shall be inoperable and either grayed out or hidden.
 - b. Example 2: A user interface includes source select buttons along the top of the screen. Operationally, if assigning a source requires a destination selection button to be visibly active, then if the destination button is neither active nor visible (because of another operation in process), the source select buttons shall also be disabled and grayed out or hidden.
 - c. This theme can be observed using various Microsoft Windows™ applications that gray-out selections that are not applicable in the current context.
 2. Disabling and/or hiding of controls shall be handled in a consistent manner throughout the Software.

2.8 DEFAULT SETTINGS

- A. Software shall ensure that controlled devices are in a known state when the system it controls is powered on, off, or placed into or taken out of standby.
1. Default values shall be set when the system is powered off so that in the event the controlled system is powered up using a means other than the control system interfaces, the system shall power up to a known state.
- B. Default settings shall include, but shall not be limited to:
1. Volume settings.
 2. Switcher / matrix settings.
 3. Mode settings.
 4. Video and audio processor settings.
 5. Screen positioning.
 6. Display status.
 7. Others as determined appropriate and necessary by the Software Developer and the Owner's Representative.
- C. Properly deployed default settings shall guarantee that proper settings are set in controlled devices when the system is powered on, regardless of what the settings were when the system was last used, and regardless of what setting changes may have been made locally to a controlled device by the user.

- D. Default settings shall be stored in a non-volatile memory location of the control system components.

2.9 CONTROLLED DEVICES

A. General:

- 1. Refer to related Sections and Drawings for identification of controlled devices. Controlled devices include:
 - a. Control system products appearing in the Drawings.
 - b. Products appearing on control system diagrams.
 - c. Products noted on control system diagrams as being connected to or otherwise communicating with the control system.
 - d. Products appearing in system diagrams and noted as being connected to the control system.
 - e. Products noted on related Drawings.
 - f. Products identified in related Sections.
- 2. Following are various controlled products that may be encountered, as well as common device-specific functions that shall be performed.

B. Multi-Media Sources:

- 1. Blu-ray, DVD, and similar devices:
 - a. Play, Stop, Pause.
 - b. Fast-Forward, Fast Reverse.
 - c. Step-Forward, Step Reverse.
 - d. Counter-Reset.
 - e. Power On/Off.
 - f. Channel Up/Down.
 - g. Discrete Channel and track selection.
 - h. Channel Display On/Off.
 - i. On-screen Display On/Off.
 - j. Closed Caption On/Off.
 - k. Menu Navigation Controls.
- 2. Document Cameras:
 - a. Zoom: In, Out.
 - b. Focus: In, Out.
 - c. Top Lights: On, Off.
 - d. Base Lights: On, Off.
 - e. Camera Up, Camera Down.
 - f. Power On, Power Off.
 - g. Presets Recall.
 - h. Preset Storage.

C. Recording Equipment:

- 1. Blu-ray, DVD, DVRs, NVRs
 - a. Play, Stop, Pause, Record.
 - b. Fast-Forward, Fast Reverse.
 - c. Step-Forward, Step Reverse.
 - d. Counter-Reset.
 - e. Counter/Track/Chapter Display.
 - f. Finalize/Close Disc.

- D. Video Display Equipment:
 - 1. Source selection based control.
 - 2. Manual signal routing.
 - 3. Power On/Off.
 - 4. Standby/warming-up/cooling-down messages.
 - 5. Lamp status/hours used/hours remaining.
 - 6. Video mute.
 - 7. Video freeze.
 - 8. Alignment controls.
 - 9. Menu navigation controls.

- E. Cameras:
 - 1. Pan, Tilt, Zoom.
 - 2. Storage and recall of presets, as required for the intended operation of the system:
 - a. Separate preset registers shall be implemented for each room layout.
 - b. Separate preset registers shall be implemented for each mode of camera automation as deemed necessary.

- F. Microphones:
 - 1. Software control of Status Lights/LEDs.
 - 2. Software monitoring of switch status, followed by execution of desired actions.

- G. Lighting Systems:
 - 1. Control of lighting levels of discrete lighting zones: Up, Down, Off.
 - 2. Recall of presets.
 - 3. Monitoring and display of current lighting preset(s).
 - 4. Store lighting presets.

- H. Drapes, Shades, Curtains, Screens:
 - 1. Up, Down, Open, Close, Stop.
 - 2. Recall presets.

- I. Routers and Matrices – Audio, Video, Data:
 - 1. Source/Destination based switching.
 - 2. Audio and Video breakaway switching.
 - 3. Manual switcher control.
 - 4. Input trim levels.
 - 5. Preview.

- J. Switchers – Audio, Video, Data:
 - 1. Source/Destination based switching.
 - 2. Audio and Video breakaway switching.
 - 3. Manual switcher control.
 - 4. Input trim levels.
 - 5. Seamless transition.
 - 6. Preview.

- K. Audio Products:
 - 1. Gain Up/Down.
 - 2. Mute.
 - 3. Routing.

4. Preset Recall.
5. Macro Recall.

2.10 CAMERA AUTOMATION

- A. Systems with cameras for video teleconferencing, broadcasts, recording and similar uses shall implement camera automation modes to manage which camera(s) and camera position(s) are active based upon various criteria. Common modes that shall be accommodated in the Software include the following:
 1. Push-To-Talk.
 2. Push-To-See.
 3. Automatic (gate based).
 4. Queued – First in, first out (i.e., manual “Next Question” selection).
 5. Manual Telemetry Control.
 6. Manual Preset Recall.
- B. The behavior of each mode shall be established during Software development.
- C. Camera automation shall regulate camera positioning and switching so that camera movement is not normally seen when the camera is live. This requires camera queuing and pre-positioning before the camera is made live.
- D. Visible movement from a camera shall only occur when a user manually positions a camera after it is live.
- E. Camera automation shall permit camera(s) to be taken out of service when a camera fails or is otherwise not available for use, and the remaining camera(s) shall pick up the work load of the camera(s) that are not available.
- F. The Software shall support multiple room configurations, where applicable, and shall manage separate camera selection and preset values for each configuration.

2.11 PREVIEW AND CONFIDENCE MONITORING

- A. Where the system under control is equipped with video preview and confidence monitoring equipment, the Software shall enable preview and confidence monitoring in a manner agreed to during Software development.
- B. When, where, what and how signals are triggered for monitoring shall be determined during Software development.

2.12 GLOBAL MONITORING AND CONTROL

- A. Control systems shall be programmed to communicate with, be controlled by, and supply status and statistical data to global management software, as applicable to the brand of control system hardware used on the Project. Sample applications include but are not limited to: AMX Media Manager and Crestron Room View.

2.13 HELP REQUEST

- A. User interfaces shall incorporate a “Call for Help” or similarly labeled button. This button shall be used to send an email, trigger the sending of a numeric or text page, or send a command/message to any other notification device connected to the system.
- B. The specific action taken shall be as agreed to during Software development.

2.14 HELP MESSAGES

- A. Graphical user interfaces shall incorporate the use of text-based help messages and operating instructions.
- B. Unless additional help messages are requested elsewhere in the specifications, at a minimum provide one unique pop-up style help message for each controlled device.
- C. Help messages shall be context sensitive. The message presented to the user shall be relevant to the current user interface view and mode at the time the button is activated.
- D. The manner in which the messages are activated and presented to the user shall be determined during Software development.

2.15 E-MAIL MESSAGING

- A. Software shall include provisions for sending automated email messages from the system.
- B. Up to **[20]** <Insert number> distinct email messages shall be programmable into each system.
- C. The system events that trigger messages shall be determined during Software development.

2.16 SHUTDOWN TIMERS

- A. General:
 - 1. Timers shall be implemented to shutdown select equipment or a complete system as described herein.
 - 2. Timer values shall be consistent values, stored in non-volatile memory.
 - 3. Time-of-day shutdown timers shall include a one-time-only bypass capability, whereby the user can instruct the system to bypass the next logical shutdown event so that shutdown will not occur at the next regularly scheduled time.
 - 4. Prior to automatic shutdown, the Software shall present a message on the various graphical user interfaces warning of a pending system shutdown. The message shall present options to the user, including options to shut down now, ignore the shutdown event altogether, or extend/delay shut down by a fixed amount of time. The amount of the advance warning and the amount of the time delay shall be determined during Software development. Initial values shall be five (5) minutes and one (1) hour.

5. Shutdown parameters shall be changeable by an advanced user or system administrator without the aid of a programmer. Updating these parameters shall be achieved through the use of one of the system's user interfaces, PC interface or database provided by the Software Developer.
6. If suitable replacement timers are incorporated into global monitoring and control application, local timers may not be necessary.

B. Visual Display Shutdown Timers:

1. Auto shutdown timers shall be programmed to place displays into standby or equivalent state, based upon various conditions. Common conditions include:
 - a. When a display has been assigned a Black or Blank source, a countdown timer shall commence that places the display into standby when the countdown timer reaches Zero.
 - b. When a predefined time of day is reached.
2. Display shutdown timer durations shall be global; however, each display shall feature a unique timer.

C. System Auto Shutdown:

1. Automatic system shutdown timers shall be programmed to power down the system under the following conditions:
 - a. When a user defined time of day has been reached.
 - b. After a user defined period of user interface inactivity.
2. Two separate time-of-day shutdown timers shall be programmed. One shall be used for weekends, and one shall be used for weekdays.
3. When a global management application is used, system auto shutdown timers may be relegated to the global management application instead of the local Software provided this is agreeable to the Owner's representative.

D. Special Circumstance Timers:

1. Where controlled devices other than those represented here are prone to excessive wear, operating or maintenance expense when left in a particular state, the Software Developer shall implement additional discrete timers adapted to the product. Software Developer shall consult with the Designer to determine which controlled devices may require special timers.

2.17 DATE, TIME, CLOCK AND TIMERS

A. Setting Date and Time:

1. The Software shall include the ability for the Owner to set the current date and time or feature an agreed upon alternate method for ensuring that the current date and time is accurate (e.g., network time server).
2. Special software or a programmer shall not be required to set these values.

B. User Interface Clock and Timer:

1. The Software shall incorporate clocks and timers on the user interfaces, visible at such locations as agreed to during Storyboarding, as described in Part 3 below.
2. Clocks shall be configured to permit 12-hour and 24-hour time. Consult with the Owner's representative.

3. Clocks shall be configurable to allow operation as timers. Each shall be programmed to achieve count-up and count-down operation. The user shall have the ability to switch between the various modes of operation.
4. Count-up and Count-down timers shall also be programmed to present some form of indication to the user that warns time is about to expire. The appearance of this indication (e.g. color change, dialog box, flag) shall be determined during Software development. Means shall also be included for a technician to change the warning period, means that does not require recompiling Software.

2.18 MODES OF OPERATION

- A. The Software shall include multiple modes of operation to suit the needs of the Owner. Common modes include the following:
 1. Normal Mode.
 2. Executive or Simple Mode.
 3. Advanced Mode.
 4. Administrative Mode.

PART 3 - EXECUTION

3.1 DEVELOPMENT PROCESS

- A. General:
 1. Software Development shall be the responsibility of the Software Developer.
 2. Development shall be a multi-phased interactive and iterative process lead by the Software Developer. Development shall involve input from, and interactive review with, the Owner's representative.
 3. Development shall begin not less than two weeks after award or notice of intent to award. Work shall be completed within such timeframe as to permit Work to be completed prior to the Owner's scheduled completion date(s).
 4. The Software Developer shall closely collaborate with parties providing related Work.
- B. Development Phases:
 1. Phase 1 – Needs Analysis:
 - a. This phase shall be used to refine the general expectations of the Software for each system that the Software controls, from a very high level perspective.
 - b. One or more meetings per system shall be expected.
 - c. The first meeting shall be scheduled within two weeks following Contract award, and the first meeting shall be held within three weeks following Contract award.
 - d. Information gathered during this phase, in the Contract Documents, and in subsequent development phases, shall be used to evolve expectations of the final Software Work.
 2. Phase 2 – Storyboarding / Flow-Charting:
 - a. The Software Storyboarding / Flow-Charting phase (henceforth called Storyboarding or Storyboards) shall be where the Software Developer

- creates physical documents to depict the navigational flow of the system (from a user interface/operation standpoint) and document the operation of the Software relative to the system(s) being controlled.
- b. This shall be an iterative phase whereby the Developer creates, presents, discusses and revises storyboards until there is a mutual agreement with the Owner.
 - c. At the conclusion of this phase, the resulting documents shall include information that:
 - 1) When reviewed by the Owner, the documents clearly communicate the operation and behavior of their system.
 - 2) When reviewed by a qualified programmer (including one with no prior knowledge of the system that the Software controls), communicates sufficiently to permit the writing of code that would meet the requirements of the Contract Documents and the intent of the Owner.
 - 3) When reviewed by the system installer, clearly communicates the intended operation and behavior of the system.
 - d. Storyboards shall be presented in hard-copy form on paper, either 24 inches by 36 inches or 30 inches by 42 inches in size.
 - e. Storyboards shall evolve to contain images of the permutations of each user interface. User interface images shall be drawn and interconnected in a flow chart fashion, and each element of the user interface shall be represented and described. Each button that performs a navigational action shall be interconnected to the view that results. Buttons performing an action shall also be described. The reader of the storyboard shall be able to follow it like a map, navigating through the operation of the system from start-up to shut-down and how to take advantage of features of the Software in-between.
 - f. The representations of user interfaces shall be presented as black on white line drawings, without graphic elements or color. Graphic elements and color on the storyboard representations at this phase routinely causes loss of functional focus and shall be avoided. Color may be used for annotations, interconnecting lines, and flow-chart logic and action text to enhance readability or flow interpretation.
 - g. Storyboards shall be used for graphical user interfaces (i.e., touch panels, client applications, web interfaces) as well as non-GUI type user interfaces (i.e., push-button panels).
 - h. The duration between review meetings covering a single user interface shall be kept as short as is practical, preferably not more than (2) to (3) days.
3. Phase 3 – User Interface Development:
- a. This phase shall result in the final appearance and operation of each user interface. This is an iterative process conducted between the Software Developer and the Owner’s representative.
 - 1) This phase shall involve reworking of the storyboards to accommodate modified Software flow, behaviors and conditions not evident or fully understood during prior phases.
 - b. This phase includes the following:
 - 1) Creation of real world user interfaces based upon the storyboarding documents.
 - 2) Development and implementation of graphics.
 - 3) Final sizing, shaping and positioning of buttons, indicators and text.
 - 4) Identification and assignment of color themes.

- 5) Creation/implementation of companion emulation Software that brings the user interface to life and enables evaluation of appearance, operational and navigational flow, behavior, and general responsiveness. Acceptable emulation Software allows the user interface to behave as though it were actively controlling the associated system.
 - a) Emulation Software includes: (a) Full navigational operation, (b) Button feedback, (c) Device status emulation, (d) System status emulation, (e) Working screen changes, page changes, pop-ups and messaging, and (f) Variable text change emulation.
- c. This phase is complete when the Software Developer has completed each prior development phase, and:
 - 1) Conducted working hands-on user interfaces demonstrations with the Owner's representative.
 - 2) Received conditional acceptance of the user interfaces from the Owner's representative.
 - 3) Final versions of this phase of Work, in electronic form, have been turned over to the Designer and the Owner's representative.
4. Phase 4 – Programming:
 - a. The Programming phase is the where the Software Developer shall write the Software to perform in accordance with the specifications and decisions made during prior Software development phases.
5. Phase 5 – Loading, Testing and Debugging:
 - a. The Loading, Testing and Debugging phase begins during, but near the end of the programming phase. During this phase, the Software shall be refined to make it fully usable by the Owner.
 - b. Software shall be loaded into the memory of applicable processors and components.
 - c. The Software shall be tested and debugged as an integral part of the complete systems being controlled. Adjustments shall be made to ensure that the Software meets the expectations of the Owner's representative.
 - d. If during this phase the Software Developer determines that the Software does not function as desired; the user interfaces do not operate in a familiar manner; the Software is unstable; or interactions with controlled equipment render the Software unstable, awkward to use, or unusable for the intended purpose, the Software Developer shall take remedial action. Should this be necessary, the Software Developer shall review the issue(s) with the Owner's representative and offer suggestions for remedial action. Acceptable remedial actions may include modifying user interfaces or adding, modifying or deleting Software features.

3.2 CHALLENGE RESOLUTION

- A. If for technical reasons it is not possible to achieve a specific functionality identified in the Contract Documents or included in the storyboards, consult with the Designer and the Owner's representative to review alternative options and assist in reaching a compromise solution.

3.3 OWNER'S MANUAL

- A. Software Developer shall provide custom printed and editable electronic documentation containing high quality graphical representations of user interfaces.
- B. Documentation shall include descriptive text that describes the use, flow, and operation of the system from a user perspective.
- C. Documentation shall be suitable for printing, photocopying and distribution by the Owner to users of the Software.
- D. Documentation shall include information covering advanced modes, hidden buttons, and other pertinent advanced features, as well as service information that a technical person, advanced user, and/or system administrator will need for the operation, management, maintenance and expansion of the system. Information regarding these advanced features shall be included on separate pages from the documentation so that they can easily be omitted from the information duplicated by the Owner and distributed to less advanced users of the Software.

END OF SECTION 27 41 03

SECTION 28 00 01 - COMMON WORK RESULTS FOR ELECTRONIC SAFETY AND SECURITY**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, Division 28 Specification Sections apply to all sections.
- B. NFPA 70
- C. Chicago Electrical code, Title 18 Chapter 27 of the Municipal code of Chicago
- D. Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section Underwriters Laboratories Inc. (UL):
 - 1. UL 365: Police Station Connected Burglar Alarm Units and Systems.
 - 2. UL 636: Holdup Alarm Units and Systems.
 - 3. UL 684: Local, Central Station, and Remote Station.
 - 4. UL 985: Household Fire-Warning System Units
 - 5. UL 1037: Antitheft Alarms and Devices
 - 6. UL 1610: Central-Station Burglar-Alarm Units.
 - 7. UL 1635: Installation and Classification of Residential Burglar Alarm Systems.
 - 8. Federal Communications Commission (FCC):
 - 9. Code of Federal Regulations Title 47: Part 15: Radio Frequency Devices.
- E. Code of Federal Regulations Title 47: Part 68: Connection of Terminal Equipment to the Telephone Network.
- F. Obtain the latest City of Chicago Design and Construction Standards document(s) from the Owner. Comply with all Owner-specific requirements in addition to requirements set forth in these specifications and accompanying drawings. Should there be a conflict, the Owner's standards shall take precedence, unless prevailing codes and regulations mandate otherwise.
- G. Related Drawings
 - a. All Electrical Drawings
 - b. All Technology (T-Series) Drawings
 - c. All Security and Fire Alarm Drawings

1.2 QUALITY ASSURANCE

- A. Qualifications: The Contractor's must be certified on the system being installed and if applicable with security systems be a licensed Alarm Contractor in the State of Illinois,

all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) .

1. Company with a minimum of five (5) years system design, engineering supervision, and installation experience in the security industry and has been authorized to install the products specified.
2. Comply with City of Chicago Electrical Code.
3. Code Compliance: UL or ULC Compliance and Labeling.

- B. Installer Qualifications: Engage an experienced installer for the installation and application of the products identified herein.
- C. Provide the services of locally licensed and authorized electrician(s) to perform that portion of the Work of this Division that is required by the applicable codes and/or the AHJ to be performed by licensed electrician(s).

1.3 GENERAL DIRECTION

A. EXAMINATION

1. Carefully review the Contract Drawings and Specifications.
2. Visit the site and verify that site conditions are in agreement with the design package.
3. Verify that all surfaces and areas are ready to receive work.
4. Verify field measurements as shown on drawings and as instructed by manufacturer.
5. Verify that required utilities are available, in proper location, and ready for use.

- B. Submittal of a bid indicates that the contractor has examined the drawings, specifications, and had an opportunity to visit the site to be able to provide a comprehensive complete bid.
- C. The intent of these specifications and the accompanying drawings is to provide complete and workable systems as shown, specified and required by applicable codes. Interpret these specifications in conjunction with the drawings and provide all work described. If work is shown on drawings and not mentioned in the specifications, or vice versa, it is to be included in the work the same as though clearly set forth by both. Should there be a conflict between the specifications and drawings, provide the greater quantity or better quality. Immediately notify owner's representative and design professional of such conflicts.
- D. The drawings that accompany these specifications are diagrammatic and although size and location of equipment is drawn to scale, wherever possible make use of submittal data and verify all dimensions on site. They do not show every conduit, offset or pull / junction box which may be required to install work in the space provided and avoid conflicts. Follow the drawings as closely as is practical and install additional pull / junction boxes and offsets where required by site conditions and codes at no additional cost. Install all new work in such manner as to conform to the structure, avoid obstructions, provide required service clearances and preserve headroom. Do not scale from drawings, measurements shall be taken in the field.

- E. Coordinate all new work with all other contractors and installers in addition to existing building obstructions and install accordingly. Refer to coordination drawings of other trades. Comply with requirements of architectural drawings including but not limited to mounting height and locations.
- F. Fully research peculiarities and limitations of space available for installation of work with materials being provided. Work around material lead times to not extend project schedule.
- G. Complete work, or part(s) thereof, at times as may be designated by the Owner's Representative, so that it can be used for temporary or permanent use. Do not construe such use of the system as an acceptance of it by Owner.
- H. During mobilization or construction, if an abnormal condition is uncovered either with existing conditions, equipment loads, submittal data, etc. bring these to the attention of the Design Professional for review.
- I. Owner's Representative or Design Professional may relocate fixtures, devices, equipment, etc. prior to installation within a 20-foot limit at no additional charge.
- J. Phasing - Where the scope of work dictates that the project shall be constructed in phases, all costs shall be incurred by this contractor for any temporary work required so that previous phases can be operational while construction is being done to adjacent spaces.

1.4 GENERAL STANDARDS

- A. Provide work in compliance with applicable provisions of the following standards. Provide listing and labeling for all electrical materials, marked for respective intended uses, from UL or other Nationally Recognized Testing Laboratory (NRTL) that is acceptable to applicable Authorities Having Jurisdiction (AHJs).
- B. Provide materials, installation methods, workmanship, testing, etc., in strict accordance with the latest edition of applicable standards and adopted codes, including (but not limited to) the following.
 - 1. International Building Code
 - 2. State Building Code and applicable amendments
 - 3. State Energy Code
 - 4. Utility company requirements and standards as applicable
 - 5. All provisions and requirements of NFPA (National Fire Protection Association)
 - 6. National Electrical Code (NEC), NFPA 70
 - 7. Life Safety Code, NFPA 101
 - 8. Local governmental and other prevailing codes and ordinances
 - 9. ADA/ADAAG requirements (American with Disabilities Act) including all applicable Standards for Accessible Design.
 - 10. UL (Underwriters Laboratories Inc.)
 - 11. ETL (Intertek Testing Services NA, Inc.)
 - 12. CSA (CSA Group Testing and Certification Inc.)
 - 13. FM (Factory Mutual Insurance Company)
 - 14. ASME (American Society of Mechanical Engineers)

15. NEMA (National Electrical Manufacturers Association).
16. NECA (National Electrical Contractors Association)
17. IP (International Protection Rating / Ingress Protection Rating)

1.5 PERMITS AND REGULATIONS

- A. Obtain and pay for permits, fees, certificates of inspection and approval, etc. required for this branch of the work. Furnish Owner with certificates of final inspection and approval prior to final acceptance of this branch of the work.
- B. Laws and regulations which bear upon or affect the various branches of this work shall be complied with by this contractor and are hereby made a part of this contract.

1.6 DEFINITIONS

- A. Furnish - Procure, supply and deliver to project site, ready for installation, install and warrant (unless indicated otherwise on documents). Include warranty expenses.
- B. Install - Assemble, wire and connect loose-shipped components on site. Place in position for service or use, including material, labor, accessories, services, and testing. Wire, connect, and render fully operational for intended use.
- C. Provide - Furnish and Install. Similar Terms: "include", "shall", "equip with", "consisting of"
- D. Equal or Equivalent - Determination of equivalency to be made by design professional for all products not listed as basis-of-design.
- E. Substantial Completion - Where frontend documentation does not define, products and systems must be fully installed as designed, tested, adjusted, labeled, and functionally demonstrated to owner.
- F. High Voltage: For the sake of this Division, greater than 70.7vac RMS; greater than 100vac P-P; greater than 49vdc.
- G. Low Voltage: For the sake of this Division, less than or equal to 70.7vac RMS; less than 100vac P-P; less than or equal to 49vdc.
- H. Structured Cabling: A standardized repetitive passive physical infrastructure of cables, conductors, terminations, hardware and supporting products that together are used to enable the conveyance of signals, information, and data between different locations. Such systems are commonly constructed in accordance with standards published by various standards organizations, including but not limited to the TIA, EIA, NICET and BICSI. In some cases, specialized derivatives of these standards are constructed to meet specialized system needs. Common usages of structured cabling systems include such things as computer or data networks (including wireless infrastructure), telephone systems, building automation systems, electronic safety and security systems, and building intercommunications systems. The structured cabling system does not include any active electronic equipment.

- I. Audio-Visual / Audio and Video Systems Work: That portion of the Project that involves the supply, installation, programming, or testing of products whose fundamental purpose is the reproduction, pickup, storage, transporting, processing, control of audio and/or video signals. Scope of this definition includes all incidentals that are regularly and fundamentally required to provide complete and working systems from the small and simple to the large and complex.

1.7 REQUESTS FOR INFORMATION

- A. See Section 01 25 13 – Request for Interpretations

1.8 ACRONYMS AND ABBREVIATIONS

A. General Industry Terms

1. ADA: Americans with Disabilities Act.
2. ANSI: American National Standards Institute.
3. AWG: American Wire Gauge.
4. BICSI: Building Industry Consulting Services International.
5. BOM: Bill of Materials.
6. Bps: Bits per second.
7. LEC: Local Exchange Carrier.
8. dB: Decibel.
9. Device ID: A system specific label assigned to a product to uniquely identify it within a given a system.
10. DSL: Digital Subscriber Line.
11. EF: Entrance Facility.
12. EIA: Electronics Industries Association.
13. EMI: Electromagnetic Interference.
14. ER: Equipment Room (a type of Communications Room).
15. Gb/s (Gbps): Gigabits per second.
16. GHz: Gigahertz.
17. IDF: Intermediate Distribution Frame (Replaced by TR).
18. IEEE: Institute of Electrical and Electronics Engineers.
19. ISO: International Organization for Standardization.
20. ISP: Internet Service Provider.
21. LAN: Local Area Network.
22. MAC: Media Access Control.
23. Mb/s (Mbps): Megabits per second.
24. MDF: Main Distribution Frame (Replaced by ER).
25. MHz: Megahertz.
26. MPLS: Multi Protocol Label Switching.
27. OFCI: Owner Furnished Contractor Installed.
28. OFE: Owner Furnished Equipment.
29. OFOI: Owner Furnished Owner Installed.
30. PoE: Power over Ethernet.
31. PSTN: Public Switched Telephone Network.
32. QoS: Quality of Service.
33. RAID: Random Array of Inexpensive Disks.
34. RAM: Random Access Memory.

- 35. RFC: Request for Comment.
- 36. RFI: Request for Information/ Radio Frequency Interference.
- 37. RFP: Request for Proposal.
- 38. RFQ: Request for Quotation.
- 39. SNMP: Simple Network Management Protocol.
- 40. SSD: Solid State Drive.
- 41. TB: Terabyte.
- 42. TCP: Transmission Control Protocol.
- 43. TCP/IP: Transmission Control Protocol/Internet Protocol.
- 44. TIA: Telecommunications Industries Association.
- 45. TR: Telecommunications Room (a type of Communications Room)
- 46. VoIP: Voice over Internet Protocol.

1.9 ADMINISTRATION

- A. See Section 01 31 00 Project Management and Coordination

1.10 WARRANTY

- A. System Components including all subsystems that comprise the systems as described within this specification shall be warranted for a period of one (1) year that shall begin after Owner acceptance.
- B. The Contractor shall guarantee all labor, workmanship, and materials for a period of three years from the date of final acceptance. Should a failure occur within the warranty period, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and acceptance for this contract, at no cost to the Owner. During this period, the Contractor shall provide, free of charge, all software upgrades and patches.
- C. During the warranty period, additional card readers and components may be connected and their use entered in database. New devices will be connected in the same manner as shown on the drawings for this contract and the existence of the new connections shall not void this warranty.
- D. Provide a warranty/guarantee in written form as part of O&M manual stating that all work, materials, equipment and parts are warranted to be free of defect for a minimum period of one year from the date of Substantial Completion. Warranty period and requirements may be expanded in drawings or subsequent specification sections. Repair or replace (owner's option) any defects or failures at no cost to the owner within the warranty period. Issues arising within warranty period must be attended to in a timely manner and in no case exceed four (2) working days. State this in writing as part of O&M manual. Replace defective items to the satisfaction of the Owner's Representative and the Design Professional.

1.11 SUBMITTALS

- A. Product Data: For each type of product indicated.

- B. Shop/Coordination Drawings: Detail major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.
1. Wiring diagrams showing device circuiting.
 2. System plan drawings showing device zones.
 3. Battery backup calculation.
 4. CCTV display pattern diagram.
 5. Proper labeling for panels and equipment
- C. Furnish a copy of an operation and maintenance manual consisting of PDFs, word documents etc. with a copy of the warranty, equipment specification, programming instructions, programming software disks, maintenance instructions and full sized copies of **as built drawings** including conduit routing, junction points, and devices in electronic format as well. In addition all system programming data shall be backed up and provided in electronic USB format to 2FM Alarm Section. Include names and phone numbers to contact for assistance, maintenance, and warranty service on the first page. Deliver to 2FM Alarm Section at time of demonstration and training required in Part 3.
1. License to Use: All software required for each component, and for the complete operation of the system as specified herein shall be delivered with either full Ownership transferred to the Owner or a non-time limited License to use on each machine it is installed on, including the right to make backup copies and the right to install the software on a new piece of hardware upon failure of the original. The licenses are to be provided on a CDROM or other storable form at the time of project acceptance.

1.12 INTELLECTUAL PROPERTY

- A. Patents:
1. Should patented articles, methods, materials apparatus, etc., be used in this work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and his agents harmless for any delay, action, suit, or cost growing out of the patent rights for any device on this Project.
- B. Copyrights:
1. Should copyrighted software be used in this work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and his agents harmless for any delay, action, suit, or cost growing out of the copyrights for any software on this Project.

PART 2 - PRODUCTS

2.1 GENERAL

- A. Materials, apparatus and equipment shall bear the Underwriter's Laboratory, Inc. label (or other nationally recognized testing laboratory label) where regularly supplied, and as additionally required by Code or the Contract Documents.

- B. Products furnished shall be new, full weight and of the best quality. Similar supplied materials shall be of the same type and from the same manufacturer.
- C. If a specified product is discontinued by the manufacturer and is no longer available for purchase, replacement product of equal or greater value, performance and function as the discontinued Basis of Design product shall be furnished. The replacement product shall be from the same manufacturer as the Basis of Design product unless written permission has been granted by the Designer. The Contractor is solely responsible for researching and submitting proposed replacement product. The final decision as to whether a Contractor proposed replacement is acceptable lies solely with the Designer.
- D. Substitute products shall only be considered if the Contractor has strictly adhered to the guidelines set forth under "Substitutions" as defined in this Section.

2.2 BASIS OF DESIGN

- A. Some of the Contract Documents are prepared on the basis of specific products that are designated as the "Basis of Design."
- B. The Basis of Design products for the Work of this Division are designated explicitly within the specifications, and in the case of some products, designated by brand and model on the Drawings.
 - 1. Where a product brand and model is expressly identified on the Drawings, this product represents the Basis of Design for that instance of the product in the associated system.
- C. The combination of Basis of Design products and the interconnection thereof collectively represent a work that includes the feature set and performance intended by the Designer and the Owner. The specifications may identify additional manufacturers whose equipment may be used in the system, provided the use of such products achieves the same capabilities and performance as that of the specified combination of the Basis of Design products.
 - 1. Due to the varied and integrated nature of modern communications products, there is no guarantee that any single product manufactured by any one of the listed additional manufacturers will be an exact equivalent to a single Basis of Design product in terms of functionality, capability or performance. Therefore, where the use of substitute product is considered, the product shall be verified by the substituting party to include the capabilities, features and performance as that of the Basis of Design product.
 - 2. Work of the Contract shall include covering the cost of additional products and labor necessary to achieve the same end results as would be achieved by using the specified combination of Basis of Design products, including additional costs for coordination, modifications to the building, pathway modifications, casework and furniture modifications, power modifications, licensing, or anything else that may cause additional expense to the Owner.
 - 3. In addition, costs incurred by the Owner's design team to accommodate such changes shall be the responsibility of the party making the substitution.

2.3 SUBSTITUTIONS

- A. A substitution is the use of any product other than that identified as the “Basis of Design,” the “Standard of Quality,” or an “Additional Approved Product.”
- B. Substitutions require pre-bid approval. Only substitutions authorized via addendum shall be considered.
- C. Substitutions are considered on a product-by-product and model specific basis.
- D. Substitution Submittal Requirements:
 - 1. Substitution requests must be received by the Designer sufficiently in advance of the scheduled bid date to allow time for review and issuance of an Addendum. If the timing of the request does not permit an Addendum, substitution shall not be considered or acceptable.
 - 2. Substitution requests shall consist of the following for each proposed substitution:
 - a. Substitution Request Letter
 - b. Product Datasheets/Brochures
- E. Costs that result from the use of substitute products and/or Additional Approved Manufacturer(s), including costs for additional equipment, coordination, accessories, modules, interface products, cables, software, and programming, as well as costs for any additional labor, materials, and products incurred by other trades or members of the project Design Team or Owner, are the sole responsibility of the Contractor making the substitution. This includes costs that may not be incurred or known until after Contract award or Work execution. Such costs shall be deducted from final sum payable to the Contractor.
- F. Post Contract award substitutions may be considered, but only if the proposed substitution includes substantial additional benefit to the Owner. Post award substitutions are considered solely at the discretion and convenience of the Designer. For a post Contract award substitution to be considered, one or more of the following shall apply:
 - 1. The Designer initiates the request for substitution.
 - 2. A basis of design product has become discontinued and is no longer available, and as a result, the use of a substitute product has become a necessity to meet the Owner’s objectives for the Project. See “Discontinued Products.”
 - 3. The request for substitution is accompanied by a proposal that identifies the benefits to the Owner, including a fair-market Contract price reduction.

2.4 DISCONTINUED PRODUCTS

- A. The availability of products shall be verified by the Contractor prior to submitting pricing for Work of the Contract.
- B. In the event that a specified product is discontinued at any time and becomes unavailable for use on the Project, provide a replacement product deemed acceptable to the Designer. Replacement product shall be of equal or greater value, performance and functionality.

1. Replacement product shall be from the basis of design manufacturer, from one of the additional product manufacturers identified for the product within the Section, or from another manufacturer deemed acceptable to the Designer.
- C. The cost for the supply and installation of suitable replacement product is the sole responsibility of the Contractor.
- D. Replacement products are considered substitutions and require Designer review and authorization. See "Substitutions."

PART 3 - EXECUTION

3.1 WORK AND WORKMANSHIP

- A. Provide labor, materials, equipment, and services necessary for complete installation of systems required to comply with the requirements of authorities having jurisdiction (AHJ), as indicated within the Contract Documents.
- B. Work shall be functional and complete in every detail, including items required to complete the system, regardless of whether each necessary item is fully enumerated in the Specifications or shown on the Drawings.
- C. Contractor and Subcontractors shall be knowledgeable of the details of Work to be performed by other trades and take necessary steps to integrate and coordinate Work of this Division with that of other Divisions and other trades.
- D. Wherever tables or schedules show quantities, they shall not be interpreted to represent the total contract quantity requirement, but instead a portion of the Contract requirement. The Contractor shall be responsible for the higher quantity communicated by the Drawings, within the Specifications and on the schedules/tables. Seek clarification from the Designer should a discrepancy be found.
- E. The Designer and Owner's Representative may, at their sole discretion, condemn or reject any Work, materials, or equipment not in accordance with the Contract Documents or the manufacturer's specifications or drawings reviewed by the Designer or Owner.
- F. Work or equipment that is rejected shall be removed and replaced to the satisfaction of the Owner and Designer at the Contractor's expense. Work or equipment that is rejected shall be so stated in writing by the Owner or Designer.
- G. Work shall fully comply with the Contract Documents and manufacturer's recommended installation guidelines.
- H. Work shall be performed with the best practices of the trade for performance, functionality, safety, endurance and aesthetics.
- I. Coordinate ordering and installation of equipment with long lead times or having a major impact on work by other trades so as not to delay the job or impact the schedule.

- J. Where mounting heights are not detailed or dimensioned, install systems, materials and equipment to provide the maximum headroom possible. Consult the Designer for direction.
- K. Supply scaffolding, rigging, hoisting and services necessary for erection and delivery of equipment and apparatus furnished into the premises. These items shall be removed from premises when no longer required.
- L. Work shall be installed level and plumb, parallel and perpendicular to prevailing building lines, except as expressly detailed otherwise or required for proper form, function or Designer-intended operation.
- M. Specialty tools shall be used for assembly, installation, termination, and removal of products as recommended by the product manufacturer.

3.2 TESTING

- A. General:
 - 1. Upon complete physical installation of products, align, balance, and adjust equipment to make it usable to the Owner for the intended purpose, and ensure compliance with the Contract Documents.
 - 2. Test each system and each component thereof, and correct deficiencies prior to scheduling acceptance testing.
 - 3. Replace malfunctioning or damaged products with new product, following immediately with retesting until satisfactory performance and specification compliant conditions are achieved.
- B. Operational Testing:
 - 1. Perform operational testing of supplied products individually and collectively to verify conformance with the Contract Documents, to ensure compliance with the product manufacturer's published specifications, and as additionally necessary for the system to meet the intended purpose.
- C. Performance Testing:
 - 1. Perform measurements and testing necessary to demonstrate performance compliance.

3.3 TRAINING

- A. Training shall be supplied for each Section of this Division and for each unique system provided.
- B. The Owner shall have the right to use the total allocated training for a period of 1 year following final completion of onsite work, solely at its discretion.
- C. Training shall be supplied as expressly identified within individual Sections. Where training requirements are not otherwise expressly identified, the Contractor shall furnish a minimum of two (2) hours per unique system, per Section. The Contractor

shall presume that at least two (2) discrete trips to the project site shall be required per unique system to conduct training.

- D. Training dates and times shall be coordinated with the Owner's designated training representative(s).
- E. Training shall cover the following:
 - 1. Normal system use and operation.
 - 2. Procedures and schedules involved in troubleshooting and performing routine preventative maintenance.
 - 3. Other facets as identified in individual Sections.
- F. Agenda and relevant training handouts shall be prepared and distributed to attendees at each training session.
- G. A sign-in sheet shall be created and used for each training session. The sheet shall identify the following, at a minimum:
 - 1. Specification Section reference and system(s) being trained.
 - 2. Date and starting time of the session.
 - 3. Signatures of attendees.
 - 4. Ending time of the session, along with a separate owner signature certifying the ending time.
 - 5. Training outline/agenda.
- H. Recording of Sessions:
 - 1. Recordings shall be supplied on DVD video format media playable in standard consumer grade reproduction appliance. Recordings do not need to be professionally edited but shall feature intelligible audio and a clear image of the subject trainer and any supplemental visual content material to the training.
 - 2. Recordings shall be turned over and signed for by an Owner's training representative at the end of each session. A copy of a signed delivery receipt shall be included as part of the closeout documentation.
 - 3. Contractor shall require each attendee to sign-in at the start of each training session. The sign-in form shall summarize the training conducted, specification section reference and system being trained on, as well as the starting time and duration of training. Following training, a representative of the Owner shall sign the form, acknowledging the same. Contractor shall retain the original copy of these forms and turn over a photocopy of the form to the Owner's representative as evidence of training. Training conducted without this official record of training shall not be considered as part of the Contractor's training obligation.
- I. For a training session to count towards the training obligation, each of the following shall be met:
 - 1. Training occurs after Training Submittal review.
 - 2. Training session outlines / agenda are distributed at the session.
 - 3. Quality Assurance requirements for the instructor have been met.
 - 4. Training occurs after the system / section is complete and working as intended by the Contract Documents, usually following Acceptance Testing. Training in advance of this requires Designer approval.
 - 5. Sign-in sheets are used, completed, and retained for the session.
 - 6. A master log of training conducted for the project is maintained.



28 00 01 - COMMON WORK RESULTS FOR
ELECTRONIC SAFETY AND SECURITY - 13

END OF SECTION 28 00 01

SECTION 27 00 02 - QUALITY ASSURANCE FOR ELECTRONIC SAFETY AND SECURITY**PART 1 - GENERAL****1.1 SUBMITTAL REQUIREMENTS**

- A. Quality Assurance:
 - 1. Quality Assurance: General Qualifications.

1.2 SUMMARY

- A. Section Includes:
 - 1. Quality Assurance requirements for Work of this Division.
- B. Related Requirements
 - 1. Related Sections
 - a. All Division 28 Sections.

1.3 QUALITY ASSURANCE

- A. General Qualifications:
 - 1. Business history of the last five (5) contiguous years performing work of similar type, value and scope as that required of the Contract Documents.
 - 2. Capable of demonstrating through valid references and other means that it has successfully completed no less than six (6) projects of similar type, monetary size, and scope of work within the last twenty-four (24) calendar months.
 - 3. A "Factory-authorized" reseller (e.g., distributor, dealer, integration partner, value-added reseller, channel partner) for the products furnished for each Section.
 - 4. House substantial business operations within a 300-mile radius of the project site.
 - 5. Employ full-time service staff based within a 50-mile radius of the project site.
 - 6. Financial Disclosure of the Contractor: Prior to contract award, upon request.
- B. Superintendent/Project Manager Qualifications:
 - 1. Furnish the services of an experienced superintendent/project manager who shall be constantly in charge of the Work, together with a qualified foreman and technical specialists to properly install, connect, adjust, start, operate and test the Work involved.
 - 2. Qualifications are subject to the review and acceptance by the Designer and Owner. Unless the Designer and Owner grant prior permission, the same superintendent/project manager shall be utilized throughout the duration of the Project and shall remain responsible for the complete scope of the Work.
- C. Subcontractor Qualifications:
 - 1. If the Contractor, as a singular entity, does not meet 100-percent of the quality assurance requirements for each specification section, the Contractor shall enlist the services of qualified subcontractors to perform the Work of those specific

section(s). This includes, but is not limited to, the supply of the products for the Section and the supply of the project engineering services, preparation of shop drawings and section submittals, technical installation labor, training, warranty, post-installation support and service.

2. The Contractor shall ensure that each subcontractor supplies the services of a project manager to represent its interests at the same project meetings in which the Contractor participates.
3. The Designer and Owner reserve the right to disqualify the use of any subcontractor that does not meet the quality assurance requirements set forth in these specifications. Should a subcontractor be disqualified, the Contractor shall supply the services of a different subcontractor that complies with the published quality assurance requirements. The Contractor is solely responsible for costs incurred as a result. It is therefore incumbent upon the Contractor to pre-qualify subcontractor choice(s) prior to submitting pricing for work.
4. To achieve quality assurance compliance, an equipment vendor that is not performing the technical installation labor associated with work of a Section shall not be considered a subcontractor.

D. Training Qualifications:

1. Personnel conducting training shall be knowledgeable of the product, system and technology on which they train. Personnel shall be factory trained, factory certified and/or otherwise recognized by the Designer as possessing sufficient experience and knowledge in the subject area.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 QUALITY ASSURANCE SUBMITTALS

- A. Provide documentation that demonstrates the qualification for each requirement articulated in this Section and in compliance with Section 01 33 0.

END OF SECTION 28 00 02

SECTION 28 00 03 - OWNER'S STANDARDS DOCUMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Division 01 Specification Sections, Division 27, and Division 28 (if applicable) Specification Sections apply to this Section.

1.2 SUMMARY

- A. This Section includes the current version of the City of Chicago, **Electronics Systems Specifications Standard dated 2019 and Surveillance Systems dated 2019**. Comply with the requirements of this Section which shall be referred to as the "Owner's Standards Document."
- B. Related Requirements:
 - 1. The requirements of the Contract Documents and the Owner's Standards Document shall be additive. E.g., if the Contract Documents require cables to be labeled, and the Owner's standards do not indicate labeling, labeling shall be provided as specified in the Contract Documents.
 - 2. Where other Division 27 and Division 28 Specification Sections and this Section (i.e., the Owner's Standards Document) are in direct conflict, the Owner's Standards Document shall supersede the requirements of other Division 27 and Division 28 Section(s). E.g., if the Contract Documents require cables to be labeled, and the Owner's Standards Document expressly states do not label cables, the Documents are in direct conflict and the Owner's Standards Document shall supersede the Contract Documents.

1.3 OWNER'S STANDARDS DOCUMENT

CITY OF CHICAGO (2FM) - ELECTRONIC SYSTEMS SPECIFICATIONS

1.4 OVERVIEW

- A. Standardization of systems
 - 1. In an effort to maintain consistency and serviceability across the portfolio of facilities under its control 2FM requires specific system types and models so that system certified in house staff can successfully repair and maintain said systems.

1.5 RELATED DOCUMENTS TO 280001

- A. NFPA 70

- B. Chicago Electrical code, Title 18 Chapter 27 of the Municipal code of Chicago
- C. Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section Underwriters Laboratories Inc. (UL):
 - 1. UL 365: Police Station Connected Burglar Alarm Units and Systems.
 - 2. UL 636: Holdup Alarm Units and Systems.
 - 3. UL 684: Local, Central Station, and Remote Station.
 - 4. UL 985: Household Fire-Warning System Units
 - 5. UL 1037: Antitheft Alarms and Devices
 - 6. UL 1610: Central-Station Burglar-Alarm Units.
 - 7. UL 1635: Installation and Classification of Residential Burglar Alarm Systems.
 - 8. Federal Communications Commission (FCC):
 - 9. Code of Federal Regulations Title 47: Part 15: Radio Frequency Devices.
 - 10. Code of Federal Regulations Title 47: Part 68: Connection of Terminal Equipment to the Telephone Network.

1.6 SUMMARY TO 281301

- A. This Section includes the limited scope construction materials and methods for application with electrical installations as follows:
 - 1. ACMS, IDS, CCTV and facility's security related equipment.
 - 2. Remote door lock release as well as card reader equipped door access monitoring by ACMS.
 - 3. Miscellaneous materials for support of electrical materials and equipment.
 - 4. Connection to existing head end equipment for monitoring and alarm signals.
 - 5. Monitoring and signal connection to ACMS,IDS, CCTV systems.
 - 6. Provide door hardware for ACMS,IDS system.

1.7 PROJECT CONDITIONS TO 281301

- A. The Contractor shall configure the system as described and shown. The system shall include all connectors, adapters, and terminators necessary to interconnect all equipment. The Alarm Contractor's must be a licensed Alarm Contractor in the State of Illinois and City of Chicago, all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) on their person and shall be furnished to 2FM Security before work is to begin. In the event of personnel changes the above requirements shall be updated and furnished to 2FM Security before that individual is to begin working.
- B. Data Entry TO 281301
 - 1. The Contractor shall enter all data needed to make the system operational. The Contractor shall identify and request from the Owner, any additional data needed to provide a complete and operational security system. The completed forms shall be delivered to the Owner for review and approval at least 10 days prior to the Contractor's scheduled needed date.

C. Conduits TO 280501 AND 281301

1. All IDS cabling shall be encased in conduit **Blue** in color minimum of ¾".
2. All CCTV cabling shall be encased in conduit **Purple** in color minimum of ¾".
3. All ACMS cabling shall be encased in conduit **Orange** in color minimum of ¾".
4. All fire systems shall be encased in conduit **Red** in color minimum of ¾".
5. If conditions do not allow for colored conduit to be installed, the contractor is responsible for labeling the conduit and to inform the Owner as how to proceed immediately.

D. WIRE AND CABLE TO 280501

1. Cabling utilized for the interconnection of field items specified herein shall comply with or exceed the recommendations of the component manufacturers.
2. Refer to Specification Division 16 for general wiring requirement.
3. Material and method utilized for the equipment described herein must meet the local building code and all the applicable codes.

E. GROUNDING TO 280501 AND 281301

1. All twisted pair shields shall be grounded at one point only. Cables that originate from equipment in systems/electrical rooms and terminate at field devices shall be grounded to the signal ground terminal in the system / electrical room. The field end shield shall be pulled back, trimmed, and taped in a good workmanlike manner.
2. Equipment, racks and associated devices shall be grounded per Division 26 specification.
3. Refer to Contract document drawings for additional information

1.8 QUALITY ASSURANCE TO 280001

A. Qualifications: The Contractor's must be certified on the system being installed and if applicable with security systems be a licensed Alarm Contractor in the State of Illinois, all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) .

1. Company with a minimum of five (5) years system design, engineering supervision, and installation experience in the security industry and has been authorized to install the products specified.
2. Comply with City of Chicago Electrical Code.
3. Code Compliance: UL or ULC Compliance and Labeling.
4. Installer Qualifications: Engage an experienced installer for the installation and application of the products identified herein..

1.9 WARRANTY

A. TO 280001

- B. A. System Components including all subsystems that comprise the systems as described within this specification shall be warranted for a period of one (1) year that shall begin after Owner acceptance.
- C. B. The Contractor shall guarantee all labor, workmanship, and materials for a period of three years from the date of final acceptance. Should a failure occur within the warranty period, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and acceptance for this contract, at no cost to the Owner. During this period, the Contractor shall provide, free of charge, all software upgrades and patches.
- D. C. During the warranty period, additional card readers and components may be connected and their use entered in database. New devices will be connected in the same manner as shown on the drawings for this contract and the existence of the new connections shall not void this warranty.

1.10 SUBMITTALS TO 280001

- A. Product Data: For each type of product indicated.
- B. Shop/Coordination Drawings: Detail major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.
 - 1. Wiring diagrams showing device circuiting.
 - 2. System plan drawings showing device zones.
 - 3. Battery backup calculation.
 - 4. CCTV display pattern diagram.
 - 5. Proper labeling for panels and equipment
- C. Furnish a copy of an operation and maintenance manual consisting of PDFs, word documents etc. with a copy of the warranty, equipment specification, programming instructions, programming software disks, maintenance instructions and full sized copies of **as built drawings** including conduit routing, junction points, and devices in electronic format as well. In addition all system programming data shall be backed up and provided in electronic USB format to 2FM Alarm Section. Include names and phone numbers to contact for assistance, maintenance, and warranty service on the first page. Deliver to 2FM Alarm Section at time of demonstration and training required in Part 3.
- D. License to Use: All software required for each component, and for the complete operation of the system as specified herein shall be delivered with either full Ownership transferred to the Owner or a non-time limited License to use on each machine it is installed on, including the right to make backup copies and the right to install the software on a new piece of hardware upon failure of the original. The licenses are to be provided on a CDROM or other storable form at the time of project acceptance.

1.11 INTELLECTUAL PROPERTY TO 280001**A. Patents:**

1. Should patented articles, methods, materials apparatus, etc., be used in this work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and his agents harmless for any delay, action, suit, or cost growing out of the patent rights for any device on this Project.

B. Copyrights:

1. Should copyrighted software be used in this work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and his agents harmless for any delay, action, suit, or cost growing out of the copyrights for any software on this Project.

1.12 COORDINATION TO 280501

- A. Coordinate layout and installation of system equipment and system components with other construction that penetrates roofs, risers, masonry, ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Install all system components and appurtenances in accordance with the Contract Documents and per manufacturer's instructions.
- C. Installation of conductors shall comply with the Contract Documents, manufacturer's recommendations, and the Chicago Electrical Code Article 900 using the 40% fill column from the appropriate table.

1.13 EXAMINATION TO 280001

- A. Carefully review the Contract Drawings and Specifications.
- B. Visit the site and verify that site conditions are in agreement with the design package.
- C. Verify that all surfaces and areas are ready to receive work.
- D. Verify field measurements as shown on drawings and as instructed by manufacturer.
- E. Verify that required utilities are available, in proper location, and ready for use.

1.14 INSTALLATION TO 280501

- A. Enclosure Penetrations: Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be made with water tight hubs. The conduit riser shall terminate in a suitable junction/pull

box (see Div. 16). When required, the riser shall be sealed as recommended by the cable manufacturer and in such a manner that the cable is not damaged.

- B. Install the Intrusion Detection, Access Control, and Video Surveillance related equipment as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each device for conditions encountered at the site; connect signal lines and AC power to equipment interfaces.
- C. Install systems in accordance with manufacturer's recommendations. This includes, but is not limited to the following:
 - 1. Wiring within racks shall be routed horizontally and vertically in neatly tied bundles. Point-to-point wiring shall not be used.
 - 2. Cable bundles shall cross from one rack to the next at the top, center, or bottom only, leaving sufficient working room within the rack.
 - 3. Wiring for shall be tie-wrapped or Velcro-strapped so that all connectors in a bundle can be removed and re-installed without the possibility of cross connecting.
 - 4. Where wiring is routed through sheet metal or over frame members, the metal edges shall be covered with flexible grommeting or edge dressing designed for this purpose.
 - 5. Double-sided foam tape shall not be used to secure any terminal boxes, relay bases or circuit boards, etc. All device mounting shall be of a permanent nature.
 - 6. All excess length AC cords are to be tie-wrapped out of the way, and new plugs installed.
 - 7. All cabling shall be in conduit, present a professional appearance, and maintain the esthetics of the installation area. Refer to Division 26.
 - 8. Care shall be exercised at all times to protect Owner's property.
- D. Provide all panel wiring required, including temporary wiring. Install wiring in accordance with CEC and NFPA regulations (as applicable), local building codes and ordinances, and all Owner wiring standards. Contractor shall be responsible for obtaining and adhering to applicable regulations, codes, ordinances, and standards.
- E. Provide cable labeling per Division 26. Label all conductors at each end with legible, laser printed, self-laminating vinyl labels.

1.15 TESTING TO 280501

- A. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Owner shall witness all performance verification. Written notification shall be provided to the Owner one week prior to proceeding with system testing. Original copies of all data produced during performance verification shall be turned over to the Owner at the conclusion of each phase of testing prior to Owner approval of the test.
- B. Cable Testing
 - 1. All cables and termination hardware shall be 100% tested for defects in the installation and the materials used in order to verify performance under installed

conditions. All conductors of each installed cable and system component shall be verified usable by the contractor.

2. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
3. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 or above tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-TSB67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of TIA/EIA-568-A.
4. Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommended test procedures. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.
5. All test results shall be well documented and the documentation given to the owner.

C. Contractor's Field Testing TO 281301

1. The Contractor shall calibrate and test all equipment, place the systems in service, and test the systems. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Owner that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.
2. If any conditions or other conditions exist that cause degradation or interfere with any security device, the Contractor shall inform the Owner.
3. The field testing shall as a minimum include:
 - a. Verification that the any signal or control cabling have been installed, tested, and approved as specified. All cabling to be identified and labeled to be included in test report.
 - b. When the system includes remote control/monitoring stations or remote switch panels, verification that the remote devices are functional, communicate with the center, and perform all functions as specified.
 - c. Verification that all systems devices are fully functional, and that applicable software has been programmed as needed for the site configuration.
 - d. Operation of all electrical and mechanical controls and verification that the control performs the designed function.
 - e. Verification that all cables are terminated properly. Verification that the any signal or control cabling have been installed, tested, and approved as specified.
 - f. When the system includes remote control/monitoring stations or remote switch panels, verification that the remote devices are functional, communicate with the center, and perform all functions as specified.
 - g. Verification that all security devices are fully functional, and that applicable software has been programmed as needed for the site configuration.
 - h. Verification that applicable software is functioning correctly. All software functions shall be exercised.

- i. Operation of all electrical and mechanical controls and verification that the control performs the designed function.
- j. Verification that all data sources and data outputs provide a full bandwidth signal at all data inputs.
- k. Verification that all cables are terminated properly.
 - 1) Deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Designer that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

1.16 SYSTEM STARTUP TO 281301

- A. Do not apply power to any systems until the following items have been completed:
 - 1. Equipment items have been set up in accordance with manufacturer's instructions.
 - 2. A visual inspection has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
 - 3. System wiring has been tested and verified as correctly connected as indicated.
 - 4. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
 - 5. Power supplies to be connected to the Systems have been verified as the correct voltage, phasing, and frequency as indicated.
 - 6. Verify network communications for the NVR, cameras, S2 controller, and network switch.
 - 7. Provide written and signed checklist indicating this was done.
 - 8. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

1.17 CLEANING AND ADJUSTING

- A. Clean installed items using methods and materials recommended by manufacturer.

1.18 DEMONSTRATION AND ACCEPTANCE 280501 AND 281301

- A. Create a written, step by step, plan to demonstrate the operation of all systems and submit it for approval two weeks prior to the demonstration date. The Owner will review and comment, or approve the plan at that time. Submit a suggested demonstration date and time along with the plan.
- B. On the accepted date, execute the demonstration plan in the presence of the Owner and their representatives. If the demonstration is successful, the systems will be considered accepted and a punch list will be generated. If the demonstration fails, the systems will be considered not accepted and another demonstration event shall be scheduled. This process will be repeated until the systems are accepted.

- C. Multiple Contractor User privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor User privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner.

1.19 TRAINING TO 280501

- A. Training of the Owner's employees shall be provided by a factory trained instructor for each individual system. The training is to cover all systems; ACMS, IDS and video surveillance, including any particulars of the communications network operation.
- B. Training shall be conducted by experienced trainers for each of the systems. The trainers must be certified by the manufacturer of the system for which training is provided.
- C. Training shall take place at a location that is mutually agreed upon between all parties.
- D. Training shall provide information regarding the operation of the systems, diagnostics, data input, alarm handling, as well as any other aspects required to provide a knowledge base to manage the system(s).
- E. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain. Conduct training courses for designated personnel in the maintenance and operation of the systems as specified. The training shall be oriented to the specific system being installed under this contract.
- F. Training manuals shall be delivered for each trainee with two additional manuals delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson.
- G. The Contractor is responsible for furnishing all training materials and supplies in addition to those described above. Where the Contractor presents portions of the course through the use of audio-visual material, copies of the audio-visual materials shall be delivered to the Designer, either as a part of the printed training manuals or on the same media as that used during the training sessions.
- H. A training day is 8 hours of instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during times that will allow for all shifts at the facility to obtain training.
- I. Training shall have provided information regarding the operation of the systems, diagnostics, data input, alarm handling, as well as any other aspects required to provide a knowledge base to manage the Security systems.

1.20 ON-SITE ASSISTANCE 280501 AND 281301

- A. When requested by 2FM within one year of date of 2FM sign off/acceptance, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions

and to optimize performance. Provide up to 36 hours of time by a qualified technician, on site, for adjustments of the system without additional cost.

END OF SECTION**CITY OF CHICAGO (2FM)****SURVEILLANCE SYSTEMS****GENERAL**

1.21 OVERVIEW

- A. 2FM uses only Genetec CCTV systems and associated compatible hardware. All cabling shall be encased in conduit purple in color unless otherwise agreed upon.

1.22 RELATED DOCUMENTS IN 280001

- A. NFPA 70
- B. Chicago Electrical code, Title 18 Chapter 27 of the Municipal code of Chicago
- C. Provide systems which meet or exceed the requirements of the following publications and organizations as applicable to the Work of this Section Underwriters Laboratories Inc. (UL):
 - 1. UL 365: Police Station Connected Burglar Alarm Units and Systems.
 - 2. UL 636: Holdup Alarm Units and Systems.
 - 3. UL 684: Local, Central Station, and Remote Station.
 - 4. UL 1037: Antitheft Alarms and Devices
 - 5. UL 1610: Central-Station Burglar-Alarm Units.
 - 6. UL 1635: Installation and Classification of Residential Burglar Alarm Systems.
 - 7. Federal Communications Commission (FCC):
 - a. Code of Federal Regulations Title 47: Part 15: Radio Frequency Devices.
 - b. Code of Federal Regulations Title 47: Part 68: Connection of Terminal Equipment to the Telephone Network.

1.23 SUMMARY TO 281302

- A. This Section includes the limited scope construction materials and methods for application with electrical installations as follows:
 - 1. CCTV and facility's security related equipment.
 - 2. Miscellaneous materials for support of electrical materials and equipment.
 - 3. Connection to existing head end equipment for monitoring and alarm signals.

4. Monitoring and signal connection to CCTV systems.

1.24 PROJECT CONDITIONS TO 281302

- A. The Contractor shall configure the system as described and shown. The system shall include all connectors, adapters, and terminators necessary to interconnect all equipment. The Alarm Contractor's must be a licensed Alarm Contractor in the State of Illinois and City of Chicago, all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) on their person and shall be furnished to 2FM Security before work is to begin. In the event of personnel changes the above requirements shall be updated and furnished to 2FM Security before that individual is to begin working.
- B. Data Entry
 1. The Contractor shall enter all data needed to make the system operational. The Contractor shall identify and request from the Owner, any additional data needed to provide a complete and operational security system. The completed forms shall be delivered to the Owner for review and approval at least 10 days prior to the Contractor's scheduled needed date.

1.25 GENERAL TO 281302

- A. All CCTV cabling shall be encased in conduit Purple in color minimum of $\frac{3}{4}$ ".

1.26 QUALITY ASSURANCE TO 280001

- A. Qualifications: The Alarm Contractor's must be a licensed Alarm Contractor in the State of Illinois, all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) .
 1. Company with a minimum of five (5) years system design, engineering supervision, and installation experience in the security industry and has been authorized to install the products identified under PART 2 – PRODUCTS of this document.
- B. Comply with City of Chicago Electrical Code.
- C. Code Compliance: UL or ULC Compliance and Labeling.
- D. Installer Qualifications: Engage an experienced installer for the installation and application of the products identified herein. Installer must be licensed by the State of Illinois (PERC) and certified to install the required products.

1.27 WARRANTY TO 280001

- A. System Components including all subsystems that comprise the systems as described within this specification shall be warranted for a period of one (1) year that shall begin after Owner acceptance.

- B. The Contractor shall guarantee all labor, workmanship, and materials for a period of three years from the date of final acceptance. Should a failure occur within the warranty period, the Contractor shall provide all labor and materials necessary to restore the system to the condition required for the final test and acceptance for this contract, at no cost to the Owner. During this period, the Contractor shall provide, free of charge, all software upgrades and patches.
- C. During the warranty period, additional card readers and components may be connected and their use entered in database. New devices will be connected in the same manner as shown on the drawings for this contract and the existence of the new connections shall not void this warranty.

1.28 SUBMITTALS TO 280001

- A. Product Data: For each type of product indicated.
- B. Refer to Book 2a Section “Submittals” for administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other miscellaneous submittals.
- C. Shop/Coordination Drawings: Detail major elements, components, and systems of electrical equipment and materials in relationship with other systems, installations, and building components. Show space requirements for installation and access. Indicate if sequence and coordination of installations are important to efficient flow of the Work.
 - 1. Wiring diagrams showing device circuiting.
 - 2. System plan drawings showing device zones.
 - 3. Battery backup calculation.
 - 4. CCTV display pattern diagram.
 - 5. Proper labeling of panels and equipment
- D. Furnish a copy of an operation and maintenance manual consisting of PDFs, word documents etc. with a copy of the warranty, equipment specification, programming instructions, programming software disks, maintenance instructions and full sized copies of as built drawings including conduit routing, junction points, and devices in electronic format as well. In addition all system programming data shall be backed up and provided in electronic USB format to 2FM Alarm Section. Include names and phone numbers to contact for assistance, maintenance, and warranty service on the first page. Deliver to 2FM Alarm Section at time of demonstration and training required in Part 3.
- E. License to Use: All software required for each component, and for the complete operation of the system as specified herein shall be delivered with either full Ownership transferred to the Owner or a non-time limited License to use on each machine it is installed on, including the right to make backup copies and the right to install the software on a new piece of hardware upon failure of the original. The licenses are to be provided on a CDROM or other storable form at the time of project acceptance.

1.29 INTELLECTUAL PROPERTY TO 280001**A. Patents:**

1. Should patented articles, methods, materials apparatus, etc., be used in this work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and his agents harmless for any delay, action, suit, or cost growing out of the patent rights for any device on this Project.

B. Copyrights:

1. Should copyrighted software be used in this work, the Contractor shall acquire the right to use same. The Contractor shall hold the Owner and his agents harmless for any delay, action, suit, or cost growing out of the copyrights for any software on this Project.

1.30 COORDINATION TO 280501

- A. Coordinate layout and installation of system equipment and system components with other construction that penetrates roofs, risers, masonry, ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.

PART 2 - PRODUCTS TO 281302**2.1 MANUFACTURERS****A. Approved Manufactures are as follows;**

1. Axis Communications
2. Genetec

B. Video Surveillance Components

1. Refer to section 2.5 IP Video Surveillance Components

- c. Genetec Security Center – Omnicast Enterprise

2.2 GENETEC SOFTWARE REQUIREMENTS**A. Seamless Unification with VMS**

- B. Through the USP, the ACS shall support integration with an IP Video Surveillance System or MVS. Integration with an IP video surveillance system shall permit the user to view live and recorded video.

- C. Users shall be able to associate one or more video cameras to the following entity types: doors, elevator, and hardware zone (input points) and more.
- D. The Monitoring UI shall present a true Unified Security Interface for access control and video surveillance. Advanced live video viewing and playback of archived video shall be available through the Monitoring UI.
- E. It shall be possible to view video associated with access control events when viewing a report.
- F. Outputs
 - 1. DOOR CONTACT SWITCH(ES)
 - a. The door position switch shall consist of a magnasphere type two part hermetically sealed assembly and will be designed for either metal or wood frame installations.

2.3 CCTV COMPONENTS TO 281302

- A. NVR SERVER
 - 1. Manufacturer: Genetec Omnicast Streamvault appliance line
 - 2. 2U rack mount type.
 - 3. 96 camera capability with minimum 16 IP camera licenses or a minimum of 20% of the total amount of cameras.
 - 4. Minimum 20TB HD capacity.
 - 5. Required license and programs to make system fully functional must be provided to owner.
 - 6. The NVR server hardware shall be capable of running Microsoft's latest Server OS.
- B. Lens Optics
 - 1. Provide high quality CCTV lenses sized according to the intended area of coverage as shown on the drawings and in accordance with the following minimum specifications:
 - a. Fixed cameras shall be provided with aspherical varifocal lens optics. Lenses provided for fixed cameras shall be aspherical varifocal length type and shall include provisions for automatic iris adjustment and standard "CS" or "C" mounting. Adapter rings shall be provided for all "C" mount lenses, aspherical varifocal lenses shall also be compatible with a CCD camera imager. Exact focal lengths of the lenses will be coordinated with the Owner based on the scene to be viewed.
 - b. The average video level sampled from the camera will determine automatic iris operation. Iris control signals and operating voltage shall be obtained from the camera and the lens will include a pre-wired plug assembly compatible with the cameras being provided.
 - c. Lenses for speed-dome cameras shall be provided as an integral part of the speed-dome camera configuration.
 - d. Lens optics shall be high quality precision ground glass. All optics shall be color corrected to provide accurate color scene reproduction.

2.4 IP VIDEO SURVEILLANCE COMPONENTS

- A. IP Cameras must be either a fixed type, 180°, 360° type camera depending on its location and use. PTZ and Fisheye type cameras are not acceptable.
 - 1. Acceptable manufacturers for security cameras:
 - a. Arecont Vision IP Cameras
 - b. AXIS IP Cameras
 - c. SONY IP Cameras
 - d. Vivotek IP Cameras
- B. Basic performance requirement:
 - 1. Color mode: 0.3 lux at F1.4, 30IRE
 - 2. Black/white mode: 0.005 lux at F1.4, 30IRE
 - 3. Motion JPEG
 - 4. MPEG-4 Part 2 (ISO/IEC 14496-2), Profiles: ASP and SP
 - 5. Mode: NTSC only
 - 6. Resolutions 4CIF, 2CIFExp, 2CIF, CIF, QCIF Max 704x480 (NTSC) min 160x120 (NTSC)
 - 7. Frame rate: MJPEG Up to 30/25 fps in all resolutions; MPEG-4: Up to 21/17 fps at 4CIF/2CIFExp; Up to 30/25 fps at 2CIF/CIF/QCIF
 - 8. Streaming: Simultaneous Motion JPEG and MPEG-4 Controllable frame rate and bandwidth; Constant and variable bit rate (MPEG-4)
 - 9. IP protocol using TCP and UDP protocol

2.5 APPROVED MANUFACTURER AND MODEL NUMBER FOR NETWORK SWITCHING COMPONENTS.

- A. Cisco WS-C2960S-24PS-L (POE ports)
 - 1. Generally supplied by Department of Innovation and Technology, arranged by Owner

2.6 CCTV CAMERA HOUSING

- A. The Contractor shall provide all cameras with permanent connections. Specifically, wiring shall not be open or loose. It is the contractors responsibility to provide rigid conduit for all installations to prevent wire tampering.
- B. Camera housings and their installation shall be coordinated with the owner as to maintain the esthetics of the installation sites.
- C. Camera platform shall be constructed of a non-conductive or insulated to eliminate grounding problems.
- D. Exterior camera housing shall be equipped with internal heating element.
- E. Camera housings shall also have the following characteristics:
 - 1. All cables shall be terminated, encapsulated in rigid conduit.

2. The housing shall be constructed with the intent to provide quick and easy servicing of the camera within it. Specifically, a slip in tray or cover with 180° opening.
3. The Contractor shall coordinate with the Owner the exact architectural style of the housing and finish, prior to ordering.
4. It the Contractors responsibility to perform all necessary calculations to verify that lens and camera combination can be accommodated by the housing being furnished.
5. Camera Housing shall have tamper resistant screws. The Contractor shall provide the Owner (2FM Alarm Section) with a tool to remove the tamper resistant screws allowing them to service the housing themselves.

2.7 CAMERA MOUNTS TO 281302

- A. Camera mounts shall be 100% compatible with the housing being provide and shall have the following characteristics:
 1. The Contractor shall field verify each camera location, prior to ordering.
 2. Mounts shall be constructed from steel or aluminum and shall prevent corrosion.
 - a. Mounts shall be 100% compatible with the housing.
 - b. Fixed cameras mounts and their installation shall be coordinated with the owner as to maintain the esthetics of the installation sites.

2.8 CAMERA POWER SUPPLY

- A. This section pertains to cameras that shall be powered from central location(s) and shall operate from a power source. Power supplies shall also have these characteristics.
 1. The Contractor shall furnish isolated power supplies, where required.
 2. Support eight (8) individually fused outputs. Fused outputs shall allow the Contractor to conduct maintenance on any given camera that is connected to the power supply without dropping power to the remaining seven (7) cameras.
 3. Power supply components shall be furnished in a lockable enclosure constructed for wall mounting.
 4. Each camera shall have an isolated fuse associated to only one given camera. Multiple cameras powered in series from a common fuse shall not be acceptable.
 5. The power supply shall additionally have two points of surge suppression. Typically, a main fuse and an inline fuse to protect cameras from up line surges.
 6. The unit shall maintain camera sync.
 7. Power supplies shall be equipped with a main power switch located inside the enclosure.
 8. Power supplies shall be UL 2044 listed.
 9. Power supplies shall be furnished to provide 120% of the current requirements for all associated locking devices.
 10. Power supplies shall be equipped with a minimum of a (8) eight-hour backup battery for continued camera operation after a power failure.
 11. Power supplies shall be equipped with the following features
 - a. Battery Backup:
 - 1) Built-in charger for sealed lead acid or gel type batteries.
 - 2) Automatic switch over to stand-by battery when AC fails.

- 3) Zero voltage drop when unit switches over to battery backup

2.9 VMS (VIDEO MANAGEMENT SYSTEM) SOFTWARE FEATURES SOME USED 281302

- A. The VMS shall be based on a true open architecture that shall allow the use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.
- B. The VMS shall offer a complete and scalable video surveillance solution that shall allow cameras to be added on a unit-by-unit basis.
- C. The VMS shall interface with analog-to-digital video encoders and IP cameras and with digital-to-analog video decoders, hereafter referred to as digital video servers (DVS). The VMS shall support DVS from various manufacturers.
- D. The VMS shall integrate DVS using the DVS native SDK or using the following industry standards to interface to the DVS:
 1. ONVIF
- E. All video streams supplied from analog cameras or IP cameras shall be digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, Wavelet, or JPEG2000 compression formats and recorded simultaneously in real time.
- F. All audio streams supplied from IP video servers shall be digitally encoded in g711 (u-law), g721, g723, or AAC compression formats and recorded simultaneously in real time.
- G. Each camera's bit rate, frame rate, and resolution shall be set independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.
- H. The VMS shall be able to use multiple CCTV keyboards to operate the entire set of cameras throughout the system, including brands of cameras from various manufacturers and including their PTZ functionalities (i.e.: Pelco keyboard controls Panasonic dome or vice-versa).
- I. The VMS shall be able to retrieve and set the current position of PTZ cameras using XYZ coordinates.
- J. The VMS shall support PTZ camera protocols from multiple manufacturers, including analog and IP protocols.
- K. The VMS shall arbitrate the user conflict on PTZ usage based on user levels per camera.

2.10 NVR HARDWARE FEATURES

1. The NVR server shall have recording resolutions of CIF, 2CIF, and D1 and shall be user selectable for each individual analog camera attached to the server.

Standard resolution and high resolution mega-pixel IP cameras shall also be selectable. MPEG-4 ASP or MJPEG video compression format shall be user selectable on any camera. Video recording shall be available at up to 30 images per second per input channel depending on IP camera type and server model selected.

2. The NVR server shall have video outputs for multi-monitor and spot monitors touring (switching) between analog camera video in either full, quad (2 x 2), 3 x 3, and 4 x 4 screen display modes.
 - a. The exacqVision Server shall be capable of recording line level audio, with synchronous video playback as well as playing live audio from any single audio channel selected.
3. Each server shall have the capability of automatically exporting a predetermined time frame of video to the internal server DVD/CD device upon an external trigger input connected to the server or by depressing a specific switch on the server. Such input shall export to the DVD/CD device a user defined amount of video and video camera source both pre and post event schedulable to the maximum capacity of the DVD/CD media selected.
4. Server hardware shall have an internal DVD/CD device that will allow the server to export video clips to the device in Standalone.Exe (*.exe), AVI Files (*.avi) and PS Files (*.ps) formats.
5. Each Server shall have a watchdog system that monitors the system and automatically reboots the system should it lock-up or fail to operate.
6. Each server shall be capable of integration with the City's SMS, Manitou, from Bold Technology.
 - a. Common System components

2.11 MONITOR AND KEYBOARD

- A. Provide a 22" color monitor, keyboard and mouse. A rack mounted tray/shelve to serve as an operator interface for the NVR.

2.12 UPS SYSTEM SEE OTHER SECTIONS

- A. Provide UPS systems to ensure continuity of electric power to the load without any interruption, upon failure of the normal power source. Emergency electric power to the load shall be maintained for 240 minutes, at a minimum.
 1. Enclosure:
 - a. Shall provide all the hardware necessary to mount in a standard 19-inch equipment rack.

2.13 INSTALLING AND UPDATING VMS CLIENT SOFTWARE. TO 281302

- A. Installing a new release of the VMS Client software shall be easily accessed by clicking on an icon in the Client software that will connect to a website and give an option to automatically download the new software. If the most recent version of the VMS software is already installed a message box will be displayed informing you have the most recent release.

- B. Provide required power outlets, interconnecting cables, hardware and equipment for a complete and operable system.
- C. Perform complete programming of the system, including matrix switch, and NVR(s) in coordination with the Owner, or designated representative. Programming shall include, but not be limited to, elimination of duplicate or redundant titling information, synchronization of system clocks, camera sequences, dome presets, salvos and tours. Programming of any system passwords or limiting of accessibility prior to commissioning and training is prohibited.
- D. Obtain IP addresses from 2FM Alarm Section for initial setup of all devices.

END OF SECTION 28 00 03

SECTION 28 01 00 - OPERATION AND MAINTENANCE OF COMMUNICATIONS**PART 1 - GENERAL****1.1 SUBMITTAL REQUIREMENTS**

- A. Closeout
 - 1. Operation and Maintenance Manual: For equipment and systems to include in operation and maintenance manuals.

- B. Shop Drawings
 - 1. As-Built Drawings: For recording installed conditions that deviate from design documents.

1.2 OPERATION AND MAINTENANCE MANUAL

- A. The contents of operating and maintenance manual shall include the following:
 - 1. Project Information Cover: Title of Project; Name and address of Owner, Design Professionals, Contractor of Record and Subcontractor; System name and specification references.
 - 2. Index: Contents of the manual.
 - 3. Warranty Statements: Furnish a warranty statement for each system, reiterating the terms of warranty identified within the Contract Documents, and identifying how the Owner is to obtain warranty service. Clearly identify which products are covered by Manufacturer warranties beyond the Contractor required minimum warranty period. The term of manufacturer warranty shall also be identified (e.g., 1-year parts and labor). Identify the date that the warranty for the system starts. This date shall be the date listed on the Certificate of Substantial Completion (if one was issued to the contractor specifically for the system) or the date listed on the Notice of Final Completion. Supply standard out-of-warranty service rates and service contact information.
 - 4. Bill of Materials: List of products supplied, and serial numbers of each product.
 - 5. Product Datasheets and Shop Drawings: Manufacturer datasheets and shop drawings for each product and system supplied.
 - 6. Manufacturer Owner / User Manuals: Manufacturer's Owner's or User's manual for each product, and Manufacturer's Installation instructions and other documentation supplied with the product.
 - 7. Extra Material Schedule:
 - a. Complete spare parts schedule for components of equipment furnished, which are not factory generic information, but accurate for the equipment provided.
 - b. Itemized list of each piece of communications, architectural and Owner equipment having communications connections with termination locations; also, list related expendable equipment required for each item as applicable.
 - 8. Maintenance Procedures: Maintenance procedures for routine preventative maintenance and troubleshooting; disassembly, repair, and reassembly; testing, aligning and adjusting instructions.

9. Function and Operating Descriptions: Description of function, normal operating characteristics and limitations, performance curves, engineering data and tests, and complete nomenclature and commercial numbers of replacement parts.
10. Operating Procedures: Manufacturer's printed operating procedures including start-up, break-in, normal operating instructions, regulation, control, stopping, shutdown, and emergency instructions.
11. Include Product Certificates, Source quality-control test reports and Field Quality-Control Reports
12. Test Reports and Checklists: Test reports, checklists, and other forms generated and completed for the Project.
13. Training Information: Copy of training outlines/agendas, training session handouts, training sign-in sheets, and signed delivery receipt for each training session recording; Separate USB drive, labeled, for audio/video-recorded instructions to Owner, for operations and maintenance for each system.
14. As-Built Drawings.
15. Software: Application and operating software documentation; Software licenses; Software service agreements; Manufacturer's operating specifications; design user's guide for software and hardware; Editable configuration files for system equipment; Software source code used in supplied products; Compiled versions of configuration files and source code; IP addresses of products configured to have static IP addresses; MAC addresses of products featuring network communication ports (wired and/or wireless); Network device names for products configured for DHCP; Software required for reviewing and editing supplied files.

1.3 AS-BUILT DRAWINGS

- A. Obtain two complete sets of communications prints and use them to provide progress record drawings which are separate, clean, prints reserved for the purpose of showing a complete picture of the work as actually installed (including routing of conduit and cables). These drawings also serve as work progress report sheets. Make notations, neat and legible thereon daily as work proceeds. Make these drawings available for inspection at all times and keep them at the job at a location designated by the Owner's Representative.
- B. Maintain the clean, undamaged set of prints of drawings as well as a set of submittal drawings and coordination drawings. Mark the sets to show the actual installation where the installation varies from the Documents as originally shown. Include locations of underground and concealed items if placed other than shown on the Documents. Where shop drawings are used, record a cross-reference at the corresponding location on the Drawings. Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- C. Show changes in: size, type, capacity, etc., of material, device or piece of equipment, location of device or piece of equipment; location of outlet or source of building service systems; routing of piping, conduit, or other building services. Record location of concealed equipment, by indication of measured dimensions to each line from readily identifiable and accessible walls, column lines or corners of building. Indicate approved substitutions, modifications, and actual equipment and materials installed.

- D. Affix near the title block on each drawing the Contractor's Company Name(s), signature of Contractor's Representative(s) and current date.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 INSTRUCTION OF THE OWNER'S PERSONNEL

- A. Provide instruction in the proper operation and maintenance of equipment that requires routine servicing. Include the following:
1. Review of operation and maintenance manuals.
 2. Required tools.
 3. Extra Materials.
 4. Cleaning.
 5. Hazards.
 6. Warranties and maintenance agreements.
- B. Demonstrate equipment and systems operation including the following:
1. Start-up.
 2. Shut-down.
 3. Emergency conditions.
 4. Safety procedures.
 5. Setpoint and schedule adjustments.
 6. Economy and efficiency adjustments.

END OF SECTION 28 01 00

SECTION 28 05 01 - BASIC MATERIALS & METHODS FOR ELECTRONIC SAFETY A SECURITY**PART 1 - GENERAL****1.1 SUMMARY**

- A. Section Includes: Requirements applicable to work of this Division.
 - 1. Basic materials, methods and installation guidelines applicable to the installation of all communication systems.

1.2 QUALITY ASSURANCE

- A. Explosives
 - 1. Use of explosives at the project site shall not be permitted.
- B. Welding
 - 1. Welding at the project site, where necessary, shall be performed only by persons licensed to perform such work at the project site(s). Welding shall require a permit and the approval of the Owner's Representative. Request for permission to perform onsite welding shall be submitted in writing through designated project channels.

PART 2 - PRODUCTS**2.1 CABLE BUNDLING HARDWARE**

- A. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - 1. Hellermann Tyton.
 - 2. Millepede, Inc.
 - 3. Panduit.
 - 4. Velcro.
- B. General: Provide reusable, adjustable cable straps.
 - 1. Hook and Loop Fastener:
 - a. Shall be utilized within all cabinets and racks and below the ceiling of Telecommunications and Equipment rooms.
 - b. Provide plenum rated ties in plenum environments.
 - c. Minimum cable strap width shall be 3/4-inch.
 - d. Basis of Design: Velcro One-Wrap Qwik Ties.
- C. Nylon Plastic Cable Management Ties:
 - 1. Not to be used within cabinets or racks or below the ceiling line in Telecommunications or Equipment rooms.

2. Provide plenum rated tie in plenum environments.
3. Outdoor ties shall be Weather and ultraviolet resistant.
4. Sized as necessary for the quantity of cables.
5. Cable tie shall have no sharp edges when cut.
6. Basis of Design: Panduit PLT series.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate layout and installation of system equipment and system components with other construction that penetrates roofs, risers, masonry, ceilings or is supported by them, including light fixtures, HVAC equipment, fire-suppression-system components, and partition assemblies.
- B. Install all system components and appurtenances in accordance with the Contract Documents and per manufacturer's instructions.
- C. Installation of conductors shall comply with the Contract Documents, manufacturer's recommendations, and the Chicago Electrical Code Article 900 using the 40% fill column from the appropriate table.
- D. High Voltage Wiring
 1. Review all high voltage provisions for This Contractor's work with the Division 26 electrical contractor. Coordinate specific device termination, loading and circuiting requirements with the electrical contractor.
- E. Coordinate installation of new pathways with parties and the Work that will utilize the pathways, prior to installation.
- F. Review pre-existing pathways prior to installation of the Work, and report to the Designer any discrepancies between specified pre-existing pathway conditions and actual existing pathway conditions.
- G. Participate in coordination efforts through the preparation of shop drawings and details prior to fabrication or installation of any products. Coordinate actual clearance requirements of installed products.
- H. Begin coordination immediately upon award of contract. Coordinate the Work with other parties and adjust equipment locations accordingly. Participate in the preparation of coordination drawings.
- I. Devices and equipment shall be located symmetrical with architectural elements and shall be installed at the heights and locations shown on the Drawings. If a height or location is in question, seek immediate clarification from the Designer.
- J. Evaluate the Contract Documents and existing conditions to gain an understanding of the peculiarities and limitations of the spaces where the Work is to be performed. The final Work shall be accessible for servicing. Although the locations of equipment and

conduit may be shown on the Drawings in certain positions, the architectural details and conditions existing on the Project shall guide the Contractor, coordinating the Work with that of others. Provide necessary offsets to provide a neat workmanlike arrangement.

- K. The Drawings are generally diagrammatic and indicate the design intent, required sizes, points of termination and, in some cases, suggested routes of raceways. However, it is not intended that the Drawings indicate fully coordinated routing and placement or necessary offsets.
- L. Refer to each Drawing, including enlarged plans, elevations, sections, and details for additional information that may include dimensions and greater resolution and notes that serve to refine the intent and further assist and guide installation.
- M. Work in harmony with other parties performing work at the project site so as not to cause any delays in pouring concrete or erecting masonry walls. Consult each Contract Drawing, including those predominately used by other trades, before installing Work so as to ensure that performance of Work will not interfere with or be adversely affected by Work of others.
- N. Attend each regularly scheduled project meeting as well as any special meetings called to coordinate and/or resolve special issues that arise during the course of the Project.
- O. Conflicts in equipment and materials shall be corrected prior to installation. Should there be a conflict with drawings of other trades, work with the other trades to correct the conflict while coordinating the Project (prior to installation). If a conflict cannot be resolved, seek the direction of the Owner's representative. Refer to the drawings used by other trades for details, dimensions and locations of their work and route around their work so as not to conflict. Work installed that creates a conflict shall be removed and readjusted to the satisfaction of the Owner's representative at the Contractor's expense.

3.2 INSTALLATION

A. Conduits

1. All IDS cabling shall be encased in conduit **Blue** in color minimum of $\frac{3}{4}$ ".
2. All CCTV cabling shall be encased in conduit **Purple** in color minimum of $\frac{3}{4}$ ".
3. All ACMS cabling shall be encased in conduit **Orange** in color minimum of $\frac{3}{4}$ ".
4. All fire systems shall be encased in conduit **Red** in color minimum of $\frac{3}{4}$ ".
5. If conditions do not allow for colored conduit to be installed, the contractor is responsible for labeling the conduit and to inform the Owner as how to proceed immediately.

B. General:

1. Enclosure Penetrations: Penetrations of interior enclosures involving transitions of conduit from interior to exterior, and all penetrations on exterior enclosures shall be made with water tight hubs. The conduit riser shall terminate in a suitable junction/pull box (see Div. 26). When required, the riser shall be sealed as recommended by the cable manufacturer and in such a manner that the cable is not damaged.

2. Install the Intrusion Detection, Access Control, and Video Surveillance related equipment as specified by the manufacturer and as shown, provide mounting hardware sized appropriately to secure each device for conditions encountered at the site; connect signal lines and AC power to equipment interfaces.
3. Install systems in accordance with manufacturer's recommendations. This includes, but is not limited to the following:
 - a. Wiring within racks shall be routed horizontally and vertically in neatly tied bundles. Point-to-point wiring shall not be used.
 - b. Cable bundles shall cross from one rack to the next at the top, center, or bottom only, leaving sufficient working room within the rack.
 - c. Wiring for shall be tie-wrapped or Velcro-strapped so that all connectors in a bundle can be removed and re-installed without the possibility of cross connecting.
 - d. Where wiring is routed through sheet metal or over frame members, the metal edges shall be covered with flexible grommeting or edge dressing designed for this purpose.
 - e. Double-sided foam tape shall not be used to secure any terminal boxes, relay bases or circuit boards, etc. All device mounting shall be of a permanent nature.
 - f. All excess length AC cords are to be tie-wrapped out of the way, and new plugs installed.
 - g. All cabling shall be in conduit, present a professional appearance, and maintain the esthetics of the installation area. Refer to Division 26.
 - h. Care shall be exercised at all times to protect Owner's property.
4. Provide all panel wiring required, including temporary wiring. Install wiring in accordance with CEC and NFPA regulations (as applicable), local building codes and ordinances, and all Owner wiring standards. Contractor shall be responsible for obtaining and adhering to applicable regulations, codes, ordinances, and standards.
5. Provide cable labeling per Division 26. Label all conductors at each end with legible, laser printed, self-laminating vinyl labels.
6. Cabling installed within open ceilings shall be ran in conduit or fully concealed from view behind the building structure.
7. Work installed in finished areas shall be concealed.
8. Sequence, coordinate, and integrate installations of communications materials and equipment with the work of other trades for efficient flow of the Work.
9. Install systems, materials, and equipment to conform to reviewed submittal data, including coordination drawings.
10. Install systems, materials, and equipment level and plumb, parallel and perpendicular to other building systems and architectural/structural components (prevailing building lines), except as expressly detailed otherwise or required for proper form, function or Designer intended operation. Except where otherwise specified, detailed or directed by the Designer, install visible products level to within 1/8-inches per 100-feet.
11. Install equipment to facilitate servicing, maintenance, and repair or replacement of equipment components. Connect equipment for ease of disconnecting, with minimum of interference with other installations.
12. Install systems, materials, and equipment giving right-of-way priority to systems required to be installed at a specified slope.
13. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.

14. Verify dimensions by field measurements. Take measurements and be responsible for exact size and locations of all openings required for the installation of work. Figured dimensions are reasonably accurate and should govern in setting out work. Where detailed method of installation is not indicated or where variations exist between described work and approved practice, direction of the owner's representative on job shall be followed.
15. If during construction it becomes apparent that certain minor changes in layout would result in a neater appearance or better arrangement, such alterations shall be made as part of the Contract. Designer's review shall be obtained before making such changes.
16. Workmanship throughout shall conform to the standards of best practice. Marks, dents or finish scratches shall not be permitted on any exposed materials, fixtures or fittings. Interiors of panels and equipment boxes shall be left clean.

C. Cabling

1. Cabling utilized for the interconnection of field items specified herein shall comply with or exceed the recommendations of the component manufacturers.
2. Refer to Specification Division 28 for general wiring requirement.
3. Material and method utilized for the equipment described herein must meet the local building code and all the applicable codes.
4. Use caution not to exceed the manufacturer allowed bending radius for cables and not to compromise the integrity of the cables during installation by pulling cable management devices too tightly, damaging cables. Raceway/cabling bending radii shall be minimum as directed by cable manufacturer. Use pulling compound or lubricant where necessary to ensure cable does not experience tension beyond manufacturer limits during installation. Compounds used shall be compatible with the cable and pathway products and shall not cause deterioration of either.
5. Where indicated, provide color-coded jackets to identify runs of different systems.
 - a. See related specifications and drawings for applicable color coding.
6. Neatly route cables parallel and perpendicular to building architectural lines.
 - a. Cables and cable assemblies shall be run as straight as possible and symmetrical (perpendicular to or parallel with) with architectural items and at a consistent elevation. Work installed diagonal to building members shall not be permitted.
7. Neatly comb out multiple cable bundled runs to remove tangling and crossing of cables within the bundles. Neatly dress all cable work and provide vertical and horizontal cable management (or other approved method) for properly dressing all work at racks, control panels, backboards etc. See detail(s) if applicable.
 - a. To avoid Alien Crosstalk, do not cinch UTP cables into tight bundles.
8. Cable shall be installed within approved pathways. Cables not installed within raceway, cable tray or ladder rack shall be supported by discrete cable supports. Support cables at box and faceplate.
9. All penetrations to walls and floors designed to shall include metal sleeves. All sleeves shall be mechanically secured in place and sealed between the sleeve and structure. Apply firestop to the interior of the sleeve.
10. Loosely bundle cables within racks, ladder racks, cable trays and in discrete cable supports. Utilize reusable cable bundling hardware. Utilize plenum-rated hardware in plenum spaces.
11. Plenum-rated cable ties shall be used wherever wire ties are permitted and wherever plenum rated cable is used.

12. Cable ties shall never be used in a manner that causes deformation of the cable jacket, damage to the cable, or has any adverse effect on the usability, specifications or longevity of the cable(s) on which it is applied.
13. Velcro type wire ties shall be used in non-plenum spaces; in equipment racks; in rack cabinets, and; in related equipment housing enclosures and backboards.

D. Cable Support

1. All cables shall be supported/anchored every 5 feet (or less) and within 12" of device boxes, outlets, racks/cabinets and cable tray.
2. Use J-Hook type cable supports for all cables run outside of conduit or cable tray. Bridle rings shall not be used for Communications Technology cables.
 - a. Use separate J-Hook cable support systems for cables belonging to different systems and for cables carrying different operating levels. See Cable Separation guidelines in this section.
3. Loosely secure cables at each J-Hook.
4. Cables shall not be directly or indirectly supported by a suspended ceiling or any other surface, support, material or structure not permissible for this use by all applicable codes and standards.
5. Cable pathway
 - a. Use and positioning
 - 1) Pathway shall be installed to form a reusable pathway system.
 - 2) Totally enclosed raceways (i.e. conduit, wireway, etc.) shall be utilized to span in-accessible or working spaces (i.e. offices, classrooms, etc.).
 - 3) Cable trays and discreet cable supports shall be utilized to support cables.
 - a) To form an open-top reusable pathway
 - b) Shall be used in accessible ceiling cavities and areas not accessible by the public (i.e. mechanical and service areas).
 - c) Shall follow corridors unless specifically noted otherwise.
 - d) Shall provide usable clearances above, below and beside for access space for the re-use of the pathway. Minimum 6" below and beside and 12" above.

E. Cable Separation:

1. Low-voltage cables shall be kept as far from electrical cables and equipment as possible. Avoid running low-voltage cables parallel to medium and high-voltage cables. When parallel runs cannot be avoided, keep low-voltage cables at least 24 inches away and cross cables at 90 degrees to minimize the risk of interference
2. Low-voltage cables shall not be permitted in the same conduit with high-voltage electrical cables.
3. Avoid running low-voltage cables any closer than 24 inches to any ballast type lighting fixture or other high RF energy producing device.
4. Cables for each system shall be installed separately and isolated from cables from other systems.
5. Cables carrying signals of different types and different nominal operating levels shall be kept separated to reduce the risk of undesirable interference and cross-talk between cables.
 - a. As a general rule, for each 25dBV difference in nominal operating level between cables, provide at least 6 inches of separation. Example 1: Cables with a 75dBV level difference between them shall be separated by 18 inches

- or greater. Example 2: Cables with a 13dBV difference between them shall be separated by 3 inches or greater.
- b. Contractor shall provide additional separation to prevent and to remedy any crosstalk that adversely affects the performance and usability of the system, or that exceeds specific crosstalk performance guidelines defined elsewhere in these specifications.
 - c. Provide greater separation than this guideline where the contractor believes and/or determines it is necessary to prevent or remedy interference between cables.
6. Keep length of parallel runs to a minimum. Cross cables of different nominal levels at 90 degrees.
 7. In common areas where cables from multiple systems are run in general proximity to one another, cables from each system shall be labeled to identify the system the cables serve.
 8. Additional pathway devices/systems shall be provided as required to comply with cable separation requirements, including, but not limited to, conduits, sleeves, discrete pathway devices and cable tray.
- F. Cable Splices:
1. Splices shall not be permitted in any cable except where expressly specified and/or approved by the Designer.
 2. In cases where splices are specified and/or otherwise reviewed and permitted, splices shall be made within UL listed junction or device boxes. Open air connections shall not be permitted.
- G. Cable Terminations:
1. Termination types shall correctly match cable and device termination. As an illustration, if “spade lug” type of termination is appropriate, then the spade lug cable entry size shall match the cable used. The spade lug shall also have the correct stud size to match the terminal to which it is connected. Terminations shall be completed with tools designed and sized for the specific application and connector.
 2. Where field installed cables connect to manufactured products via pig-tails or connectorized cable assemblies, terminations shall be made within the product enclosure or within a UL approved box. Exposed and open air splices shall not be permitted.
- H. Strain Relief:
1. Permanently installed cables shall be properly secured with an approved device. Strain relief shall be applied typically within 6 inches from the point of entry into a product enclosure, junction box, pull box, or device box. When properly applied, the strain relief device shall not damage the cable being secured and shall not permit movement of the cable in any way that may adversely affect the long-term integrity of nearby connections.
- I. Identification:
1. General:
 - a. Identification shall be in English, except as otherwise noted.
 - b. Where identification is applied to surfaces that require a finish, install identification after the surface finish is applied.

- c. Labeling products, color, sizes, nomenclature and location of the identification product are subject to the review of the Designer.
 2. Cables:
 - a. Each cable shall be uniquely labeled at each end.
 - b. Labels shall be permanent and feature computer generated type-written text.
 - c. Label text shall be bold-type and clearly readable by a person with average sight, and under the lighting conditions typical within the area of installation.
 - d. Labels shall be applied approximately 4-6 cable-inches from the point of termination.
 - 1) Adjust application to make legible during service/maintenance of system.
 - e. Systems cables installed for "Future Use" shall be clearly identified as such at both ends. Such cables shall be labeled to identify where the opposite end of the cable can be found.
 - 1) Not applicable for Structured Cabling for voice/data connectivity.
 - f. Each cable installed shall be recorded on the as-built drawings.
 3. Boxes:
 - a. Junction boxes and pull boxes shall be labeled on their interior and on their exterior covers with the identity of the system(s) the box serves along with the function of the box. Interior markings shall be made using permanent marker. Permanent marker may also be used on the cover of boxes installed in concealed areas (above accessible ceilings, for example). Exposed boxes shall be labeled with engraved plastic labels. Labels shall closely match the color of the box.
 - b. Device boxes, when first installed, shall be identified on its interior as to the system(s) served and the device(s) the box will contain.
 - 1) Where conduit feeding the device box is concealed, label the exterior of the conduit with permanent marker.
 4. Equipment Racks, Cabinets, Enclosures:
 - a. Equipment racks and enclosures shall be labeled.
 - b. The nomenclature, color, size, installed location, and type of labels are subject to the Designer's review.
 5. System Equipment:
 - a. Each individual instance of system equipment shall be labeled.
 - b. Front panel controls of equipment shall be labeled with nomenclature meaningful to the end user based on the intended use of the equipment in the system. Examples include, but are not limited to:
 - 1) Label router/matrix control panels with system specific input/output names.
 - 2) Label patch panels with meaningful input/output destination names.
 - 3) Label mixer input and output controls to identify the signal source and destination.
 - c. Professionally prepared, installed and readily visible "cheat sheets" may be acceptable under select circumstances with the approval of the Designer.
 - d. The nomenclature, color, size, installed location, and type of labels are subject to the Designer's review and approval.
- J. High Voltage Cabling (greater than 70.7 Volts):
1. Cabling that carries voltages higher than 70.7 Volts RMS AC or DC shall be installed and terminated by persons licensed to perform such work.

- K. Plates and Panels:
 - 1. Box covers and faceplates shall be installed flush against the surface over which it is mounted. There shall be no visible gap between the backside of a plate/panel and the wall, ceiling or floor; there shall be no visible gap between the backside of plate/panel and a surface mount box to which the plate/panel mounts). Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.
 - a. The same shall apply to other wall and ceiling mounted products.
 - 2. Plates and panels shall be installed with all screw holes filled and fastened securely.

- L. Device Boxes, Pull-Boxes, Junction Boxes:
 - 1. Boxes installed in walls and ceilings shall be installed so that the box does not stand proud (protrude out beyond) of the finished surface. Boxes shall be installed such that when the mounted devices and cover plates are installed, the backside of the cover plate rests flush with the finished surface of the wall or ceiling. Advanced craftsmanship and construction techniques shall be employed where necessary to achieve this.

3.3 GROUNDING

- A. All twisted pair shields shall be grounded at one point only. Cables that originate from equipment in systems/electrical rooms and terminate at field devices shall be grounded to the signal ground terminal in the system / electrical room. The field end shield shall be pulled back, trimmed, and taped in a good workmanlike manner.
- B. Equipment, racks and associated devices shall be grounded per Division 27 specification.
- C. Equipment shall be properly bonded to ground for the safety of personnel and property and as additionally necessary to satisfactory performance of the equipment.
- D. Comply with Section "Grounding and Bonding for Communications."

3.4 CUTTING, PATCHING AND SEALING

- A. General:
 - 1. Perform cutting as required for the execution of the Work. Unless directed otherwise in the field, provide related patching and painting to match surrounding methods, materials and colors. Any damage caused during the progress of Work shall be remediated. Perform cutting, fitting, and patching and materials as required to:
 - a. Uncover Work to provide for installation of ill-timed Work.
 - b. Remove and replace defective Work.
 - c. Remove and replace Work not conforming to requirements of the Contract Documents.
 - d. Remove samples of installed Work as specified for testing.
 - e. Install equipment and materials within existing structures.

2. Upon written instructions from the Owner's representative, uncover and restore Work to provide for observation of concealed Work by Owner's representative or by inspection by the Authority Having Jurisdiction.
 3. During cutting and patching operations, protect adjacent installations (e.g., structure, finishes, and furnishings). Where applicable, provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to system components and components of other trades.
 4. Patch surfaces and building components using new materials matching existing materials and using experienced Installers. Refer to Division 01 for definition of experienced "Installer" or determine qualifications as directed in the field by the Owner's representative.
 5. Patching through fire rated walls and enclosures shall not diminish the rating of that wall or enclosure. Materials used for patching shall be installed to meet or exceed the smoke and fire rating of the respective surface being patched.
 6. Neatly cut and drill openings in walls and floors where openings are required for installation of the Work. Secure the approval of the Owner's Representative before cutting and drilling in existing facilities. Neatly patch any openings created.
 7. Cutting and patching shall be held to a minimum by arranging with other parties for sleeves and openings before construction is started.
 8. Provide factory-assembled watertight wall and floor seals, of types and sizes required, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws.
 9. Pipe sleeves shall be fabricated from Schedule 40 rigid, heavy wall, full weight galvanized steel pipe; remove burrs. Use sleeves which are two standard sizes larger than conduit passing through respective sleeve.
 10. Provide sleeve seals for piping that penetrates foundation walls below grade, or through exterior walls or roofs. Caulk between sleeve and pipe with non-toxic, UL-classified caulking material to ensure watertight seal. Elsewhere provide mechanical type seals, consisting of interlocking synthetic rubber links shaped to continuously fill annular space between pipe and sleeve, connected with bolts and pressure plates which cause rubber sealing elements to expand when tightened, providing watertight seal and electrical insulation.
 11. Install standard Schedule 40 black steel pipe sleeves two sizes larger than pipes passing through floors, bearing walls, fire walls and masonry construction. Furnish and set forms required in masonry walls or foundation to accommodate pipes.
- B. Grout:
1. Provide non-shrink, nonmetallic grout, pre-mixed, factory-packaged, non-staining, non-corrosive, and non-gaseous grout, recommended for interior and exterior applications.
- C. General Joint Sealer Application:
1. Joint sealers, joint fillers, and other related materials compatible with each other and with joint substrates under conditions of service and application.
 2. Apply joint sealers under temperature and humidity conditions within the limits permitted by the joint sealer manufacturer. Do not apply joint sealers to wet substrates.
 3. Clean affected surfaces, joints, etc. immediately before applying joint sealers to comply with recommendations of joint sealer manufacturer.

4. Apply sealant primer to substrates as recommended by manufacturer. Protect adjacent areas from spillage and migration of sealant, using masking tape. Remove tape immediately after tooling without disturbing seal.
5. Comply with joint sealer manufacturers' printed application instructions applicable to products and applications indicated, except where more stringent requirements apply.
6. Immediately after sealant application and prior to time shinning or curing begins, tool sealants to form smooth, uniform beads; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint. Remove excess sealants from surfaces adjacent to joint. Do not use tooling agents that discolor sealants or adjacent surfaces or are not approved by sealant manufacturer.
7. Colors for exposed seals shall be as selected by the Owner's representative from manufacturer's standard colors.

3.5 FIRESTOPPING

- A. Penetrations created in support of any work of this Division shall be firestopped in accordance with locally applicable codes as acceptable to the Authority Having Jurisdiction.

3.6 TESTING

- A. The Contractor shall provide all personnel, equipment, instrumentation, and supplies necessary to perform all site testing. The Owner shall witness all performance verification. Written notification shall be provided to the Owner one week prior to proceeding with system testing. Original copies of all data produced during performance verification shall be turned over to the Owner at the conclusion of each phase of testing prior to Owner approval of the test.
- B. Cable Testing
 1. All cables and termination hardware shall be 100% tested for defects in the installation and the materials used in order to verify performance under installed conditions. All conductors of each installed cable and system component shall be verified usable by the contractor.
 2. Operational Test: After installation of cables and connectors, demonstrate product capability and compliance with requirements. Test each signal path for end-to-end performance from each end of all pairs installed. Remove temporary connections when tests have been satisfactorily completed.
 3. Copper Cable Procedures: Inspect for physical damage and test each conductor signal path for continuity and shorts. Use Class 2, bidirectional, Category 6 or above tester. Test for faulty connectors, splices, and terminations. Test according to TIA/EIA-TSB67, "Transmission Performance Specifications for Field Testing of Unshielded Twisted-Pair Cabling Systems." Link performance for UTP cables must meet minimum criteria of TIA/EIA-568-A.
 4. Fiber-Optic Cable Procedures: Perform each visual and mechanical inspection and electrical test, including optional procedures, stated in NETA ATS, Section 7.25. Certify compliance with test parameters and manufacturer's written recommended test procedures. Test optical performance with optical power meter capable of generating light at all appropriate wavelengths.

5. All test results shall be well documented and the documentation given to the owner.

3.7 DEMONSTRATION AND ACCEPTANCE

- A. Create a written, step by step, plan to demonstrate the operation of all systems and submit it for approval two weeks prior to the demonstration date. The Owner will review and comment, or approve the plan at that time. Submit a suggested demonstration date and time along with the plan.
- B. On the accepted date, execute the demonstration plan in the presence of the Owner and their representatives. If the demonstration is successful, the systems will be considered accepted and a punch list will be generated. If the demonstration fails, the systems will be considered not accepted and another demonstration event shall be scheduled. This process will be repeated until the systems are accepted.
- C. Multiple Contractor User privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor User privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner.

3.8 TRAINING

- A. Training of the Owner's employees shall be provided by a factory trained instructor for each individual system. The training is to cover all systems; ACMS, IDS and video surveillance, including any particulars of the communications network operation.
- B. Training shall be conducted by experienced trainers for each of the systems. The trainers must be certified by the manufacturer of the system for which training is provided.
- C. Training shall take place at a location that is mutually agreed upon between all parties.
- D. Training shall provide information regarding the operation of the systems, diagnostics, data input, alarm handling, as well as any other aspects required to provide a knowledge base to manage the system(s).
- E. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain. Conduct training courses for designated personnel in the maintenance and operation of the systems as specified. The training shall be oriented to the specific system being installed under this contract.
- F. Training manuals shall be delivered for each trainee with two additional manuals delivered for archiving at the project site. The manuals shall include an agenda, defined objectives for each lesson, and a detailed description of the subject matter for each lesson.
- G. The Contractor is responsible for furnishing all training materials and supplies in addition to those described above. Where the Contractor presents portions of the course through the use of audio-visual material, copies of the audio-visual materials shall be delivered

to the Designer, either as a part of the printed training manuals or on the same media as that used during the training sessions.

- H. A training day is 8 hours of instruction, including two 15 minute breaks and excluding lunchtime, Monday through Friday, during times that will allow for all shifts at the facility to obtain training.
- I. Training shall have provided information regarding the operation of the systems, diagnostics, data input, alarm handling, as well as any other aspects required to provide a knowledge base to manage the Security systems.

3.9 ON-SITE ASSISTANCE

- A. When requested by 2FM within one year of date of 2FM sign off/acceptance, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance. Provide up to 36 hours of time by a qualified technician, on site, for adjustments of the system without additional cost.

END OF SECTION 28 05 01

SECTION 28 13 01 - SECURITY ACCESS CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the limited scope construction materials and methods for application with electrical installations as follows:
 - 1. ACMS, IDS, CCTV and facility's security related equipment.
 - 2. Remote door lock release as well as card reader equipped door access monitoring by ACMS.
 - 3. Miscellaneous materials for support of electrical materials and equipment.
 - 4. Connection to existing head end equipment for monitoring and alarm signals.
 - 5. Monitoring and signal connection to ACMS,IDS, CCTV systems.
 - 6. Provide door hardware for ACMS,IDS system.

- B. The Contractor shall configure the system as described and shown. The system shall include all connectors, adapters, and terminators necessary to interconnect all equipment. The Alarm Contractor's must be a licensed Alarm Contractor in the State of Illinois and City of Chicago, all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) on their person and shall be furnished to 2FM Security before work is to begin. In the event of personnel changes the above requirements shall be updated and furnished to 2FM Security before that individual is to begin working.

- C. Data Entry
 - 1. The Contractor shall enter all data needed to make the system operational. The Contractor shall identify and request from the Owner, any additional data needed to provide a complete and operational security system. The completed forms shall be delivered to the Owner for review and approval at least 10 days prior to the Contractor's scheduled needed date.

- D. Related Sections
 - 1. All Division 27 and 28 Sections
 - 2. Technology Series Drawings

- E. Products supplied by others but installed under this Section
 - 1. Card Readers
 - 2. Door Controllers

1.2 SUBMITTALS

- A. Product Data Submittal
 - 1. Manufacturer datasheets for each system component
 - 2. Bill of Materials (BOM) List

- B. Shop Drawing Submittal

1. Plan Drawing(s)
 - a. Depicting the location of all devices and major equipment locations on the project site, coordinated with work of related sections.
2. System Diagram(s).
 - a. Depicting the interconnecting cabling between system equipment located at different locations at the project site.
3. Panel Board Elevations
 - a. Depicting system equipment drawn to scale, including cabling paths and support products and methods.
 - b. Location of products shall be shown coordinated with work of other Sections.
4. Equipment Rack Elevations
 - a. Scaled
 - b. Depicting the locations of all system products installed within the rack, coordinated with work of other sections, as applicable.

1.3 QUALITY ASSURANCE

- A. The contractor providing work of this section shall be engaged in the full-time business of providing integrated security systems of the type and scale of system specified herein.
- B. The contractor shall have been in the full-time business of providing like systems for the last contiguous (60) months. Contractor shall have completed not less the (6) systems of similar size, scope and complexity within the last 12 calendar months and shall be able to demonstrate proof of such upon request.
- C. Programming of the system shall be performed by the Owner.

1.4 SYSTEM DESCRIPTION

- A. General
 1. The system shall be constructed of products from one or more manufacturers that are designed by the manufacturer to integrate and interoperate with one another to the degree necessary to achieve compliance with these specifications.
 2. The system shall achieve integrated Access control functionality within a single unified software user interface solution.
 3. The system shall be capable of and enabled to communicate across a LAN and WAN for both fundamental and administrative functions.
 4. The system shall allow upgrades of both hardware and software seamlessly without the loss of database, system configuration, and historical data.
 5. The system shall feature integrated user interface maps that enable viewing of system status and control of devices (end points), e.g. doors.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. This specification, the functionality, the products and the system capabilities that are represented herein are based upon capabilities achievable through integration of products from a variety of listed product manufacturers. It is however the responsibility of the Contractor to provide such combination that meets and exceeds all expressed and implied requirements of these project documents.

- B. Commercial Security Products from the following manufacturers will be considered acceptable
 - 1. Access Control System
 - a. Genetec Security Center – Synergis Enterprise
 - 2. ACS Server (hardware)
 - a. None Required
 - 3. Switches
 - a. By AIS
 - 4. Accessories
 - a. Altronix
 - b. Life Safety Power

- C. Latest Version
 - 1. Software supplied shall be the latest and most up-to-date official-release shipping version shipping at the time of acceptance.
 - 2. Hardware supplied shall be the latest and most up-to-date shipping version available at the time of installation, complete with the most current official-release firmware.

2.2 ACCESS CONTROL SYSTEM

- 1. The system shall include alarm monitoring, video imaging and credential badging.
 - 2. Authentication device control modules throughout the installation shall communicate with the system server using IP based communications.
 - 3. Events within the access control installation shall cause video alarm / recordings.
 - 4. The system shall feature a distributed software and hardware architecture.
 - 5. The architecture shall place key access decisions, event/action processing, and alarm monitoring functions within the controllers.
 - 6. Controllers shall operate independently of the host server for extended periods of time in the event communications with the host server is temporarily lost.
 - 7. Communications between the server/workstations, controllers, and other system hardware shall be via the Security Management System server software.
 - 8. Hardware shall include upgradable flash memory designed to enable firmware updates via network communications.
 - 9. The system shall feature supervised and non-supervised alarm point monitoring.
 - 10. Manual or automatic arming or disarming alarm points shall be achievable through the creation of schedules by time of day, day of the week, and date.
-
- B. Database partitioning shall be provided to achieve an administrative option that allows restrictive access to sensitive information by user ID.

2.3 COMPUTERS, MONITORS AND ACCESSORIES

A. General

1. All supplied computers (Servers, Workstations, etc....) and peripherals (monitors etc....) shall meet or exceed software manufacturers' recommendations for running the software and operating the specified system.
 - a. Computers that meet the Access Control manufacturer's "minimum" computer requirements are not acceptable.

B. Work Station Computers

1. Provide software and install it on (5) work station computers, that shall be owner furnished or designated. The software shall also be compatible with Mac OS or the Mac OS Microsoft OS simulation.

2.4 DOOR HARDWARE (COORDINATE WITH ARCHITECTURAL HARDWARE SPECIFICATIONS AND SCHEDULE)

A. Coordinate with the published door hardware schedule and specifications to assure no duplication in the provision of components required for fully functioning access control and door hardware.

1. This includes but is not limited to:
 - a. Door locking device
 - b. Door locking device power supply(s)
 - c. Authentication devices
 - 1) Integral within the door hardware being provided
 - 2) Type of device being provided to assure interchangeable with the access control system provided
 - d. Door status device
 - 1) Integral with the door hardware being provided
 - 2) Assurance with the specified capabilities of the access control and intrusion alarm system(s)
 - e. Request to exit (REX) device
 - 1) Integral within the door hardware being provided
 - 2) Type of device being provided to assure interchangeable with the access control system provided
2. Where these devices are provided in the architectural door hardware specification, the contractor shall integrate them into the access control system.
 - a. This includes but is not limited to:
 - 1) Connection to the access control panel(s)
 - 2) Provision of cabling between the door hardware termination point and the access control panel(s)

2.5 AUTHENTICATION DEVICES

A. Card Reader Dual Frequency 125kHz & 13.56mHz

1. HID (interior only)
2. Essex Electronics (exterior only)

- B. Interior units shall be a HID sealed, single package weatherproof unit and shall be constructed of high impact ABS plastic.
- C. Exterior units shall be an Essex Electronics sealed unit, single package weatherproof unit faceplate shall be constructed of 1/8" stainless steel. Basis of Design shall be Essex IRXP-2
- D. Power for card reader shall be derived from the HID controller; therefore, the Contractor shall adhere to the manufacturer's guidelines for maximum distance from the reader to the controller.
- E. Access control devices shall incorporate a dual means of notification of door operation. Specifically, the access control reader shall supply an audible tone for access granted, access denied, out of service and door propped conditions. Additionally, the reader shall also supply a visual means of notification, such as colored LED's, for the above events. Each of these notifications shall be selectable by the host ACMS system.
- F. Typical access control readers shall be furnished and installed on a single gang backbox in accordance with the manufacturer guidelines. Standard card readers requiring a special mountings shall not be acceptable.

2.6 DOOR HARDWARE (SEE ARCHITECTURAL DOOR HARDWARE SCHEDULE)

- A. Door Status Switches (Provide if not integral with architectural door hardware)
 - 1. Two-piece design
 - 2. Designed for concealed installation
 - 3. Rare-earth magnet switch trigger
 - 4. Double Pull Double Throw (DPDT) contacts
- B. Request to Exit (REX) sensor (Provide if not integral with architectural door hardware)
 - 1. Passive Infrared (PIR) motion sensing type
 - 2. Adjustable time
 - 3. Variable coverage angle

2.7 CABLE

- A. General
 - 1. Supply cable that meets or exceeds the technical requirements of the components being interconnected suitable for the length and signal type and communication speed carried.
 - 2. Supply cable of sufficient gauge to ensure that connected components receive adequate voltage, power and signal integrity to ensure reliable operation of the system.
 - 3. Supply shielded version of cable for interconnection of system components that require such for proper operation.
 - 4. Safety listed by a nationally recognized safety testing laboratory (UL or equivalent)
 - 5. Code compliant for its purpose, location and method of installation.
 - a. For example, plenum rated cable shall be installed in plenum environments.
 - 6. Approved Cable Manufacturers: Windy City Wire.

- a. Basis of Design shall be Windy City Wire #NJ446110

EXECUTION

3.1 GENERAL

- A. Provide labor and all products necessary to render the system(s) complete and working.
- B. In addition to the requirements set forth by these project documents, provide additional work that is reasonable and customary for systems of the type and scope identified herein, as well as additional work recommended to be performed by the product manufacturers for completion of like systems.
- C. Perform work in a code-compliant manner to the satisfaction of the Authority having jurisdiction.
- D. Perform work according to the highest quality industry standards.

3.2 COORDINATION

- A. Refer to project drawings, including but not limited to architectural and electrical drawings for additional details that impact work of this section.
- B. Coordinate adequately with other trades to resolve conflicts.
- C. Review in detail the cabling pathway requirements for this system against the pathways indicated on the drawings.
 1. Review pathways with the pathway system provider.
 2. Take timely and proactive action to ensure that the pathway system is installed accurately and sufficiently supports this system.
- D. Provide qualified representation at project meetings to ensure that work of this section is adequately represented in the project schedule and that work is coordinated with other trades.
- E. Coordinate with the Owner's designated IT and security representative(s):
 1. Sufficiently early in the project so to negate negative impact on the project schedule and allow for timely completion of work.
 2. For the assignment of IP addresses and device naming conventions
 3. Communicate network configuration parameters material to the successful implementation of this system.

3.3 INSTALLATION

- A. General
 1. Install products in accordance these project documents and with product manufacturer's published installation instructions.

B. Conduits

1. All IDS cabling shall be encased in conduit **Blue** in color minimum of ¾".
2. All CCTV cabling shall be encased in conduit **Purple** in color minimum of ¾".
3. All ACMS cabling shall be encased in conduit **Orange** in color minimum of ¾".
4. All fire systems shall be encased in conduit **Red** in color minimum of ¾".
5. If conditions do not allow for colored conduit to be installed, the contractor is responsible for labeling the conduit and to inform the Owner as how to proceed immediately.

C. Authentication Devices

1. Coordinate with door hardware schedule and specifications.
2. Install authentication devices (e.g. card readers, keypads etc...) at the locations and height(s) designated on the drawings.
3. Install devices flat, plumb and level.

D. Door Controllers, Reader and I/O Modules

1. Install door controllers, reader and input/output modules in designated rooms as indicated on the drawings.
2. Equipment shall be mounted within approved communications rooms except where otherwise indicated on the drawings.
3. Equipment shall be mounted to plywood backboards installed over the finished walls within the rooms.
4. Where specific wall locations are indicated on the drawings, use these locations.
 - a. Where specific locations are not identified, review and coordinate mounting locations with the Owner's representative and other trades that also have work in the space.

E. Power Supplies

1. Supply and install power supplies of adequate capacity to allow for full rated operation of all system equipment.
2. Install and Provide power supplies for door hardware, controllers and other equipment within designated/approved rooms.
3. Connect power supplies to AC power.

F. Cabling

1. Install cabling that meets or exceeds the technical requirements of the components being interconnected suitable for the length and signal type carried.
2. Install cable of sufficient gauge to ensure that connected components receive adequate power, voltage and signal integrity to ensure reliable operation.
3. Install shielded cable for interconnection of system components that require such for proper operation.
4. Neatly dress and support all cables.
5. Take precautions to avoid damage to cable during installation, and to protect cables from damage after installation. Avoid cable bends and pulling tensions that are outside the manufacturer's recommended limits.
6. Maintain adequate separation of cables from sources of ingress interference that could negatively impact the performance of this system.
7. Utilize approved pathway products for supporting, securing and protecting cables. Ensure that horizontal cable runs are supported at increments not exceeding 48-inch.

8. Route cables in dedicated pathways, separated from cables serving other systems.
9. Label each end of each cable.
10. Use cable pulling compound/lubricant where necessary. Use only non-hardening compounds that do not deteriorate cable conductors, insulation or pathway components.

G. Grounding

1. All twisted pair shields shall be grounded at one point only. Cables that originate from equipment in systems/electrical rooms and terminate at field devices shall be grounded to the signal ground terminal in the system / electrical room. The field end shield shall be pulled back, trimmed, and taped in a good workmanlike manner.
2. Equipment, racks and associated devices shall be grounded per Division 27 specification
3. Ground products in accordance with industry standards, the NEC and in accordance with additional codes applicable at the project site.
4. Provide special grounding in accordance with referenced standards.

H. Labeling

1. Uniquely label the ends of every cable in the system using permanent computer generated self-laminating wrap-around cable labels.
2. Labels shall be clearly legible, using dark-black bold-type fonts.
3. Record actual label nomenclature on the as-built drawings.
4. Concealed Equipment
 - a. Identify the location of concealed equipment (e.g. TVSS devices) above ceilings, in walls, etc... using a labeling schema agreeable to Owner.

I. AC Power

1. Provide connection of supplied equipment to source(s) of AC power.
2. Provide services of licensed professional electrician to perform work required by code and the local jurisdiction to be performed by a licensed electrician.

3.4 PROGRAMMING

1. By Owner

3.5 TESTING

A. General

1. Conduct a complete inspection and test installed system equipment, inclusive of Owner furnished equipment utilized.
2. Include testing of interconnected equipment specified in other Divisions or Sections (e.g. Life Safety and Elevators).
3. Conduct tests recommended by all system equipment manufacturer(s).
4. Verify alarm condition scenarios perform as programmed
5. Exercise interactive maps and test each object/control.
6. Simulate alarm scenarios and verify each performs as intended by the Owner.
7. Update program to remediate problems encountered.

8. Replace malfunctioning and/or damaged items with new product and retest until satisfactory specification compliant conditions are achieved.

B. Access Control

1. Lock/Unlock based on credential presented
2. Lock/unlock based on time schedule
3. Door status alarm reported correctly on screen
4. Door status shut not reported
5. Schedules function as programmed
6. Special event override works when applied
7. Entry of credential works for each group applied, based on group access rights.
8. Exercise each authentication device, status switch, request to exit device and locking mechanism
9. Verify restoration of normal operation following simulated complete and partial power outage scenarios

3.6 ACCEPTANCE TESTING

- A. Acceptance testing shall be conducted after designer receipt and review of the pre-acceptance submittal aka "Sign Off Report". Allow (10) business days in the project schedule for the Designer's review.
- B. Acceptance testing may include, but may not necessarily be limited to:
 1. Visual and mechanical inspections of Contractor's workmanship.
 2. Inventory of equipment.
 3. Inspection of system components, sub-systems, software, component functionality, etc.
 4. Any other tests or inspections determined necessary by the Designer.
- C. The Contractor shall be onsite in advance of the scheduled acceptance testing time.
- D. Contractor shall have made adequate arrangements for access to all areas of work.
- E. Acceptance Testing will not pass if:
 1. Contractor's work does not appear to the Designer to be of Professional quality and/or the Contractor has failed to follow clearly established installation requirements.
 2. Detailed as-built drawings are not present on site for review and/or are found to be incomplete or inaccurate.
 3. More than one cable inspected is found to be missing required labels or if more than one cable is verified to be inaccurately recorded on the as-built drawings.
 4. Installed equipment does not match the equipment specified and/or reviewed by the Designer (in writing) during the course of the project.
 5. More than one piece of equipment, cable, connector, circuit, etc. fails to pass any test performed upon it by the Designer.
 6. Any substantive specification or workmanship issue judged by the Designer to be of material importance to the long-term usability, safety, professional appearance, or service and maintainability of the Contractor's work; any material deviation from the intent of these specifications.

7. Terminations of connectors ruled to be below the highest quality industry standards.

F. Contractor's Field Testing

1. The Contractor shall calibrate and test all equipment, place the systems in service, and test the systems. The Contractor shall deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Owner that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.
2. If any conditions or other conditions exist that cause degradation or interfere with any security device, the Contractor shall inform the Owner.
3. The field testing shall as a minimum include:
 - a. Verification that the any signal or control cabling have been installed, tested, and approved as specified. All cabling to be identified and labeled to be included in test report.
 - b. When the system includes remote control/monitoring stations or remote switch panels, verification that the remote devices are functional, communicate with the center, and perform all functions as specified.
 - c. Verification that all systems devices are fully functional, and that applicable software has been programmed as needed for the site configuration.
 - d. Operation of all electrical and mechanical controls and verification that the control performs the designed function.
 - e. Verification that all cables are terminated properly. Verification that the any signal or control cabling have been installed, tested, and approved as specified.
 - f. When the system includes remote control/monitoring stations or remote switch panels, verification that the remote devices are functional, communicate with the center, and perform all functions as specified.
 - g. Verification that all security devices are fully functional, and that applicable software has been programmed as needed for the site configuration.
 - h. Verification that applicable software is functioning correctly. All software functions shall be exercised.
 - i. Operation of all electrical and mechanical controls and verification that the control performs the designed function.
 - j. Verification that all data sources and data outputs provide a full bandwidth signal at all data inputs.
 - k. Verification that all cables are terminated properly.
4. Deliver a report describing results of functional tests, diagnostics, and calibrations including written certification to the Designer that the installed complete system has been calibrated, tested, and is ready to begin performance verification testing. The report shall also include a copy of the approved performance verification test procedure.

3.7 SYSTEM STARTUP

- A. Do not apply power to any systems until the following items have been completed:
 1. Equipment items have been set up in accordance with manufacturer's instructions.

2. A visual inspection has been conducted to ensure that defective equipment items have not been installed and that there are no loose connections.
3. System wiring has been tested and verified as correctly connected as indicated.
4. All system grounding and transient protection systems have been verified as properly installed and connected as indicated.
5. Power supplies to be connected to the Systems have been verified as the correct voltage, phasing, and frequency as indicated.
6. Verify network communications for the NVR, cameras, S2 controller, and network switch.
7. Provide written and signed checklist indicating this was done.
8. Satisfaction of the above requirements shall not relieve the Contractor of responsibility for incorrect installation, defective equipment items, or collateral damage as a result of Contractor work/equipment.

3.8 DEMONSTRATION AND ACCEPTANCE

- A. Create a written, step by step, plan to demonstrate the operation of all systems and submit it for approval two weeks prior to the demonstration date. The Owner will review and comment, or approve the plan at that time. Submit a suggested demonstration date and time along with the plan.
- B. On the accepted date, execute the demonstration plan in the presence of the Owner and their representatives. If the demonstration is successful, the systems will be considered accepted and a punch list will be generated. If the demonstration fails, the systems will be considered not accepted and another demonstration event shall be scheduled. This process will be repeated until the systems are accepted.
- C. Multiple Contractor User privilege levels will likely be established during the installation and testing periods of this Project. As a condition of system final acceptance, all Contractor User privileges shall be removed from the system, unless otherwise authorized in writing, by the Owner.

3.9 ON-SITE ASSISTANCE

- A. When requested by 2FM within one year of date of 2FM sign off/acceptance, provide on-site assistance in tuning and adjusting the system to suit actual occupied conditions and to optimize performance. Provide up to 36 hours of time by a qualified technician, on site, for adjustments of the system without additional cost.

3.10 CLEANING AND ADJUSTING

- A. Clean installed items using methods and materials recommended by manufacturer.

END OF SECTION 28 13 01

SECTION 28 13 02 - SIMULATION TRAINING VIDEO RECORDING SYSTEM**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the materials, software and labor as required for a complete working system as follows:
 - 1. New Video Cameras with audio recording capability.
 - 2. Video Recording and Playback Server.
 - a. If the existing VMS hardware can be upgraded to support the new cameras being added with this work, then it may be utilized if not a new server shall be provided.
 - 3. Connection to existing head end equipment for recording and playback.
 - 4. Client Playback Software to be installed on owner supplied computer workstation.
 - 5. Provide all required software licenses.

- B. Related Sections
 - 1. All Division 27 and 28 Sections
 - 2. Technology Series Drawings

1.2 SUBMITTALS

- A. Product Data Submittal
 - 1. Manufacturer datasheets for each system component
 - 2. Bill of Materials (BOM) List

- B. Shop Drawing Submittal
 - 1. Plan Drawing(s)
 - a. Depicting the location of all devices and major equipment locations on the project site, coordinated with work of related sections.
 - 2. System Diagram(s).
 - a. Depicting the interconnecting cabling between system equipment located at different locations at the project site.
 - 3. Equipment Rack Elevations
 - a. Scaled
 - b. Depicting the locations of all system products installed within the rack, coordinated with work of other sections, as applicable.

- C. Training Plan Submittal

- D. Closeout Submittal

1.3 QUALITY ASSURANCE

- A. The contractor providing work of this section shall be engaged in the full-time business of providing integrated security systems of the type and scale of system specified herein.

- B. The contractor shall have been in the full-time business of providing like systems for the last contiguous (60) months. Contractor shall have completed not less the (6) systems of similar size, scope and complexity within the last 12 calendar months and shall be able to demonstrate proof of such upon request.
- C. Programming of the system shall be performed by individuals that are manufacturer certified and fluent in both the software and hardware used to build the system.
 - 1. Each individual shall possess a comprehensive knowledge of the programming options available and have no less than (2) years of actual programming experience for systems of this type.

1.4 SYSTEM DESCRIPTION

- A. General
 - 1. The system shall be constructed of products from one or more manufacturers that are designed by the manufacturer to integrate and interoperate with one another to the degree necessary to achieve compliance with these specifications.
 - 2. The system shall be capable of and enabled to communicate across a LAN and WAN for both fundamental and administrative functions.
 - 3. The system shall allow upgrades of both hardware and software seamlessly without the loss of database, system configuration, and historical data.
 - 4. The system shall feature integrated user interface maps that enable viewing of system status and control of devices (end points), e.g. doors.
- B. The Contractor shall configure the system as described and shown. The system shall include all connectors, adapters, and terminators necessary to interconnect all equipment. The Alarm Contractor's must be a licensed Alarm Contractor in the State of Illinois and City of Chicago, all personnel installing systems must have a State of Illinois Permanent Employee Registration Card (PERC) on their person and shall be furnished to 2FM Security before work is to begin. In the event of personnel changes the above requirements shall be updated and furnished to 2FM Security before that individual is to begin working.
- C. Data Entry
 - 1. The Contractor shall enter all data needed to make the system operational. The Contractor shall identify and request from the Owner, any additional data needed to provide a complete and operational security system. The completed forms shall be delivered to the Owner for review and approval at least 10 days prior to the Contractor's scheduled needed date.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. This specification, the functionality, the products and the system capabilities that are represented herein are based upon capabilities achievable through integration of products from a variety of listed product manufacturers. It is however the responsibility

of the Contractor to provide such combination that meets and exceeds all expressed and implied requirements of these project documents.

- B. Commercial Security Products from the following manufacturers will be considered acceptable
 - 1. VMS Software.
 - a. Genetec
 - 1) Genetec Security Center – Omnicast Enterprise
 - 2. VMS Server (hardware)
 - a. Genetec Certified
 - b. BCDVideo
 - 3. Switches
 - a. By AIS
 - 4. Surveillance Cameras
 - a. Axis
 - 5. Workstations
 - a. By AIS
- C. Latest Version
 - 1. Software supplied shall be the latest and most up-to-date official-release shipping version shipping at the time of acceptance.
 - 2. Hardware supplied shall be the latest and most up-to-date shipping version available at the time of installation, complete with the most current official-release firmware.

2.2 GENETEC SOFTWARE REQUIREMENTS

- A. Seamless Unification with VMS
- B. Through the USP, the ACS shall support integration with an IP Video Surveillance System or MVS. Integration with an IP video surveillance system shall permit the user to view live and recorded video.
- C. Users shall be able to associate one or more video cameras to the following entity types: doors, elevator, and hardware zone (input points) and more.
- D. The Monitoring UI shall present a true Unified Security Interface for access control and video surveillance. Advanced live video viewing and playback of archived video shall be available through the Monitoring UI.
- E. It shall be possible to view video associated with access control events when viewing a report.

2.3 VIDEO MANAGEMENT SYSTEM (VMS)

- A. The VMS shall be based on a true open architecture that shall allow the use of non-proprietary workstation and server hardware, non-proprietary network infrastructure and non-proprietary storage.
 - 1. The system shall feature IP based network video recording of all system cameras.

2. The system shall include the ability to record video from selected cameras based upon user defined access control activity.
3. The system shall include the ability to record video from cameras based upon preprogrammed video conditions;
 - a. Record at all times
 - b. Record only during selected times
 - 1) As a result of activity in the view of the camera
 - 2) As a result of setting minimum frames per second regardless of activity (time lapse)
 - c. Record at different frame rates or image quality based upon predetermined administrator selected conditions.
4. The VMS shall offer a complete and scalable video surveillance solution that shall allow cameras to be added on a unit-by-unit basis.
5. The VMS shall interface with analog-to-digital video encoders and IP cameras and with digital-to-analog video decoders, hereafter referred to as digital video servers (DVS). The VMS shall support DVS from various manufacturers.
6. The VMS shall integrate DVS using the DVS native SDK or using the following industry standards to interface to the DVS:
 - a. ONVIF
7. All video streams supplied from analog cameras or IP cameras shall be digitally encoded in MPEG-4, MPEG-2, MJPEG, H.264, Wavelet, or JPEG2000 compression formats and recorded simultaneously in real time.
8. All audio streams supplied from IP video servers shall be digitally encoded in g711 (u-law), g721, g723, or AAC compression formats and recorded simultaneously in real time.
9. Each camera's bit rate, frame rate, and resolution shall be set independently from other cameras in the system, and altering these settings shall not affect the recording and display settings of other cameras.
10. The system shall log alarm activity and enable users to search video and associated database for such activity.
11. The system shall include support for recording of all cameras simultaneously and the ability for 10 different computers to view unique combinations of cameras simultaneously.
12. The system shall be capable expansion in the future to accommodate additional concurrent viewing computers.
 - a. The expansion shall only require payment of a software license fee and installation of a licensing key to achieve this objective.
13. The system shall permit all of the following to occur simultaneously:
 - a. Record all cameras
 - b. View all cameras live (i.e. in real time)
 - c. Playback pre-recorded video from any and all cameras simultaneously.
 - d. The above shall be possible when cameras and/or video storage medium are physically located on premise or at remote facilities.
14. Video shall be stored in a non-volatile, expandable drive storage system that does not result in loss of data should a single drive unit within a chassis fail or when storage space is added to the system.
15. Each storage system chassis shall include at least one built-in spare drive unit designed to immediately take over in the event of another drive failure.
16. Data on the spare/replacement drive unit shall be reconstructed in less than 24 hours while the system continues to operate at normal operating capacity.

17. The system shall support distributed video storage, whereby storage of video does not need to be in one physical location.
18. Software shall support archival (back up) of system recordings
19. Software based remote control of cameras, associated optics and positioning devices shall be possible by administrator authorized users and groups of users.
20. Authorized users shall have the ability to create and store preset views containing 1 to multiple cameras.
 - a. Preset views shall be available for instant recall by the user.
21. Capable of matching camera resolution to the display or display area used for viewing
22. Authorized users shall have the ability to create and store preset views containing 1 to multiple cameras in a web-browser
23. The system shall enable users to search for and play back video by date, time, camera, and alarm condition as well as video analytics.
24. The system shall support recording and storage of video encoded in multiple (3) or more popular standards-based video encoding formats to accommodate future expansion using cameras from multiple manufacturers.
25. The system shall include the ability to export pre-recorded camera video of any duration to commonly recognized popular portable storage mediums.
26. Provide with Genetec Mobile APP for IOS and Android.

B. Image Storage Capacity

1. Although configuration settings at time of installation will be different, the system shall be provided with storage capacity sufficient to store (5) days of images, based upon the following specific criteria:
 - a. All system cameras recording simultaneously;
 - b. Highest scene activity based on camera location;
 - c. Highest image resolution settings available on system equipment;
 - d. Framerate (fps) based on the following criteria:
 - 1) Highest frame rate that specific camera supports
 - e. 20% additional storage capacity in reserve for future camera additions.

2.1 NVR SERVER

A. Manufacturer: Genetec Omnicast Streamvault appliance line

1. 2U rack mount type.
2. Minimum 16 IP camera licenses.
3. Required license and programs to make system fully functional must be provided to owner.
4. The NVR server hardware shall be capable of running Microsoft's latest Server OS.

B. NVR HARDWARE FEATURES

1. The NVR server shall have recording resolutions of CIF, 2CIF, and D1 and shall be user selectable for each individual analog camera attached to the server. Standard resolution and high resolution mega-pixel IP cameras shall also be selectable. MPEG-4 ASP or MJPEG video compression format shall be user selectable on any camera. Video recording shall be available at up to 30 images per second per input channel depending on IP camera type and server model selected.

2. The NVR server shall have video outputs for multi-monitor and spot monitors touring (switching) between analog camera video in either full, quad (2 x 2), 3 x 3, and 4 x 4 screen display modes.
 - a. The exacqVision Server shall be capable of recording line level audio, with synchronous video playback as well as playing live audio from any single audio channel selected.
3. Each server shall have the capability of automatically exporting a predetermined time frame of video to the internal server DVD/CD device upon an external trigger input connected to the server or by depressing a specific switch on the server. Such input shall export to the DVD/CD device a user defined amount of video and video camera source both pre and post event schedulable to the maximum capacity of the DVD/CD media selected.
4. Server hardware shall have an internal DVD/CD device that will allow the server to export video clips to the device in Standalone.Exe (*.exe), AVI Files (*.avi) and PS Files (*.ps) formats.
5. Each Server shall have a watchdog system that monitors the system and automatically reboots the system should it lock-up or fail to operate.
6. Each server shall be capable of integration with the City's SMS, Manitou, from Bold Technology.
 - a. Common System components
7. MONITOR AND KEYBOARD
 - a. Provide a 22" color monitor, keyboard and mouse. A rack mounted tray/shelve to serve as an operator interface for the NVR

2.2 ENTERPRISE SYSTEM MANAGEMENT

1. The Storage Server System Manager ("storage manager") shall be a software package installed on a dedicated server at the Network Operations Center (NOC) and provide the following functionality for compatible storage servers reachable via Internet Protocol.
2. The system shall provide a browser-based dashboard to view and monitor health and events related to storage servers and the cameras connected to them, including:
 - a. Camera Events
 - b. Video loss - IP video signal lost.
 - c. Camera Disconnected - Network cannot connect to analog or IP camera
 - d. Storage Server Events
 - e. Archive Alarm - Failure on archiving target, such as bad mount point
 - f. Content Age Alarm - Video deleted before configured retention period
 - g. Login Failure - Login attempt failed on server
 - h. Server Disconnected - Connection to server lost
 - i. Storage Alarm - Drive capacity threshold reached
 - j. Storage Hardware Alarm - Server storage malfunctioned
 - k. Temperature Sensor Alarm - System temperature not within recommended range
 - l. Voltage Sensor Alarm - System voltage not in recommended range
3. Provides e-mail notifications of user selected system events and conditions in real time or batch fashion
4. Provides software updates to storage servers on a configurable schedule
5. The system shall allow the configuration of user and server groups, consisting of monitored systems with identical settings of monitored features.

6. Provides color coded status of servers, cameras, and unacknowledged events in the following categories in list or chart format:
 - a. Server or camera device not detected
 - b. Health warning on server (such as temperature, storage alarm, archive alarm, CPU fan)
7. Allows creation of reports to:
 - a. view and manage a list of unacknowledged events
 - b. view a list of open events
 - c. search for specific events based on various criteria
8. Allows events to be searched based on various criteria, including event time, event type, and associated cameras and servers
9. Permits viewing of server licenses
10. Database compatibility
 - a. Microsoft SQL
 - b. MySQL
11. The system shall run as a service. The system manager shall not require any application to be running in order to operate.
12. The system shall run on a mobile application at no additional cost.
13. Hardware Requirements
 - a. Storage Manager Server
 - 1) The storage manager shall operate on the following minimum requirements:
 - a) Processor: Intel E3-1275 Xeon or Better
 - b) RAM: 32GB
 - c) Hard drive: 250GB SSD minimum
 - d) Operating system: Windows 10, Windows Server 2012 or 2016 R2

2.3 CAMERAS, MOUNTS & ACCESSORIES

A. Cameras

1. IP Cameras must be either a fixed type, 180*, 360* type camera depending on its location and use. PTZ type cameras are not acceptable.
2. Baseline Camera Features
 - a. Listed by a national recognized safety testing laboratory (UL or equivalent)
 - b. 10/100/1000 mbps Ethernet output for transmission of video over IP network
 - c. Lens Vari-focal
 - 1) Auto-iris / P-Iris lens
 - 2) Motorized auto focus
 - d. Camera settings shall be remotely configurable via IP communications
 - e. CMOS sensor type imaging device
 - 1) Backside illumination
 - f. Resolution scalable
 - 1) Range between CIF – UHD 4K
 - g. Bandwidth scalable
 - 1) Range between 64 Kbps and 20 Mbps
 - h. Light Sensitivity
 - 1) 0.3 (color)/0.04 (BW), 0 Lux with IR illuminator on, measured with DSS off at 30 IRE

- i. Capable of transmitting 30-progressive frames of video per second at the full native resolution of the camera
 - j. Commercial grade camera
 - k. Onscreen menu for local camera setup
 - l. Auto gain control
 - m. Auto white balance
 - n. Wide dynamic range
 - 1) True or digital WDR
 - o. Signal to noise ratio \geq 50dB
 - p. IR illuminator
 - q. Support for powering via Power Over Ethernet (PoE) enabled input, and local power.
 - r. Capable of being Low-voltage (12-24 V) powered
 - s. Support for one or more of the following standards based encoding algorithms: MJPEG, MPEG-4, H.264 and H.265 (HEVC).
 - t. Capable of simultaneously transmitting \geq 3 streams at varying rates
 - u. ONVIF Profile S compatible
3. Additional baseline features of cameras used outdoors
- a. Resolution scalable
 - 1) Range between CIF – UHD 4K
 - b. Dual modes of operation – Color during normal lighting conditions; black-and-white during low light conditions
 - c. Physical auto switching removal of the infrared filter for increased sensitivity in low-light conditions.
 - d. Backlight compensation.
 - e. Install transient voltage surge suppression protection devices in line with cables connecting outdoor equipment with indoor equipment. Protection device shall provide a margin of protection of outdoor equipment against surges originating within the building and margin of protection of indoor equipment originating from electrical surges outside the building.
 - f. Install protection devices in each conductive circuit that interconnects outdoor equipment to indoor equipment. This includes power, video and control circuits.
 - g. Protection devices shall be installed within a Ingress Protection (IP65 minimum) rated enclosure installed within 10 cable feet of cable entrance into the building. Enclosure shall be installed above accessible ceiling and sized to accommodate the fully connectorized TVSS equipment.
 - h. See Labeling for additional requirements.
4. Additional features for pole-mounted cameras
- a. Dynamic Image stabilization feature for reduction of the visual effects of minor pole swaying movement.
- B. Lens Optics
- 1. Provide high quality CCTV lenses sized according to the intended area of coverage as shown on the drawings and in accordance with the following minimum specifications:
 - a. Fixed cameras shall be provided with aspherical varifocal lens optics. Lenses provided for fixed cameras shall be aspherical varifocal length type and shall include provisions for automatic iris adjustment and standard "CS" or "C" mounting. Adapter rings shall be provided for all "C" mount lenses, aspherical varifocal lenses shall also be compatible with a CCD camera

imager. Exact focal lengths of the lenses will be coordinated with the Owner based on the scene to be viewed.

- b. The average video level sampled from the camera will determine automatic iris operation. Iris control signals and operating voltage shall be obtained from the camera and the lens will include a pre-wired plug assembly compatible with the cameras being provided.
- c. Lenses for speed-dome cameras shall be provided as an integral part of the speed-dome camera configuration.
- d. Lens optics shall be high quality precision ground glass. All optics shall be color corrected to provide accurate color scene reproduction.

C. Mounts

1. Camera Mounts

- a. Camera mounts shall be 100% compatible with the housing being provide and shall have the following characteristics:
- b. The Contractor shall field verify each camera location, prior to ordering.
- c. Mounts shall be constructed from steel or aluminum and shall prevent corrosion.
 - 1) Mounts shall be 100% compatible with the housing.
 - 2) Fixed cameras mounts and their installation shall be coordinated with the owner as to maintain the esthetics of the installation sites.
2. Provide commercial grade mounts heavy duty mounts and mounting hardware for cameras.
3. Outdoor mounts shall be designed for outdoor mounting and exposure to the elements
 - a. All outdoor hardware shall be stainless steel.
4. Refer to drawings and camera matrix for mounting form-factors of individual camera locations.
5. Provide custom painted mounts and mounting hardware where indicated on the drawings.

D. CCTV Camera Housing

1. The Contractor shall provide all cameras with permanent connections. Specifically, wiring shall not be open or loose. It is the contractors responsibility to provide rigid conduit for all installations to prevent wire tampering.
2. Camera housings and their installation shall be coordinated with the owner as to maintain the esthetics of the installation sites.
3. Camera platform shall be constructed of a non-conductive or insulated to eliminate grounding problems.
4. Exterior camera housing shall be equipped with internal heating element.
5. Camera housings shall also have the following characteristics:
 - a. All cables shall be terminated, encapsulated in rigid conduit.
 - b. The housing shall be constructed with the intent to provide quick and easy servicing of the camera within it. Specifically, a slip in tray or cover with 180° opening.
 - c. The Contractor shall coordinate with the Owner the exact architectural style of the housing and finish, prior to ordering.
 - d. It the Contractors responsibility to perform all necessary calculations to verify that lens and camera combination can be accommodated by the housing being furnished.

- e. Camera Housing shall have tamper resistant screws. The Contractor shall provide the Owner (2FM Alarm Section) with a tool to remove the tamper resistant screws allowing them to service the housing themselves

2.4 ACCESSORIES

- A. Provide microphone at each Training camera location.
 - 1. An ultra-low-noise microphone with an SNR of 80 dBA. It comes included with a Terminal Block to 3.5 mm Audio Extension, and could be installed with AXIS P32-LV Network Cameras in combination with AXIS TP3201.
 - 2. Specification: Frequency response 20 Hz – 20 kHz, ± 2 dB. Signal-to-noise ratio (SNR): 80 dBA (relative 1 kHz @ 1 Pa, 94 dB SPL). Sensitivity -28 dB ± 3 dB (at 1 kHz, 0 dB=1 V/Pa). Max sound pressure level (SPL): 119 dB at 1 kHz. Impedance 1.5 k Ω @ 1 kHz. Temperature range: -20 °C to 60 °C (-4 °F to 140 °F)
 - 3. Basis of Design shall be Axis Device Microphone B.
- B. Provide speaker at each Training camera location.
 - 1. See specification section 27 41 00 for speaker details.

2.5 COMPUTERS, MONITORS AND ACCESSORIES

- A. General
 - 1. All supplied computers (Servers, Workstations, etc...) and peripherals (monitors etc...) shall meet or exceed the software manufacturers' recommended specifications for running the software and operating the specified system.
 - a. Computers that meet the VMS manufacturer's "minimum" computer requirements are not acceptable.
 - 2. Computers shall be furnished fully loaded and configured with operating system software client user licenses necessary to allow the system to operate capacity. The operating system and database software shall be the latest version supported by the security system software.
- B. Server Computers
 - 1. Provide minimum (1) dedicated rack mount server-class computer to run the Video Management System surveillance server.
 - a. The access control server software may be virtualized on the dedicated video surveillance server where this feature is supported by both the video surveillance manufacturer and the access control manufacturer.
 - 1) This includes systems that have been expressly manufactured for this purpose by the video surveillance and access control system manufacturers.
 - b. This function shall result in no degradation in performance of either access control or video system's server software.
 - 2. Provide (1) rack mount LCD monitor (17"-class minimum), plus rack mount computer keyboard and mouse drawer system.
 - 3. Provide rack mount hardware based KVM switching system that enables all security system servers to be accessed, controlled and viewed by a single keyboard, monitor and mouse.

- a. Combination rack mount monitor, keyboard, mouse and KVM units where the features described above have been met shall be acceptable.
4. Provide servers with operating system, database software and sufficient Client Access Licenses and other applicable licensing to ensure that full operation of the system, and concurrent access by all access control and video client software computers.

C. Work Station Computers

1. Provide software and install it on (5) work station computers, that shall be owner furnished or designated. The software shall also be compatible with Mac OS or the Mac OS Microsoft OS simulation.

2.6 MASS STORAGE

- A. Hard-disk-drive (HDD) or Solid-state-drive (SSD) based arrays.
- B. Expandable without loss of existing data.
- C. Self-healing configuration with integral hot-swappable spare drives.
- D. Sufficient read/write data bandwidth to accommodate writing of data from all system video sources simultaneously (multiplied by a factor of 4) at the full resolution and frame rate of the video source, plus an equivalent amount of bandwidth for playing back (i.e. reading) data.
- E. 19" Rack mountable

2.7 CABLE

A. General

1. Supply cable that meets or exceeds the technical requirements of the components being interconnected suitable for the length and signal type and communication speed carried.
2. Supply cable of sufficient gauge to ensure that connected components receive adequate voltage, power and signal integrity to ensure reliable operation of the system.
3. Supply shielded version of cable for interconnection of system components that require such for proper operation.
4. Safety listed by a nationally recognized safety testing laboratory (UL or equivalent)
5. Code compliant for its purpose, location and method of installation.
 - a. For example, plenum rated cable shall be installed in plenum environments.
6. Approved Cable Manufacturers: West Penn, Belden, CommScope, General Cable Corporation and Windy City Wire.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Provide labor and all products necessary to render the system(s) complete and working.
- B. In addition to the requirements set forth by these project documents, provide additional work that is reasonable and customary for systems of the type and scope identified herein, as well as additional work recommended to be performed by the product manufacturers for completion of like systems.
- C. Perform work in a code-compliant manner to the satisfaction of the Authority having jurisdiction.
- D. Perform work according to the highest quality industry standards.

3.2 COORDINATION

- A. Refer to project drawings, including but not limited to architectural and electrical drawings for additional details that impact work of this section.
- B. Coordinate adequately with other trades to resolve conflicts.
- C. Review in detail the cabling pathway requirements for this system against the pathways indicated on the drawings.
 - 1. Review pathways with the pathway system provider.
 - 2. Take timely and proactive action to ensure that the pathway system installed accurately and sufficiently supports this system.
- D. Coordinate the location of camera rough-in to ensure it allows for professional quality camera installation with serviceability and with aesthetic appeal.
- E. Review existing conditions (where applicable).
- F. Provide qualified representation at project meetings to ensure that work of this section is adequately represented in the project schedule and that work is coordinated with other trades.
- G. Coordinate with the Owner's designated IT and security representative(s)
 - 1. Sufficiently early in the project so to negate negative impact on the project schedule and allow for timely completion of work.
 - 2. For the assignment of IP addresses and device naming conventions
 - 3. Communicate network configuration parameters material to the successful implementation of this system.

3.3 INSTALLATION

- A. General

1. Install products in accordance these project documents and with product manufacturer's published installation instructions.
 2. All CCTV cabling shall be encased in conduit Purple in color minimum of ¾".
- B. Power Supplies
1. Supply and install power supplies of adequate capacity to allow for full rated operation of all system equipment.
 2. Install and Provide power supplies for cameras, controllers and other equipment within designated/approved rooms.
 3. Connect power supplies to AC power.
- C. Cameras
1. Terminate cabling provided
 2. Mount cameras per the manufacturer's instructions and as additionally detailed in these project documents.
 3. Install cameras at the locations identified on the plans, coordinating with field conditions as appropriate.
 - a. Unless identified by scaled or dimensioned detail, camera mounting heights are for reference. Actual mounting heights shall be verified in the field and coordinated with architectural detail for aesthetic appeal and with obstacles that may have negative impact on visual coverage or impact serviceability.
 - b. Seek the direction of the Designer should any consequential issues arise from the use of an identified camera location or mounting height.
 4. Set camera angles and field of view in collaboration with the Owner's designated security representative.
 - a. Make adjustments to the satisfaction of the Owner.
 - b. Clean, lens, cover, housing anything that may impede or obstruct the view and assure camera is performing optimally.
 5. Assure that power source for camera is set to the proper voltage to match the cameras specified requirements.
- D. Equipment Racks
1. Secure equipment within racks using approved rack-mounting products.
 2. Utilize manufacturer accessory rack mounts where available;
 - a. Utilize custom fabricated product-specific rack mounts for other equipment.
 - b. Open shelves shall not be permitted for equipment mounting except where expressly specified, detailed or otherwise approved by the Designer.
 3. Securely attach non-portable racks to the building floor or other approved structure.
 - a. Racks that require movement for equipment installation or service shall be secured using such means that allow the rack to be deliberately moved to achieve this objective. Review proposed mounting with the Designer.
 4. Internal Cabling
 - a. Neatly route and support cables level and plumb.
 - b. Bundle and route cables of different signal types independently.
 - c. Use removable Velcro-like wire ties for bundling of cables. Do not use standard wire ties
 - d. Route vertical runs of cables along the sides of the rack.
 - e. Support horizontal runs of cables using horizontal support bars.
 - f. Fan cables to equipment neatly between horizontal lacing bars and equipment.

- g. Provide a service loop of adequate length between lacing bars equipment so as permit ease of installation and service access to equipment.
 - h. Ensure that cable connections are not subjected to any stress or strain at the point of termination during idle installation or routine servicing of system equipment.
 - 5. Filler Panels
 - a. Install solid and vent-type filler panels in all unused spaces of equipment racks. Use combinations that ensure adequate cooling of installed product.
 - 6. Power Distribution
 - a. Install AC power distribution sufficient to serve all housed equipment.
 - b. Connect power distribution equipment to local area AC power, utilizing the services of a licensed electrician where required by code.
 - c. Provide a minimum of 20% spare outlets within each rack to accommodate future equipment.
- E. Cabling
 - 1. Install cabling that meets or exceeds the technical requirements of the components being interconnected suitable for the length and signal type carried.
 - 2. Install cable of sufficient gauge to ensure that connected components receive adequate power, voltage and signal integrity to ensure reliable operation.
 - 3. Install shielded cable for interconnection of system components that require such for proper operation.
 - 4. Neatly dress and support all cables.
 - 5. Take precautions to avoid damage to cable during installation, and to protect cables from damage after installation. Avoid cable bends and pulling tensions that are outside the manufacturer's recommended limits.
 - 6. Maintain adequate separation of cables from sources of ingress interference that could negatively impact the performance of this system.
 - 7. Utilize approved pathway products for supporting, securing and protecting cables. Ensure that horizontal cable runs are supported at increments not exceeding 48-inch.
 - 8. Route cables in dedicated pathways, separated from cables serving other systems.
 - 9. Label each end of each cable. See Labeling.
 - 10. Use cable pulling compound/lubricant where necessary. Use only non-hardening compounds that do not deteriorate cable conductors, insulation or pathway components.
- F. Grounding
 - 1. Ground products in accordance with industry standards, the NEC and in accordance with additional codes applicable at the project site.
 - 2. Provide special grounding in accordance with referenced standards.
- G. Labeling
 - 1. Uniquely label the ends of every cable in the system using permanent computer generated self-laminating wrap-around cable labels.
 - 2. Labels shall be clearly legible, using dark-black bold-type fonts.
 - 3. Record actual label nomenclature on the as-built drawings.
 - 4. Concealed Equipment
 - a. Identify the location of concealed equipment (e.g. TVSS devices) above ceilings, in walls, etc. using a labeling schema agreeable to Owner.

- H. AC Power
 - 1. Provide connection of supplied equipment to source(s) of AC power.
 - 2. Provide services of licensed professional electrician to perform work required by code and the local jurisdiction to be performed by a licensed electrician.

3.4 PROGRAMMING

- A. Perform initial programming of the system to establish fundamental operational parameters; parameters shall represent industry standards for best practice.
- B. Following initial programming, collaborate with the Owner's designated security representative to formulate specific programming to satisfy Owner's objectives. Present baseline programming already in place to the Owner at the start of this collaboration.
 - 1. The programmer shall advise the Owner of the fundamental choices that must be made to render the system useful for its intended purpose and shall supply forms which the Owner shall use to aid in making programming influencing decisions.
- C. Create dynamic graphical user-interface maps of each facility and site served by the system.
 - 1. Maps shall be programmed to reflect doors and readers that are controlled and/or monitored.
 - a. Status of doors featuring status switches shall be reported.
 - b. Doors with locking mechanisms shall be remotely controllable via map.
 - 2. Maps shall include status indicators that reflect the status of other sensors identified to be connected to or monitored by this system.
 - 3. Maps shall include interactive icons reflecting the location of each video surveillance camera. The camera icon shall allow users to interact with the icon to view live video from the associated camera.
 - 4. The programming shall include the ability for the administrator to grant map based control based upon user rights.
 - 5. Map navigational hierarchy shall allow for easy navigation to maps associated with remote facilities that are connected to the system.
- D. Video Surveillance
 - 1. Enter system configuration data necessary to render the system operational and usable to the Owner.
 - 2. Programming shall include setting up Owner designated views of cameras and sequencing behaviors.
 - 3. Programming shall include setting up separate views and behaviors for each viewing location; up to maximum of (5) separate locations.
 - 4. Enable remote control of remote controllable cameras in the system.
 - 5. Program the recording behaviors of cameras.
 - a. Program when cameras are recorded;
 - b. Program when cameras are recorded at a low frame rate and / or resolution
 - c. Program when cameras are recorded at higher frame rate and / or resolution.
 - 6. If pre-recording is an option of the system, program pre-recording of designated cameras in collaboration with the Owner's direction.
 - 7. Provide programming to integrate camera behaviors with the access control functionality and maps.

8. Provide programming that results in cameras being recorded when credentials are presented to authentication device.
9. Log unauthorized credential presentation as a searchable alarm condition.
10. Program masking zones of each fixed position camera.
 - a. Where required by the owner
11. Program areas of interest on each fixed position camera.

3.5 TESTING

A. General

1. Conduct a complete inspection and test installed system equipment, inclusive of Owner furnished equipment utilized.
2. Include testing of interconnected equipment specified in other Divisions or Sections (e.g. Life Safety and Elevators).
3. Conduct tests recommended by all system equipment manufacturer(s).
4. Verify alarm condition scenarios perform as programmed
5. Exercise interactive maps and test each object/control.
6. Simulate alarm scenarios and verify each performs as intended by the Owner.
7. Update program to remediate problems encountered.
8. Replace malfunctioning and/or damaged items with new product and retest until satisfactory specification compliant conditions are achieved.

B. Video Surveillance

1. Verify restoration of normal operation following simulated complete and partial power outage scenarios
2. View, record and playback video from cameras, singularly and in combination with other cameras.
3. Exercise remote control functions of cameras

3.6 ACCEPTANCE TESTING

- A. Acceptance testing shall be conducted after designer receipt and review of the pre-acceptance submittal aka "Sign Off Report". Allow (10) business days in the project schedule for the Designer's review.
- B. Acceptance testing may include, but may not necessarily be limited to:
 1. Visual and mechanical inspections of Contractor's workmanship.
 2. Inventory of equipment.
 3. Inspection of system components, sub-systems, software, component functionality, etc.
 4. Any other tests or inspections determined necessary by the Designer.
- C. The Contractor shall be onsite in advance of the scheduled acceptance testing time.
- D. Contractor shall have made adequate arrangements for access to all areas of work.
- E. Acceptance Testing will not pass if:

1. Contractor's work does not appear to the Designer to be of Professional quality and/or the Contractor has failed to follow clearly established installation requirements.
 2. Detailed as-built drawings are not present on site for review and/or are found to be incomplete or inaccurate.
 3. More than one cable inspected is found to be missing required labels or if more than one cable is verified to be inaccurately recorded on the as-built drawings.
 4. Installed equipment does not match the equipment specified and/or reviewed by the Designer (in writing) during the course of the project.
 5. More than one piece of equipment, cable, connector, circuit, etc. fails to pass any test performed upon it by the Designer.
 6. Any substantive specification or workmanship issue judged by the Designer to be of material importance to the long-term usability, safety, professional appearance, or service and maintainability of the Contractor's work; any material deviation from the intent of these specifications.
 7. Terminations of connectors ruled to be below the highest quality industry standards.
- F. The Contractor's staff may, if permitted by the Designer, undertake very minor corrections of encountered problems while acceptance testing continues provided that such corrective action does not in any way impede Acceptance Testing progress.

3.7 SPECIAL REQUIREMENTS

- A. Preventative Maintenance
1. Following final acceptance of the system the contractor shall return to each of the project sites to perform basic cleaning and maintenance of cameras, make minor focus and/or viewing angle adjustments to cameras as requested by the Owner.
 2. Visits shall occur as 6 and 12 months following acceptance.
 3. During each visit, the contractor shall clean the exposed optical components (lens, dome, glass, etc.) of each camera in the system.
 4. Check in with the Owner's designated security representatives to determine if there are any issues with the system that need to be addressed under warranty.
- B. Software Assurance
1. Contractor shall supply and install software patches or upgrades that are made available from the software manufacture for the first 365 calendar days following final acceptance of the system.
 - a. Such upgrades shall be coordinated with the Owner and undertaken only after discussion with and approval of the Owner's designated representative.
- C. Installing and Updating VMS Client Software.
1. Installing a new release of the VMS Client software shall be easily accessed by clicking on an icon in the Client software that will connect to a website and give an option to automatically download the new software. If the most recent version of the VMS software is already installed a message box will be displayed informing you have the most recent release.
 2. Provide required power outlets, interconnecting cables, hardware and equipment for a complete and operable system.

3. Perform complete programming of the system, including matrix switch, and NVR(s) in coordination with the Owner, or designated representative. Programming shall include, but not be limited to, elimination of duplicate or redundant titling information, synchronization of system clocks, camera sequences, dome presets, salvos and tours. Programming of any system passwords or limiting of accessibility prior to commissioning and training is prohibited.
4. Obtain IP addresses from 2FM Alarm Section for initial setup of all devices

3.8 TRAINING

- A. Train Owner's designated personnel on the procedures and schedules involved in daily use of the system, administration, troubleshooting, and preventative maintenance.
- B. Provide advanced and detailed technical and administrative training (to the level desired by Owner's Security and IT) personnel covering advanced software and hardware configuration and administrative aspects of the system.
- C. Provide not less than (16) hours of dedicated training on the system, not exceeding (8) independent trips to the project site.
- D. A detailed training agenda shall be worked out with the Owner's security representative in advance of conducting the formal training intended by this section.
- E. Time spent by the contractor discussing the system prior to 100% completion, and without an agreed upon clear training agenda shall not be considered training as intended by these specifications.
- F. Training shall be conducted by factory trained and certified individuals fluent with the hardware and software used to make up the system.
- G. Schedule training with Owner at least (14) days in advance each training session.

END OF SECTION 28 13 02

SECTION 28 31 11 – MULTIPLEX FIRE ALARM SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

- A. Section provides the requirements for the installation of a complete Power Limited, Addressable, Fire Detection Alarm System including fire alarm and control panels, manual fire alarm stations, automatic smoke and heat detectors, notification appliances, and auxiliary alarm equipment and installation materials.
- B. There is an existing FACP in Room 106 in the previous project. The new addition is to be connected the existing FACP utilizing a Remote Control Panel to be located in the main electrical room in the new addition.
- C. Related Sections
 - 1. Section 23 - Building Automation and Control.
 - 2. Section 21 - Wet-Pipe Fire Suppression Sprinklers: Flow detection and alarm devices.
 - 3. Section 21 - Standpipes and Hoses: Flow detection and alarm devices.
 - 4. Section 21 – Stationary Pumps for Fire Protection
 - 5. Section 26 – Low Voltage Electrical Power Conductors and Cables.
 - 6. The General Provisions of the Contract, including Conditions of the Contract and Division 1 of the Specifications, apply to the work in this Section.
 - 7. This Section is hereby made a part of all other sections of Division 26 as fully as if repeated in each therein.
 - 8. Architectural enclosure for fire alarm panel(s).
 - 9. Security alarms and access control.
 - 10. Emergency electrical systems
- D. Furnish, wire and test under this Section. Installation specified elsewhere
 - 1. Duct smoke detectors with accessible remote mounted keyed switches with LED indicators Summary
- E. Related Sections
 - 1. All Division 27 and 28 Sections
 - 2. Technology Series Drawings

1.2 REFERENCES

- A. The work is subject to applicable portions of the following standards in affect at the time of bidding the project.
 - 1. NFPA 70 “National Electrical Code”, National Fire Protection Association.
 - 2. NFPA 72 “National Fire Alarm Code”, National Fire Protection Association.
 - 3. NFPA 90 A, Air Conditioning and Ventilation Systems
 - 4. City of Chicago Building Code, 2019 edition
 - 5. City of Chicago Electrical Code. 2018 edition

6. Underwriters Laboratories, Inc.
7. Local and State Building Codes.
8. ASME/ANSI.
9. American with Disabilities Act Accessibility Guidelines (ADAAG).
10. Illinois Accessibility Code (IAC).
11. Applicable standards of IEEE (Institute of Electrical and Electronic Engineers).

1.3 QUALITY ASSURANCE

- A. Fire alarm system engineer/designer shall be certified by a nationally recognized certification organization acceptable to the authority having jurisdiction. System designer shall be factory trained and certified for design of the fire alarm and emergency communication systems.
- B. Fire alarm system installation personnel shall be factory trained and certified for installation of fire alarm and emergency communication systems and certified by the national recognized certification organization acceptable to the authority having jurisdiction.
- C. Fire alarm equipment and all of the system components shall be listed by UL and approved by FM Global.

1.4 SYSTEM DESCRIPTION

Furnish and install an approved fully tested and functional Class I fire alarm system.

Furnish and install the following work:

1. Fire Alarm System – Digital, Addressable.
 2. Fire Alarm, Sprinkler Waterflow, Sprinkler Supervisory and Fire Pump Status Indication.
 3. Interface to Building Automation System for Fan Status.
 4. Emergency Power Status Indication.
 5. Fire Pump and Jockey Pump Status Indication.
 6. Trouble bell indication at Fire Alarm Annunciator Panel at main lobby.
 7. Duct smoke detectors with accessible keyed test switches with LED indicator at each.
 8. All cabling shall be encased in the appropriate conduit Red in color, minimum of $\frac{3}{4}$ ".
 9. All electronic locking hardware if associated with the fire alarm shall operate on 24 volts DC.
- B. Operation of a manual station, spot-type space smoke detector, (duct) smoke detector, heat detector or sprinkler flow switch, shall automatically:
1. Sound an audible alarm signal at the Fire Alarm Control. The audible signal shall be capable of being silenced during the alarm condition.
 2. Illuminate a general "Alarm" LED at the Fire Alarm Control Panel as well as the specific "zone" annunciator LED, which shall remain lit, until the alarm condition is reset.

3. Print a record at the system printer by time, date, and alarm zone or device number followed by a complete English language emergency description for that alarm "zone" or device and for all control circuits automatically operated in response to the alarm condition for that individual zone. Each alarm zone shall print its own emergency message up to eighty (80) characters and spaces. All restorations to normal shall likewise be recorded except the emergency message shall not be repeated.
 4. Display on the fire alarm control panel (FACP) the time, date and zone or device number followed by a complete emergency description for that alarm zone. All restorations to normal shall likewise be displayed. The FACP shall display messages according to their priority and shall hold any message on the display until such time as the operator acknowledges the message. No message shall be lost or scroll off the display due to operator delay. Time of day and the number of messages waiting to be acknowledged, number of abnormal points, number of disabled points shall be displayed at all times on the FACP.
 5. Activate the respective Form "C" contact(s) (one N.O. and one N.C.) to the building automation system (BAS) to indicate the floor(s) in alarm and allow that system to activate appropriate HVAC response to fire alarm condition. Exception: Operation of manual stations shall not activate BAS interface for fire response.
 6. Active control relay to initiate the transmission of an "alarm" condition to the Fire Department. Coordination of connections and testing of the system upon connection to the Central Station are the responsibility of the Contractor as part of this work.
 7. Operate control relays to de-energize (release) secured stairwell door locks.
 8. Operate control relays to release electrically held open doors.
 9. Sound audible alarms.
 10. Activate visual alarms.
- C. Elevators: In addition to functions described in B:
1. The operation of an elevator machine room smoke detector, elevator shaft smoke detectors or elevator lobby smoke detector or sprinkler flow switch shall initiate recall of the elevator car serving that lobby or controlled from that machine room. Detection at the "designated" recall floor lobby shall initiate recall to the "designated alternate" level for the affected cars. Coordinate with the Fire Department and Elevator Contractor to determine the designated recall and alternate recall levels for each elevator bank. Detection of smoke in the elevator shaft shall initiate a separate signal to the associated elevator controller. Interface to the elevator equipment shall be via addressable control modules in the elevator machine rooms.
 2. The operation of an elevator machine room or shaft elevator heat detector or sprinkler flow switch for a dedicated elevator zone shall provide a contact closure to disconnect power to the elevator machines.
- D. The operation of a duct smoke detector shall initiate a trouble signal, activate a programmable output relay wired to the supply fan motor controller location to shut down the affected fan motor(s). Initiate a trouble condition only in the Fire Alarm System.
- E. In the event of a malfunction in an alarm initiating device, signaling line circuit(s) or power supply, illuminate trouble light for the respective "zone" in the fire alarm annunciator panel(s) and a common trouble light in the fire alarm control panel.

- F. In the event of a malfunction in the alarm indicating circuits, illuminate the trouble light for the respective alarm circuit in the fire alarm annunciator panel and a common trouble light on the fire alarm control panel(s).

- G. Sprinkler Supervisory Functions
 1. Actuation of a sprinkler valve tamper switch, pressure supervisory switch, water level, water temperature, room temperature, the fire pump "Pump Running", "Power Failure" or "Phase Reversal" contact, or the emergency generator "On" or "Start Failure" contact shall automatically:
 2. Sound an audible signal at the FACP and annunciator panels. The audible signal shall be capable of being silenced during the supervisory condition. The silencing of a trouble condition in any zone shall not prevent the resounding of audible signal should a subsequent trouble condition occur.
 3. Illuminate a general trouble LED at the FACP and annunciator panels. The LED shall remain lit, until the trouble condition is cleared.
 4. Active control relay to initiate the transmission of a "supervisory" (or trouble, where supervisory signals are not able to be indicated) signal to the Fire Department.
 5. On the system printer, print a record for the monitor point.
 6. On the FACP and annunciator panels, display the information for the monitor point.

- H. System Supervision
 1. The fire alarm control equipment, power supplies and field located devices and wiring shall be electrically supervised to automatically detect and report trouble conditions to the FACP.
 2. Any opens, grounds or disarrangement of system wiring or a short across any device or system wiring shall automatically:
 3. Sound an audible signal at the FACP. The audible signal shall be capable of being silenced during the trouble condition.
 4. Illuminate a general trouble LED at the FACP. The LED shall remain lit, until the trouble condition is cleared.
 5. Visually annunciate, via the alphanumeric display, the individual circuit in trouble, at affected control panel. The LED shall remain lit, until the trouble condition is cleared.
 6. On the system printer, print a record for the panel and circuit in trouble.
 7. Grounds shall annunciate as a system trouble.
 8. Detection of fault or trouble conditions in control equipment and power supplies shall indicate as a common trouble and shall indicate the specific module or power supply.

- I. Standby Power:
 1. Upon failure of normal and/or emergency power, standby power shall be provided for the entire system by means of lead-calcium batteries including a battery cabinet/panel with battery capacity as specified herein. The control panel shall monitor battery voltage, current capacity and charge rate and shall report all changes in status to the fire alarm control panel central processing unit. Provide separate chargers, supervision, switching and batteries for the Fire Alarm System with battery capacity as follows:

NFPA 72	Local Protective Systems 24 hours standby 5 minutes of alarm
NFPA 72	Auxiliary Protective System 60 hours standby 5 minutes of alarm
NFPA 72	Remote Station Systems 60 hours standby 5 minutes of alarm
NFPA 72	Proprietary Signaling Systems 24 hours standby 5 minutes of alarm

2. The emergency power source circuits serving the Fire Alarm Control Panel shall be labeled "FIRE ALARM CIRCUIT CONTROL."
3. Each and every power supply input and power supply output shall have transient protection which shall prevent component failures and shall prevent false alarms.

1.5 SUBMITTALS

- A. Refer to Section 013300 – Submittal Procedures.
- B. For all work specified in Division 26, submittals to include Type 1 (Manufacturer's Name) and Type 2 (Product Data) information. In addition, submittals for the work listed below shall include the indicated type of information.
- C. Shop Drawings: Prepare shop drawings indicating system wiring diagram showing each device and wiring connection; complete one-line riser diagram; indicate annunciator layout and submit stamped drawings by the nationally recognized agency acceptable to the local authority having jurisdiction.
 1. Architectural floor plans shall be prepared at 1/8" = 1'-0". Fire Command Center details shall be prepared at 1/4" = 1'-0". Remote panel details shall be prepared at 1/4" = 1'-0".
 2. The shop drawings shall contain the actual location of all initiating, indicating, extinguishing, trouble, communication and supervisory equipment as required by these specifications.
 3. Each device and control equipment shall be noted with the designation of its zone/circuit. The audible devices shall also indicate its rated sound output in dbA at a distance of 10 feet.
 4. On each floor plan, provide a schedule including all zone circuit(s) on that floor.
 5. A master zone/circuit list, on 8-1/2" x 11" sheets of paper, in column form, to show all of the zone circuits within the system for all equipment. At a minimum, the master zone/circuit list shall provide designations for each individual zone/circuit floor level, location on floor, description of the monitored, controlled, detected and/or function the zone/circuit is performing, the number and type of equipment for each zone/circuit (include total wattage load for all audible equipment and available wattage remaining for each zone/circuit).

6. Provide a detail layout of all status and annunciator panels. The zone/circuit indicator shall include, but not limited to level, location and what is monitored/function (example 3FLR SPRK).
7. Provide a ½" scale elevation of all panels in each Fire Command Center.
8. Device wiring diagram for each type of device furnished.
9. Points of interface connections including sound systems, elevator, mechanical equipment, security systems, etc.
10. Complete narrative on the operation of the system detailing each event in the system and the resulting actions throughout the system and interconnections to other systems.
11. Shop drawings shall be sent to the respective contractors, suppliers, etc. for proper coordination; where their work is interdependent upon signals or controls from the fire alarm system. These would include those associated with vertical transportation, automatic temperature controls, security, door locks, motorized doors, etc.
12. Shop drawings shall be revised and resubmitted in accordance with the specified shop drawing procedures. The Contractor shall submit all shop drawings along with the voltage drop & power supply calculations to all the authorities having jurisdiction for approval only after review by the Architect/Engineer prior to start system installation.

- D. Product Data: Submit catalog data showing electrical characteristics and connection requirements.
- E. Test Reports: Indicate procedures and results for specified field testing and inspection. Provide a "Record of Completion" (NFPA 72).
- F. Manufacturer's Field Reports: Indicate activities on site, adverse findings, and recommendations.

1.6 CLOSEOUT SUBMITTALS

- A. Section 017700 - Execution Requirements: Closeout procedures.
- B. Project Record Documents: Record actual locations of fire alarm equipment.
- C. A complete record of all tests and operation of each service
- D. Operation and Maintenance Data: Submit manufacturer's standard operating and maintenance instructions.

1.7 MAINTENANCE SERVICE

- A. Section 017823 - Execution Requirements: Maintenance service.
- B. Provide service and maintenance of fire alarm equipment for one year from system acceptance.

1.8 MAINTENANCE MATERIALS

- A. Spare Equipment:
1. Furnish the following spare equipment to the Owner at the completion of the project.
 - a. Two detectors of each type, with bases.
 - b. Two addressable control modules.
 - c. Two addressable monitor modules.
 - d. Five keys to system cabinets.
 - e. Two one-way life safety audible/visual units.
 - f. Two strobe units.
 - g. Twelve glass rods or plates for manual pull stations.
 - h. Two spare fuses for each size (ampere rating) fuse furnished in the control panel.
- B. The above equipment shall be installed in a surface cabinet, furnish as part of these specifications, red in color with 1/4" high white lettering, "Spare Fire Alarm Equipment", silk screened or cabinet door. The cabinet shall be furnished and installed adjacent to the main fire alarm control panel or as directed by the Owner

PART 2 - PRODUCTS**2.1 APPROVED MANUFACTURERS**

- A. Honeywell
1. Firelite.

2.2 FIRE ALARM CONTROL PANEL (FACP)

- A. Furnish and install a fire alarm control panel which shall act as the master (Main Central Processing Unit CPU) in a multiplexed network for the operation of the fire alarm system. This unit shall be wall mounted and shall contain all main microprocessors, memory, alpha-numeric display, and operator controls. The FACP cabinet shall contain a 24 VDC power supply and batteries for all central processing, displays, and controls operations. The FACP shall be mounted in a steel cabinet with lockable door. Panel installation to be coordinated with /area layout/ /room layout/ and other electrical equipment within the /area/ /room/.
- B. The FACP shall utilize distributed processing techniques and communicating device technology, be totally solid state (except for relay associated outputs), microprocessor-based use communication between control equipment and field located panels and approved by the City of Chicago Bureau of Fire Prevention.
- C. The FACP shall differentiate between long term drift above the prealarm threshold (maintenance alert, indicative of the need for cleaning) and a fast rise above the prealarm threshold (indicative of a smoldering fire). The Maintenance Alert shall be annunciated as an alert only and shall not be confused as a Trouble or an Alarm.

- D. The FACP shall incorporate the central processing unit (CPU) which shall be microprocessor based and provide the necessary system logic circuitry and interrogate/response polling to perform all required automatic control-by-event, time of day functions and trouble switching as delineated by the drawings, specifications and City of Chicago Code and Chicago Fire Prevention Bureau requirements. The CPU shall include non-volatile memory for emergency file lists and system program instructions. All system operating program instruction code, configuration and sequence programming shall be completely non-volatile. The system shall not utilize moving disk technology where dust, humidity, or temperature can cause adverse operating performance. The CPU shall be completely field programmable on site by the manufacturer's representative. Systems requiring off-site PROM burning without on-site editing capability from this panel shall not be acceptable. Edited changes must be non-volatile. Any system remote controller (field located panel) shall also be completely field programmable
- E. The CPU shall be software equipped to provide automatic control-by-event programming, whereby the receipt of an alarm, supervisory or trouble report from a system point may be programmed to operate any or all of the control points within the system. Automatic control-by-event actions for life safety functions shall be retained in non-volatile memory for reliability.
- F. Control unit shall be supervised so that a trouble signal shall sound in the event of loss of either operating or supervising power. Light-emitting diodes (LED's) shall be installed and shall remain illuminated to indicate both operating and supervisory power are energized.
- G. Provide signaling line circuits (SLC's) to communicate with all field devices including initiating devices and remote-control equipment in the system. The FACP shall include SLC's and controllers to provide and perform the following:
- H. Monitor intelligent devices which are addressable by device and which report all status changes by individual device.
- I. Communicate with each intelligent detector and addressable module on its SLC to verify its proper function and individual status. Communication with all devices shall be performed. Maximum time to detect an alarm shall comply with UL Listings.
- J. Maintenance alert function shall be provided. This function shall automatically warn of contaminated detectors and of defective detectors before false alarms occur.
- K. The system shall provide a minimum capacity of SLC's which shall control intelligent devices and addressable modules plus **25%**. Each SLC shall be provided with a dedicated microprocessor-based controller and shall have the capacity to monitor a minimum of 240 intelligent initiating devices and addressable control/monitor modules per line. Systems not providing the signaling line circuit capacity specified shall be installed with additional signaling line circuits as required to provide the difference between the specified capacity and the system capability, while not exceeding the device loading limitations specified herein for any individual SLC.

- L. Each and every SLC shall be provided with transient surge protection located and terminated within an enclosure separate from the main control panel to prevent component failure and to prevent false alarms due to transients, lightning and surges.
- M. Class "B" for all SLC circuits.
- N. Style "B" supervised wiring for Initiating Device Circuits (IDC) and control wiring.
- O. Basic system configuration shall support a minimum of **1000** addressable and/or monitor points and control points with expansion capability for supporting up to **1000** supervised inputs/outputs. The CPU shall be provided with sufficient memory, card slot and enclosure cabinet capacity to allow system expansion.
- P. The panel face display unit shall contain as a minimum the following:
 - Q. 80-character backlit liquid crystal display (LCD).
 - R. Full key operated alpha-numeric keypad.
 - S. Local alarm/trouble sounders.
 - T. Light emitting diode annunciator for the display of the following system operating parameters:
 - 1. System AC power normal.
 - 2. System Alarm condition.
 - 3. System Supervisory condition.
 - 4. System Trouble condition.
 - 5. Alarm silence.
- U. Control keys for the following functions:
 - 1. Alarm/Trouble Acknowledgement.
 - 2. Local Alarm Silence.
 - 3. System Reset.
 - 4. Lamp Test.
- V. All system operational and test parameters shall be capable of being set through the alpha-numeric keypad.
- W. The panel face display unit shall include a password feature to prevent unauthorized manual control or programming.
- X. The panel face display unit shall contain, and display as needed, custom alpha-numeric labels for all intelligent devices and all addressable modules. Zone/device nomenclature information shall be stored in programmable, non-volatile memory.
- Y. The alpha-numeric visual display shall show the time-of-day, day-of-week, month, day-of-month, and year. Upon operator request, the normal visual display shall be replaced with the status of any system point or system trouble called up.

- Z. Separate module with amber trouble LED and disconnect switch shall be provided for system the Municipal Master Box. An amber LED shall be provided to indicate "circuit disconnected".
- AA. In the event of total power loss and restoration, the status of the initiating and indicating devices shall remain unchanged.

2.3 REMOTE CONTROL PANELS

- A. Remote Control Panels (RCP's) panels are to be used as indicated to provide addressable Signaling Line Circuits, circuits, Notification Appliance Circuits (NAC) and as a means of connecting auxiliary reporting devices such as CRT's, printers and alphanumeric displays into the system network. Each RCP shall be connected to the master Fire Alarm Control Panel (FACP) via a Style 6 Class A signaling line trunk (SLC). Communications between the CPU and RCP's shall be in digital form. Failure of the RCP to respond shall result in a communication failure indication at the FACP with a resulting display, audible alarm and printout.
- B. A status change in any addressable device shall be reported to the FACP by the RCP via the signaling line trunk (SLC), with "status changed" data accepted as valid after receipt of two alarm reports for a particular device.
- C. An LED indicator shall be provided for each SLC in each RCP to indicate the normal communication with devices. Additionally, an LED shall be provided to indicate normal communication from the RCP to the master FACP. This permits verification of polling response at the RCP location.
- D. Power for the RCP's shall be provided from a local power supply in the RCP enclosure. This shall be connected to an emergency AC power circuit and include battery back-up to operate the panel devices upon AC power failure in accordance with NFPA 72 requirements.
- E. Failure of or power loss to an RCP shall not affect any devices not directly connected to that panel and shall not prevent any other panels or network devices on the signaling trunk from reporting to the FACP.
- F. An open or shorted line between an RCP and the receiving equipment shall activate audible and visual trouble signals at the receiving equipment. In addition, the FACP memory will retain the last valid status signal received and not permit any status changes to be reported to the alarm indicators until valid status signals are received indicating such change.
- G. Where two or more cabinets are required to house control equipment, the control equipment shall be furnished with factory-wired interconnection cables with disconnect plugs and sockets so that no field wires need be added by contractor unless an open, ground or wiring connection of any such wire does not affect the operation of the alarm system.
- H. All circuitry between the RCP's and FACP shall be supervised. RCP malfunction or power failure at the panel shall activate audible and visual trouble signals at the receiving

equipment. The visual trouble signal shall include indication of the specific devices and/or circuits affected by the malfunction for rapid diagnosis of the problem.

- I. RCP's shall be /surface mounted in an approved, locked steel enclosure within a fire rated room.

2.4 FIRE-ALARM GRAPHIC ANNUNCIATORS

A. Performance Criteria:

1. Regulatory Requirements:
 - a. NFPA 72.

B. General Characteristics:

1. Graphic Annunciator Panel: Mounted in aluminum frame with nonglare, minimum 3/16 inch (4.76 mm) thick, clear acrylic cover over graphic representation of facility. Detector locations must be represented by red LED lamps. Normal system operation must be indicated by lighted, green LED. Trouble and supervisory alarms must be represented by amber LED.
2. Comply with UL 864.
3. Operating voltage must be 24 V(dc) provided by local 24 V power supply provided with annunciator.
4. Include built-in voltage regulation, reverse polarity protection, RS 232/422 serial communications, and lamp test switch.
5. Surface] mounted in NEMA 250, Type 1 cabinet, with key lock and no exposed screws or hinges.
6. Graphic representation of facility must be CAD drawing and each detector must be represented by LED in its actual location. CAD drawing must be at 1:96 (1:100) scale or larger.
7. LED representing detector must flash [two] <Insert number> times per second while detector is in alarm.

2.5 SYSTEM PRINTER

- A. The system printer shall be panel mounted type and shall provide a permanent hard copy record of all pertinent details of system activity. Included on this record shall be all unscheduled status change events, all automatic control commands and all operator control commands into the system and the time and date of all occurrences.
- B. The printer shall reflect all alarm, trouble and status change signals by device or circuit in the system. The alarm shall be printed out in English language text so that the type, device or circuit, time and date of alarm is clearly understood without referring to a code directory. Printout by code number or holes in paper tape will not be considered functionally equivalent.
- C. The printer shall have automatic paper feed, receive print messages in the 80-column format and at a minimum print rate of two-hundred (200) characters per second.

- D. In addition to event logging, the unit shall print a system off-normal status summary. The summary is initiated by manual operator command on the multi-function panel and shall list:
 - 1. All off-normal system monitor points.
 - 2. All "commanded" system control points.
- E. The printer shall include a report capability to list the sensitivity of all analog intelligent detectors in the system.
- F. The printer shall provide a summary alarm to be activated on a printer power failure, printer trouble signal or out of paper signal. Contact shall be prewired to the FACP.

2.6 REMOTE ANNUNCIATOR

- A. Description: Annunciator functions shall match those of fire-alarm control unit for alarm, supervisory, and trouble indications. Manual switching functions shall match those of fire-alarm control unit, including acknowledging, silencing, resetting and testing.
- B. Mounting shall be flush or surface mounted cabinet as determined by the architect, NEMA 250, Type 1.
- C. Display Type and Functional Performance: Alphanumeric display and LED indicating lights shall match those of fire-alarm control unit. Provide controls to acknowledge, silence, reset, and test functions for alarm, supervisory, and trouble signals.
- D. All electronics shall be assembled on factory-standard circuit boards. Interconnection of circuit boards shall be accomplished by the use of quick-disconnect wire harness assemblies. The annunciator shall have terminal strips with hold-down clamps that accept 14 to 22-gauge cabling. The panel shall have a lamp-test push button switch that, when depressed, activates all LED's.
- E. All electronics shall be factory mounted to a metal backplane that will be mounted to the backbox at the time of final annunciator installation. All field connections to the backplane must be made through system-standard terminal strips. All front panel LED's must be connected to the backplane by quick-disconnect ribbon cables.
- F. The panel shall be point back-lighted and use socket-mounted LED's to facilitate replacement and any future changes. LED's shall be available in red, orange, yellow and green. Incandescent lamps are not acceptable.
- G. The unit shall be graphically and electronically expandable. Field updates of graphic information must be possible through the use of factory-supplied change kits. More extensive changes (major modifications of graphic elements, adding or deleting LED's, etc.) must be possible without requiring full replacement of the original panel. Major changes to the annunciator, when pre-approved, shall be accomplished at the factory within a 48 hour period. A complete set of detailed, CAD generated drawing files of the panel shall be provided to the Owner from the manufacturer upon completion, installation and final testing of the annunciator panel.

- H. The panel shall be U.L. listed.

2.7 STATUS INDICATOR PANEL (SIP)

- A. Provide a SIP as part of the FACP. It shall contain:
 - 1. Fire Pump and Jockey Pump Supervision
- B. Fire pump supervision shall be an integral part of the main fire alarm control panel and annunciator panel.
- C. Each fire pump shall have status indication for:
 - 1. Power failure.
 - 2. Pump running.
 - 3. Phase reversal.
- D. Jockey pump supervision shall be an integral part of the Jockey pump controller.
- E. The Jockey pump shall have status indication for:
 - 1. Power failure
- F. An audible trouble signal shall sound until acknowledged and automatically restored.

2.8 ALARM INITIATING DEVICES

- A. Provide intelligent smoke and thermal sensors as shown. The address shall be set at the sensor by the installer using the rotary or toggle switches located in the sensor head or module. Where module/sensor addresses are required to be "programmed" into the device, the programmer device and complete instructions for use shall accompany the system. All intelligent analog sensors shall be interchangeable and shall use common twist-lock bases. All sensors shall provide alarm LED. LED shall flash under normal operating and communication conditions and shall illuminate steady state when the sensor's sensitivity level (analog value) exceeds the predetermined limit and commands from the FACP place the sensor into the alarm state. All sensors shall include a test means, whereby the sensor's actual analog value and the sensor alarm verification mode shall be displayed on the FACP display.
- B. When the sensors reach a predetermined sensitivity, the FACP shall automatically display an alert message. All single I/O modules shall contain an alarm LED that shall flash during normal operation and communication and shall go to a steady state when commanded by the control panel that an alarm or supervisory value has been detected. All intelligent devices shall connect to and communicate with the FACP or RCP via the SLC serving the respective area(s) and shall incorporate built-in type identification to allow the FACP to identify the type of sensor.
- C. Intelligent Ionization Sensor shall be continually monitored to measure any change in sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). The sensor shall use the ionization principle to measure products of combustion and shall on command from the FACP send data to the panel representing the analog value of the

smoke density, providing indication of the analog value of the products of combustion to the FACP. The sensor sensitivity shall be adjustable per device (within UL limits).

- D. Intelligent Photoelectric Sensor shall be continually monitored to measure any change in sensitivity because of the environment (dirt, smoke, temperature, humidity, etc.). The sensor shall use the photoelectric principle to measure smoke density and shall on command from the FACP send data to the panel representing the analog value of the smoke density, indication of the analog value of the level of smoke density to the FACP. The sensor sensitivity shall be adjustable by device (within UL limits).
- E. Intelligent Thermal Sensor shall be continually monitored to measure any change in sensitivity because of environment (dirt, temperature, humidity, etc.). The sensor shall use dual solid-state thermistors and shall monitor the ambient temperature from -10 degrees C. to +60 degrees C. and provide a fast response to rapid increases in temperature. The sensor, on command from the control panel, shall send data to the panel representing the analog value of the ambient temperature.
- F. Intelligent Duct Detector shall be analog /dual chamber Ionization/ /photoelectric sensor/ and shall provide (2) Form-C relay output contacts for local control purposes. Output contact shall activate upon programmed control from the FACP only. Each duct detector also shall provide address- setting means using rotary decimal or toggle switches and shall also store an internal identifying code which the FACP shall use to identify the type of device.
- G. Each detector shall be supplied with duct mount housing tubes, sized according to duct width. Provide remote alarm pilot lamp at all concealed duct smoke detector locations. For above ceiling applications, provide junction box above ceiling and whip to pilot lamp mounted on ceiling near detector access location. At each duct smoke detector location provide an accessible remote mounted keyed switch with LED indicators.
- H. Intelligent Monitor Module shall be used to connect a supervised conventional initiating device or zone of supervised conventional initiating devices (water flow switches, tamper switches, etc.). The module shall mount in a 4-inch square, 2 1/8-inch deep electrical box and shall be capable of Style B or Style D supervised wiring to the initiating device. In order to maintain proper supervision, there shall be no T-taps allowed. The Monitor Module shall provide address setting means using rotary decimal or toggle switches and also store an internal identifying code which the FACP shall use to identify the type of device. The Monitor Module shall contain an integral LED that flashes each time the monitor module is polled.
- I. Intelligent Control Module shall be used to connect and supervise a conventional indicating device or zone-of indicating devices that require an external power supply, such as horns, strobes, or bells to the /FACP via the SLC's. The Control Module shall be capable of operating as a relay (dry contact form C), to control Door Holders, Air Handling units, etc. The module shall mount in a 4-inch square, 2-1/8-inch deep electrical box and shall be capable of Class "A" or "B" supervised wiring to the indicating or control device. The Control Module shall contain an integral LED that shall flash each time the module is polled. The Control Module shall provide address setting means using rotary decimal or toggle switches and also store an internal identifying code which the control panel shall use to identify the type of device.

- J. Isolation Module shall be an automatic switch, which will open when the SLC line voltage drops below a prescribed limit, indicating a condition which could prohibit reliable operation on the line. The Isolator Module shall be placed, at a maximum vertical interval of two (2) floors, between groups of sensors/intelligent modules on each SLC in order to protect the line if a "short" should occur. If a short occurs between any two (2) isolators, then both isolators switch to an open circuit condition and isolate the group of sensors/modules between them.
- K. The remaining devices on the intelligent loop shall continue to operate and communicate normally. The number of devices between isolators shall be twenty-five (25) or less. The Isolator shall be designed to mount in a 4-inch square, 2 1/8-inch electrical box. Additional isolation modules shall be installed to meet local code requirements.
- L. Automatic Heat Detectors (Conventional Type):
- M. Rate of Rise and Fixed Temperature
- N. Automatic heat detectors shall be the combination rate-of-rise and fixed temperature type - rated at 135°F for areas where ambient temperatures do not exceed 100°F and rated at 200°F for areas where ambient temperatures exceed 100°F but not 150°F.
- O. The rate-of-rise element shall consist of an air chamber, a flexible metal diaphragm, and a factory-calibrated moistureproof, trouble-free vent and shall operate when the rate of temperature rise exceeds 15F. per minute.
- P. The fixed temperature element shall consist of a heat collector held by standard sprinkler fusible solder.
- Q. Detectors shall have a smooth ceiling rating of 2500 square feet and an electrical rating of 3 amps at 6 to 125 volts A.C. and 1 amp at 6 to 28 volts D.C. (fixed temperature detectors shall have the same temperature and electrical ratings as combination thermostats but a smooth ceiling rating of 625 square feet).
- R. 190°F heat detectors used in elevator machine rooms for power disconnection shall provide 2 sets of N.O. contacts.
- S. Sprinkler Water Flow, Valve Tamper and Air Supervisory Switches:
 - 1. Sprinkler valve tamper switches, sprinkler supervisory switches and water flow switches shall be furnished and installed under Section Fire Protection and wired under this Section. All water flow, valve tamper, air supervisory switches, low building temperature and water level shall be provided with Monitor Modules for monitoring at the FACP. Furnish and install all Monitor Modules to monitor and supervise the sprinkler system as part of this work.
- T. Intelligent Manual Fire Alarm Stations:
 - 1. The manual stations shall have a durable red finish with white raised letters, and shall be of the break-glass rod type. Hardware and backbox shall be of metal construction with a key reset switch for positive resetting action.

2. The Manual Station shall, on command from the FACP, send data to the panel representing the state of the manual switch. The Manual Station shall provide address-setting means using rotary decimal switches and shall also store an internal identifying code which the FACP shall use to identify the type of device.
3. Surface mounted stations shall mount on a red finish backbox. Flush mounted stations shall mount directly on a standard electrical outlet box.
4. The pull lever of the station shall remain in the actuated position until restored to normal by means of a special key or tool.
5. The station shall be activated by dual action.

2.9 NOTIFICATION APPLIANCES

- A. Horn Unit:
 - B. Operation shall be from 24 VDC supervised parallel notification appliance circuits.
 - C. Field selectable tones; reversible Temp 3 pattern or non-temporal continuous pattern.
 - D. Horn to be installed flush mounted in finished areas and surface or semiflush mounted in other areas.
 - E. Minimum sound pressure level shall be 92 DB on axis at 10 feet.
 - F. Unit shall be U.L. listed for use in fire protective signaling systems.
- G. Strobe Unit:
 - H. Strobe unit shall consist of a visual alarm strobe device, wall mounted, housed in a metal backbox. They shall be constructed for safe use in boiler rooms, kitchens and all indoor locations.
 - I. The visual device shall be a high intensity Xenon flasher with a minimum intensity of 15, 30, 75, and/or 110 (depending on location) candela per UL 1971. The unit shall be in full compliance with City of Chicago requirements and have terminal connections.
 - J. The strobe lens shall be clear with red lettering on the housing for "FIRE". Orientation of lettering on housing shall be such that upright letters are provided when unit is installed.
 - K. The strobe unit shall flash at a frequency of 1 to 3 Hz with maximum pulse duration of .2 seconds and maximum duty cycle of 40%.
 - L. Visual devices shall be activated, by zone, when the associated one-way communication zone is selected at the Fire Command Panel.
 - M. Power for visual devices shall be from separate, supervised 24 VDC indicating circuits, zoned for each floor and stairwell. Multiple circuits shall be provided per level to accommodate distance and loading. Visual indicators shall be synchronous by circuit, zone and area.

- N. The unit shall be U.L. listed for use in fire protective systems.
- O. Units shall be flush mounted in finished areas and surface mounted in unfinished areas and shall be provided with appropriate back boxes.
- P. Units mounted in plenum areas or ceilings shall include plenum box and mounting hardware.
- Q. Horn/Strobe Unit:
 - 1. Power for the unit shall be from separate, supervised 24 VDC indicating circuits, zoned for each floor, floor-area, and stairwell. Multiple circuits shall be provided per level to accommodate distance and loading.
 - 2. The horn assembly shall be housed in a die-cast enclosure.
 - 3. Minimum sound pressure level shall be 92 dBA on axis at 10 feet.
 - 4. The visual device shall be a high intensity Xenon flasher with a minimum intensity of 75 candela per UL 1971. /The unit shall have terminal connections/
 - 5. The strobe lens shall be clear with red lettering on the housing for "FIRE". Orientation of lettering on housing shall be such that upright letters are provided when unit is installed. Strobes shall be synchronous by circuit, zone and area.
 - 6. The strobe unit shall flash at a frequency of 1 to 3 Hz with maximum pulse duration of .2 seconds and maximum duty cycle of 40%.
 - 7. The unit shall be U.L. listed.
- R. Alarm Bell:
 - 1. Alarm bells shall be of the underdome vibrating type with gongs no smaller than (6", 8" or 10") in diameter with red finish. Outdoor bells shall be 10" in diameter.
 - 2. Bells shall be polarized and operate at 24 VDC. Bells shall be suitable for surface or semi-flush mounting. Surface mount shall be weatherproof.
 - 3. Semi-flush shall mount to any standard 4-inch square, 4 inch octagon or single-gang box with a maximum projection of 2-1/2".

2.10 DOOR HOLDERS

- A. Magnetic door holder mechanisms consist of an electromagnet (wall portion) and an armature (door portion) for operation at voltage as required for the door hardware. Furnishing of the mechanisms and installation of the armatures upon the doors are specified under Section Finish Hardware. However, complete electrical installation of the electromagnets in the walls in accordance with manufacturer's recommendations shall be the responsibility of the contractor under this section. Cooperate and coordinate respective responsibilities in order that a complete, aligned, and functioning door hold/release system is integrated into the fire alarm system.

2.11 DIGITAL ALARM COMMUNICATOR TRANSMITTER

- A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632 and be listed and labeled by an NRTL.
- B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture direct dial telephone line(s) and dial a

preset number for a remote central station. When contract is made with central station(s), signals shall be transmitted. If service on [either] line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

- C. Local functions and display at the digital alarm communicator transmitter shall include the following:
1. Verification that both telephone lines are available.
 2. Programming device.
 3. LED display.
 4. Manual test report function and manual transmission clear indication.
 5. Communications failure with the fire-alarm control unit.
- D. Digital data transmission shall include the following:
1. Address or zone of the alarm-initiating device.
 2. Zone of the supervisory signal.
 3. Zone of the trouble-initiating device.
 4. Loss of ac supply or loss of power.
 5. Low battery.
 6. Abnormal test signal.
 7. Communication bus failure.
 8. Secondary Power: Integral rechargeable battery and automatic charger.
 9. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.12 IDENTIFICATION

- A. Fire alarm terminal and junction locations shall be identified in accordance with NFPA70, Section 760-3. Junction and terminal boxes shall be painted red and stenciled "Fire Alarm", preventing unintentional interference with the signaling circuits during testing, servicing, and additional modifications to the system.

2.13 WIRING

- A. All Fire alarm system cabling shall be encased in conduit Red in color minimum of $\frac{3}{4}$ ".
- B. Wiring shall be color coded as follows:
- C. Initiating circuits (from monitor modules) -
1. #14 AWG Red/Brown
 2. #14 AWG Blue/Brown
- D. Indicating circuits:
1. General Alarm (horns) - #14 AWG Orange/Brown.

2. General Alarm (strobes) - #14 AWG Purple/Brown.
 3. Pre-Signal (chimes) - #14 AWG Yellow/Brown.
 4. Auxiliary relays/functions - #14 AWG Green/Brown.
- E. Addressable SLC's and signaling trunks shall be Style 6 Class A, with wire type as required by system manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Division 01 - Administrative Requirements: Coordination and project conditions.
- B. Verify products and systems receiving devices are ready for installation.

3.2 INSTALLATION

- A. Install manual station with operating handle 42 inches above floor.
- B. Install audible signal devices 80 inches above floor.
- C. Install strobe units and horn/strobe units 80 inches above floor.
- D. All wiring for the System shall be in accordance with Articles 760, 725, and 800 of the National Electric Code and all local amendments to applicable Codes.
- E. Provide complete wiring and conduit between all equipment. Unless specified otherwise, all system wiring shall be in separate raceway, maximum 40% fill, with approved fire alarm cable as recommended by manufacturer. Where cabling (in lieu of individual conductors) is used, conduits of proper size, minimum $\frac{3}{4}$ " , shall be installed from all equipment and devices into accessible spaces and all devices shall be mounted upon and all connections made within Listed boxes. Wiring splices are to be avoided to the extent possible and coloring of cables and wiring shall be consistent throughout the entire system, and from end-to-end on each and every circuit. Mixing and/or changing colors of wiring will not be permitted.
- F. All Equipment shall be held firmly in place. Fastening and supports shall be adequate to support the loads with a safety factor of five (5).
- G. Wiring shall be checked and tested by the contractor in accordance with the instructions provided by the manufacturer to assure that the system is free of grounds, opens and shorts.
- H. Mount end-of-line device box with last device or separate box adjacent to last device in circuit.
- I. Mount outlet box for electric door holder to withstand 80 pounds (36.4 kg) pulling force.

- J. Connect conduit and wire to door release devices, sprinkler flow switches, sprinkler valve tamper switches, fire suppression system control panels, duct smoke detectors.
- K. Automatic Detector Installation: Conform to NFPA 72 and City of Chicago Fire Department requirements.
- L. Install engraved plastic nameplates in accordance with Section 260553.
- M. Ground and bond fire alarm equipment and circuits in accordance with Section 260526.
- N. Provide ceiling mounted smoke detector at the FACP and RCP locations.
- O. Provide heat detector (190°F.) within two feet of each sprinkler located in an elevator shaft or elevator machine room.

3.3 FIELD QUALITY CONTROL

- A. Test in accordance with NFPA 72 and City of Chicago Fire Department requirements.
- B. Test Report: A complete commissioning package including letter of system Certification and copy of all test report documentation shall be submitted indicating proper installation and functioning of the system, conformance to the specifications and that the completed system is in operating condition and all components have been tested and operating satisfactory. The test shall be performed by factory-trained qualified technicians. Each and every device shall be tested, and the corresponding dated printout from the system printer during testing shall be included with the system Test Report.
- C. Manufacturer shall guarantee all system equipment for a period of one (1) year from date of final acceptance of the system.
- D. The contractor shall guarantee all raceways and wiring to be free from inherent mechanical or electrical defects for one (1) year from date of final acceptance of the system.
- E. Complete system testing and documentation in accordance with NFPA 72 is required as part of this Section. Submit completed and signed test report in quantities as required by General Conditions but not less than four (4) copies. Upon completion of the installation of fire alarm and protective systems equipment, this contractor shall provide to the Architect/Engineer a completed NFPA 72 "Record of Completion" and a signed written statement, substantially in form as follows:
 - 1. "The undersigned, having engaged as the Fire Alarm Contractor on the (NAME OF PROJECT), confirms that the fire alarm and protective system equipment was installed in accordance with the wiring diagrams, instructions, and directions provided."
 - 2. After receipt of the test report, completed record of completion form and written statement, demonstrate the operation of the system to the Owner, Architect, Engineer and Local Code Authorities (AHJ). The final acceptance test shall include complete tests as required to show compliance with these specifications and State/Local Codes.

3. In the event the system does not operate properly, corrections shall be made and the procedure repeated until it is acceptable to the Architect/Engineer and Local AHJ.
4. Submit a Fire Alarm System Service Contract for up to five (5) years, renewable annually with cost for each year for Owner=s approval as part of base contract.

3.4 SMOKE DETECTORS

- A. All area smoke detectors and sampling tubes of all duct type detectors shall be covered with UL approved plastic bags sealed airtight. A bag shall be installed immediately after installation of detector and on each device. Bags shall be removed when directed.

3.5 MANUFACTURER'S FIELD SERVICES

- A. Section 014000 - Quality Requirements: Manufacturer's field services.
- B. Include services of a NICET Certified technician to supervise installation, adjustments, final connections, and system testing.

3.6 DEMONSTRATION AND TRAINING

- A. Factory technician shall instruct owner's designated personnel in the complete operation of the system. Training sessions shall be presented by a fully qualified, trained representative of the equipment manufacturer who is thoroughly knowledgeable of the specific installation. Instruction shall include, but not be limited to, activation and restoration of:
 - B. Smoke detectors - ceiling mounted and duct type.
 - C. Waterflow and valve tamper switch zones.
 - D. Operation of the Fire Command Panel including all annunciation, status indication, interpretation of all signals, and readouts at the Command Panel.
 - E. Initiating all system inquiry and system status reports.
 - F. Replacing fuses at FACP, FAA and RCP locations.
 - G. Operation and resetting procedure for all types of initiating and output devices.
 - H. The Contractor shall post the name, address and telephone number of the Contractor, all subcontractors and the Fire Alarm Installer and Service Organization (including 24 hour-a-day response telephone number) within a non-flammable, plastic laminated cover firmly secured on the inside cover of the main control panel.

END OF SECTION 28 31 11

Section 28 55 00 – ENTRANCE SECURITY INTERCOM

PART 1 - GENERAL

1.1 SYSTEM DESCRIPTION

A. General Requirements

1. The specified unit shall be of manufacturer's official product line, designed for commercial and/or industrial 24/7/365 use.
2. The specified unit shall be based upon standard components and proven technology using open and published protocols.

B. Sustainability

1. The specified unit shall be manufactured in accordance with ISO 14001.
2. The specified unit shall be compliant with the EU directives 2011/65/EU (RoHS) and 2012/19/EU (WEEE).
3. The specified unit shall be compliant with the EU regulation 1907/2006 (REACH).

C. The specified unit shall carry the following EMC approvals:

1. EN55032: 2015
2. EN55024: 2010
3. 2014/35/EU
4. 2014/30/EU
5. 2012/19/EU
6. 2011/65/EU
7. EN 55032 Class A
8. EN 55032 Class B
9. EN 55024
10. FCC Part 15 - Subpart B Class A
11. FCC Part 15 - Subpart B Class B
12. FCC Part 15 - Subpart B Class A + B
13. ICES-003 Class A
14. ICES-003 Class B

D. The specified unit shall meet the following product safety standards:

1. IEC/EN/UL 60950-1

E. The specified unit shall meet the following standards

1. Audio:
 - a. G.711
 - b. G.729
 - c. G.722 (wideband)
 - d. L16 / 16kHz (wideband)
2. Video:
 - a. H.264 (MPEG-4 AVC)

3. Networking:

- a. IEEE 802.3af/802.3at (Power over Ethernet) [applies to products with PoE]
- b. IEEE 802.1X (Authentication)
- c. IPv4 (RFC 791)
- d. QoS
4. Mechanical Environment:
 - a. EN90529 IP69K
 - b. IEC/EN 62262 IK10

1.2 QUALITY ASSURANCE

- A. The Contractor or security sub-contractor shall be a licensed security Contractor with a minimum of five (5) years' experience installing and servicing systems of similar scope and complexity and evidence that is completed at least three (3) projects of similar design and is currently engaged in the installation and maintenance of systems herein described.
 1. All installation, configuration, setup, program and related work shall be performed by electronic technicians thoroughly trained by the manufacturer in the installation and service of the equipment provided.
 2. The contractor or designated sub-contractor shall submit credentials of completed manufacturer certification, verified by a third-party organization, as proof of the knowledge.
 3. The Contractor shall provide four (4) current references from clients with systems of similar scope and complexity that became operational in the past three (3) years. At least three (3) of the references shall be utilizing the same system components, in a similar configuration as the proposed system
 4. The specified unit shall be manufactured in accordance with ISO9001.

1.3 WARRANTY

- A. All security system components and labor furnished by the contractor including wiring, software, hardware and custom parts shall be fully warranted for parts, materials, labor and travel expenses for a minimum of three (3) years.
- B. The manufacturer shall provide warranty and optional extended warranty for the unit for a total period of maximum five years. If enacted as part of the contract, the contractor will repair or replace parts and/or labor per the warranty for the length of this warranty at no cost to the client.

1.4 System Description

1. Master Station
 - a. Aiphone IX-MV7-H (Existing – Previous Project)
2. Door Station
 - a. Aiphone IX-DVF
 - b. Provide to access existing master station
 - 1) Re-Configure master station
 - 2) Duplicate existing functionality for door/gate stations
 - 3) Coordinate mounting with bollards provided by others
 - 4) Cable for gate actuation.

PART 2 - PRODUCTS**2.1 General**

- A. Intercoms shall be IP-based and comply with established network and video standards.
- B. Intercoms shall be powered by the switch utilizing the network cable.
- C. Intercoms shall be fully supported by an open and published API (Application Programmers Interface), which shall provide necessary information for integration of functionality into third party applications.

2.2 Intercom schedule

- A. Intercom types listed below describing various resolutions, form-factor and features shall be supplied by a single intercom manufacturer.
- B. The intercom manufacture will be as follows:
 - 1. AI Phone.
 - a. IX-DV(F)

2.3 Intercom

- A. IP intercom
 - 1. The intercom shall meet or exceed the following design specifications:
 - 2. Power Source
 - a. PoE (IEEE 802.3af class 0)
 - 3. Power Draw
 - a. 5.28 Watts
 - 4. Camera
 - a. 1/3" CMOS 1.23 megapixel
 - 5. Min. illumination
 - a. 5 lux
 - 6. Audio Codec
 - a. G.711 (μ -law, A law), G.722
 - 7. Video Codec
 - a. H.264/AVC, motion JPEG
 - 8. Protocols
 - a. IPv4, IPv6, TCP, UDP, SIP, HTTP, HTTPS, RTSP, RTP, RTCP, IGMP, MLD, SMTP, FTP, DHCP, NTP, DNS
 - 9. Port Security
 - a. IEEE 802.1X
 - 10. Operating Temp
 - a. -40° - 140°F (-40° - 60°C)
 - 11. Protection
 - a. IP54, IK08
 - 12. Dimensions
 - a. 8-1/16" H x 4-1/2" W x 2-1/16" D

13. Mounting
 - a. Surface mounted with included bracket.

PART 3 - Execution

3.1 Installation

- A. The Contractor shall carefully follow instructions in documentation provided by the manufacturer to ensure all steps have been taken to provide a reliable, easy-to-operate system.
 1. System shall be configured to connect to existing
- B. All equipment shall be tested and configured in accordance with instructions provided by the manufacturer prior to installation.
- C. All firmware found in products shall be the latest and most up-to-date provided by the manufacturer.
- D. All equipment requiring users to log on using a password shall be configured with user/site-specific password/passwords. No system/product default passwords shall be allowed.

END OF SECTION 28 55 00

SECTION 31 10 00 – SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees and vegetation to remain.
2. Removing trees and other vegetation.
3. Clearing and grubbing.
4. Topsoil stripping and stockpiling.
5. Removing debris
6. Removing above-grade site improvements.
7. Removal of paving, curbs, gutters, gravel, concrete blocks, concrete barrier walls, wood, fences, posts, utility poles, utility structures and pipes, guard rail, railroad ties etc. or other structures.

B. Related Sections include the following:

1. Division 01 Specifications.
2. Division 02 Section 02 41 19 Selective Demolition.
3. Division 31 Section 31 23 16 Excavation.
4. Division 31 Section 31 23 17 Excavating, Backfilling, and Compacting for Utilities.

1.2 DEFINITIONS

- A. Topsoil: See Specification Section Topsoil. Natural or cultivated surface-soil layer containing organic matter and sand, silt, and clay particles; friable, pervious, and black or a darker shade of brown, gray, or red than underlying subsoil; reasonably free of subsoil, clay lumps, gravel, and other objects more than 2 inches in diameter; and free of weeds, roots, and other deleterious materials..

1.3 SUBMITTALS

- A. Not Required

1.4 MATERIALS OWNERSHIP

- A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become Contractor's property and shall be removed and disposed from the site.

1.5 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.
- B. Improvements on Adjoining Property: Authority for performing indicated removal and alteration work on property adjoining Owner's property will be obtained by Owner before award of Contract.
- C. Salvable Improvements: Carefully remove items indicated to be salvaged and store where indicated.
- D. Notify utility locator service for area where Project is located before site clearing.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section 31 23 23.01 "Fill."
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Provide erosion-control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- C. Locate and clearly flag trees and vegetation to remain. Contractor to provide temporary tree protection.
- D. Conform to applicable codes and local, state and federal regulations for disposal of removals and use

of herbicides. Burning of debris, lumber or scrap will not be permitted.
- E. Coordinate clearing work with the Owner's representative.
- F. Protect existing site improvements to remain from damage during construction.
 - 1. Restore damaged improvements to their original condition, as acceptable to Owner.

3.2 TREE PROTECTION

- A. Erect and maintain a temporary fence around drip line of individual trees or around perimeter drip line of groups of trees to remain. Remove fence when construction is complete.
 - 1. Do not store construction materials, debris, or excavated material within drip line of remaining trees.
 - 2. Do not permit vehicles, equipment, or foot traffic within drip line of remaining trees.
- B. Do not excavate within drip line of trees, unless otherwise indicated.
- C. Where excavation for new construction is required within drip line of trees, hand clear and excavate to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.
 - 1. Cover exposed roots with burlap and water regularly.
 - 2. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
 - 3. Coat cut faces of roots more than 1-1/2 inches in diameter with emulsified asphalt or other approved coating formulated for use on damaged plant tissues.
 - 4. Cover exposed roots with wet burlap to prevent roots from drying out. Backfill with soil as soon as possible.
- D. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.3 UTILITIES

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - 1. Notify Owner not less than two days in advance of proposed utility interruptions.
- B. Excavate for and remove overground/underground utilities indicated to be removed.

3.4 CLEARING AND GRUBBING

- A. Remove obstructions, trees, shrubs, grass, and other vegetation to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots.
 - 1. Do not remove trees, shrubs, and other vegetation indicated to remain or to be relocated.
 - 2. Cut minor roots and branches of trees indicated to remain in a clean and careful manner where such roots and branches obstruct installation of new construction.
 - 3. Completely remove stumps, roots, obstructions, and debris extending to a depth of 24 inches below exposed subgrade. Remove the remaining stump if found in conflict with proposed facilities/utilities.

4. Use only hand methods for grubbing within drip line of remaining trees.
- B. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.
 1. Place fill material in horizontal layers not exceeding 8-inch loose depth, and compact each layer to the required percentage of density.

3.5 TOPSOIL STRIPPING

- A. Remove sod and grass before stripping topsoil.
- B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.
 1. Strip surface soil of unsuitable topsoil, including trash, debris, weeds, roots, and other waste materials.
- C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.
- D. Provide silt fence in accordance with the local requirements for erosion control.

3.6 SITE IMPROVEMENTS

- A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.
- B. Remove slabs, paving, curbs, gutters, and aggregate base as indicated.
 1. Unless existing full-depth joints coincide with line of demolition, neatly saw-cut length of existing pavement to remain before removing existing pavement. Saw-cut faces vertically.

3.7 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property.

END OF SECTION 31 10 00

SECTION 31 13 00 - LANDSCAPE REMOVALS, PRUNING & PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

- A. This Section includes the protection of trees and other existing landscape areas from damage by the Contractor's equipment and operations during construction at locations shown on the plans. It also includes the pruning of trees that interfere with, or are affected by, execution of the Work, whether temporary or new construction.
 - 1. In advance of Project Work, coordinate with Architect and transformer installer to minimize damage to existing trees and other landscape areas.
 - 2. Remove existing trees which are in the way of installation of transformers, being careful to minimize damage to existing trees and turf areas.

- B. Related Sections include the following:
 - 1. Applicable provisions of Division 01 – General Requirements shall govern work under this specification section.
 - 2. Applicable provisions of "Owner" General and Detailed Technical Specifications utilized for this project.
 - 3. Section 01 81 13 -- Sustainable Design Requirements – LEED For New Construction And Major Renovations.
 - 4. Section 01 81 13.13 -- Sustainable Design Requirements.
 - 5. Division 31 – Earthwork
 - 6. Section 32 93 11 – Landscape Plantings.
 - 7. Section 32 92 01 – Sod and Seed.

1.2 SUBMITTALS

- A. LEED Submittals: Product Data as required to show compliance with LEED MR Credit Sourcing of Raw Materials, meeting all documentation requirements, including back-up documentation.

- B. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.

- C. Manufacturer's Product Data: Submit descriptions for all products, including organic fertilizer, commercial fertilizer, burlap, and each source of supply prior to the beginning of work under this Section. Delivery of materials may begin only after descriptions or samples have been approved.

- D. Bark Mulch Sample: Submit sample of specified wood mulch to Architect for review prior to placement of mulch. Sample shall be submitted in plastic bag equal to one quart size, sealed and labeled as to contents, name, brand, type, and supplier.

- E. Maintenance Recommendations: From a qualified arborist for care and protection of trees affected by construction during and after completing the Work.

- F. Certification: From a qualified arborist that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

1.3 QUALITY ASSURANCE

- A. Qualifications: Installer of tree removals and protection fencing shall be the same installer as for Landscape Plantings.
- B. Arborist Qualifications: If Architect determines that existing trees require pruning, pruning shall be done by an arborist certified by the International Society of Arboriculture or licensed in the jurisdiction where Project is located, is required for all pruning.
- C. Tree Pruning Standards: Comply with ANSI A300, "Tree, Shrub, and Other Woody Plant Management--Standard Practices (Pruning)" unless more stringent requirements are indicated.
- D. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Project Meetings."
 - 1. Before starting tree and landscape protection, meet with Architect. Review tree and landscape protection procedures and responsibilities. Notify participants at least three working days before convening conference. Record discussions and agreements and furnish a copy to each participant.
- E. Compliance: Comply with all applicable governmental laws, codes and ordinances, including all regulations regarding the disposal of organic wastes.
- F. Warranty: Repair or replace existing plant material which was designated to remain but damaged by the Contractor.

1.4 PRODUCT HANDLING:

- A. Fertilizers: Deliver in standard size bags, showing weight, analysis and name of processor, and store in weatherproof storage place and kept dry so that its effectiveness is not impaired.
- B. Maintenance Materials: Deliver anti-desiccant spray in containers of the manufacturer; mix and use according to manufacturer's direction. Deliver insecticide spray in the manufacturer's containers; mix and spray according to manufacturer's directions. Deliver fungicide in manufacturer's containers; mix and apply according to manufacturer's directions only with the acceptance of the Architect. Deliver herbicide in the manufacturer's containers; apply per manufacturer's directions, only with the acceptance of the Architect.
- C. Other Materials: Store all other materials so as to keep them clean and protected from damage, according to manufacturer's recommendations.

1.5 JOB CONDITIONS:

- A. Site Information: The existing conditions of areas where tree removal is required, as shown on the Drawings, were prepared from survey information provided by the Owner and visual

inspection of the site by the Landscape Architect. The existing conditions shown on the Drawings are not intended to be an exact representation of the conditions that the Contractor may encounter. It is expressly understood that the Owner and Landscape Architect will not be responsible for the interpretations and conclusions drawn by the Contractor. Data are made available solely for the convenience of the Contractor.

- B. Confirm Existing Conditions: Confirm existing conditions and report discrepancies to Architect prior to start of work.
- C. Coordination of Work: Coordinate work with all pertinent installers, including installer of transformers to minimize construction damage.
- D. Protection of Work: Provide temporary fences, barricades, coverings or other protection devices to preserve existing vegetation and improvements to remain. All trees designated for protection as shown on the plans or as directed by the Owner's Representative shall be identified with surveyor's flagging tape placed around the trunks at eye level.
- E. Protection of Adjacent Property and Dust Control: Prevent any substances from blowing, spilling, dropping, or depositing on adjacent property. Keep the construction area sufficiently dampened to control dust caused by operations.
- F. Permits: Obtain all necessary permits for the performance of work, including any permits required by state and local authorities.
- G. Utility Locations: Prior to performing removals or opening an excavation, determine whether underground installations; i.e., sewer, telephone, water, fuel, electricity lines, etc., will be encountered, and if so, where such utilities are located. Stake the exact location with the Utility Owner. When uncovered, provide proper supports for the existing installation. Contact and advise Utility companies of proposed work prior to the start of actual excavation.
- H. Tree Removals Around Existing Utilities: Data on the location and nature of existing and proposed utilities, as shown on the Drawings, are made available solely for the convenience of the Contractor. Contractor shall investigate the location, size, depth and nature of all utilities which may interfere with his work. Stake locations with Utility Owner, report discrepancies and consult with Utility Owner and Architect immediately prior to proceeding with work.

PART 2 - PRODUCTS

2.1 MATERIALS:

- A. General: All materials removed during demolition, except plants or other materials designated to be stockpiled, transplanted and reinstalled, shall be considered unsuitable and shall be legally disposed of outside the limits of the site.
- B. Fences:
 - 1. Fabric Fence:
 - a. Fence Fabric: 48" height, orange plastic fence, such as Tenax Alpi, or as manufactured by Du Pont, or approved equivalent. Attach securely every 6" to posts and rails.
 - b. Metal Posts: 6' foot metal T-posts.
 - c. Wood Posts and Top Rails: Pressure treated pine; posts 4" x 4" x 8 feet long, driven min. 3 feet deep spaced at 6 feet on center maximum; top rails 2" x 4",

nailed to posts.

- C. Bark Mulch: Clean shredded hardwood bark, not to exceed 2" in its largest dimension, free of foreign matter, sticks, stones and clods.
- D. Burlap Wrapping Materials: New, clean, plain burlap, manufactured for horticultural purposes. Secure with rope, strong twine or wooden stakes with staples.
- E. Wood Protection for Tree Trunks: 2" x 8" x 8 feet pressure treated pine, continuously banded with metal straps at 12 inch intervals.
- F. Commercial Fertilizers: Complete fertilizer, uniform in composition, free flowing and suitable for application with approved equipment. Type and application rate shall be determined by testing agency's soil test but may contain the following percentages by weight: 10% nitrogen, 10% phosphorous, and 10% potash.
- G. Plant Maintenance Materials:
 - 1. Anti-desiccant Spray: An emulsion which provides a protective film over plant surfaces, permeable enough to permit transpiration, such as "Wiltpruf", NCF Nursery Specialty Products, Inc., Grotan Falls, N.Y., or equivalent.
 - 2. Insecticides, Herbicides, Fungicides: Materials used for the control of pests shall be appropriate to the pest or pests which pose a problem to the materials, and shall be used by licensed personnel in strict accordance with the manufacturer's recommendations. No phytotoxic materials shall be used in areas where ornamental plants could be damaged.
- H. Drainage Fill: Selected crushed stone, or crushed or uncrushed gravel, washed, ASTM D 448, Size 24, with 90 to 100 percent passing a 2-1/2-inch (63-mm) sieve and not more than 10 percent passing a 3/4-inch (19-mm) sieve.
- I. Topsoil: Fertile, friable, surface soil, containing natural loam and complying with ASTM D 5268. Provide topsoil that is free of stones larger than 1 inch (25 mm) in any dimension and free of other extraneous or toxic matter harmful to plant growth. Obtain topsoil only from well-drained sites where soil occurs in depth of 4 inches (100 mm) or more; do not obtain from bogs or marshes.
- J. Filter Fabric: Manufacturer's standard, nonwoven, pervious, geotextile fabric of polypropylene, nylon, or polyester fibers.

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Examination: Examine areas of protection and pruning operations prior to start of operations and report discrepancies in existing conditions to Architect prior to start of work of this Section. Do not proceed with installation or operations until conditions are corrected.
- B. Prohibited Practices: Do not move, park or maneuver vehicles or machinery and do not dump, stockpile or store any materials, including debris and excavated materials, within the protection fence zone before, during or after erection of the fence. Do not allow fires under or adjacent to remaining trees or other plants.

C. Protect Root Systems:

1. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.
2. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials.
3. Tunnel the utilities through tree protection zones. Do not use machinery within or trench through site protection zones.
4. Prevent soil compaction over root systems. Do not operate machinery in tree protection zones to make grade changes. Hand dig the areas to make changes in grades.

B. Erect Protection Fencing: Prior to any demolition, site clearing or removals, construct temporary protection fences around all vegetation designated to remain, protect or preserve. Manually install fences true to line, plumb and level. The drip line is shown on Drawings as the outer edge of the tree canopy. Multiple trees may be enclosed by a single fence line provided the fence is located at drip lines of all trees. See Drawings.

1. Install temporary fencing located as indicated or at least one foot outside the drip line of trees to protect remaining vegetation from construction damage.
2. Where possible, fences shall be installed ten feet beyond the drip lines of the trees to be protected.
3. Where adjacent to pavement, install one foot outside the pavement edge.
4. Completely surround vegetation to be protected unless otherwise shown on the Drawings.
5. Install chain link fence according to ASTM F 567 and manufacturer's written instructions.
6. Securely stake fence posts into ground with fence fabric facing outward.

D. Other Protections: Prior to any demolition, site clearing, or removals, erect all other barricades and other protection devices as shown on the Drawings.

1. **Tree Trunk Protection:** Tree trunk protection will be allowed only where construction takes place closer than the drip line of existing trees. Place stakes in vertical position against tree trunk, edge to edge with edges touching and secure with metal straps.
2. **Burlap Coverings:** Entirely cover designated shrubs with burlap as shown on the Drawings. Secure with rope, strong twine or stapled to wooden stakes.
3. **Tie Up Branches:** Tie up or back any branches which may interfere with construction clearance and safety. Provide a minimum vertical clearance for equipment of twenty feet from finish grade, outside of protection fence. Tie back branches which interfere with sight distance or pose other safety hazards during the construction process.

F. Pruning for Safety and Clearance: With acceptance of Landscape Architect, prune to provide vertical clearance for equipment of twenty feet from finish grade, outside of protection fence. Prune for sight distance and safety with the acceptance of the Landscape Architect. Do not break off of branches to remain during clearing operations.

3.2 SITE CLEARING:

A. Clearing: Remove and dispose of all landscape obstructions such as debris, rubbish, fences, walls, foundations, footings, stones, boulders, paths, logs, shrubs, saplings, grass, weeds other vegetation and stumps.

1. Do not use heavy machinery in tree protection zones to accomplish clearing. Use low impact methods of removal and clearing.

- B. Inspection Prior to Removals: Removals shall be as determined by the Architect with the clear understanding by all that all removals of existing trees shall be replaced. See Drawings and refer to Section 32 93 11 – Landscape Plantings.
- C. Removals: Remove trees and other large plant materials by cutting and grubbing. Do not damage other vegetation including the roots of adjacent trees and existing landscape areas designated to remain, protect or preserve during removal process. Completely remove and legally dispose off the site all trees which are identified to be in the way of transformer installation, including branches, trunks, stumps and roots over 2 inches in diameter.
 - 1. Remove to a depth of two feet (24”) below finish grade elevation and repair grade with new topsoil. Refer to Section 32 93 11 – Landscape Plantings.

3.3 EXCAVATION AROUND EXISTING TREES

- A. Do not excavate within drip line of trees, unless otherwise indicated.
- B. Where excavation for new construction is required within drip line of trees, minimize damage to root zones.
 - 1. Install shoring or other protective support systems to minimize sloping or benching of excavations.
 - 2. Hand clear the area; do not use machinery.
 - 3. Minimize damage by using narrow-tine spading forks and comb soil, or use an air spade to expose roots.
 - 4. Relocate roots in backfill areas where possible. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches (75 mm) back from new construction.
 - 5. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.
- C. Where utility trenches are required within drip line of trees, tunnel under or around roots by drilling, auger boring, pipe jacking, air spading, or digging by hand.
- D. Root Pruning: Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities or foundations. Cut roots with sharp pruning instruments; do not break or chop.

3.4 REGRADING AROUND EXISTING TREES

- A. Maintain existing grades within drip line of trees whenever possible.
- B. Grade Lowering: Where new finish grade is indicated below existing grade around trees, slope the grade away from trees as recommended by qualified arborist, unless otherwise indicated. Follow natural contours, where feasible to maintain the natural drainage patterns of the site so as not to cause the tree to get reduced moisture.

1. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.
- C. Minor Fill: Where existing grade is 6 inches (150 mm) or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.
- D. Moderate Fill: Where existing grade is more than 6 inches (150 mm), but less than 12 inches (300 mm), below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade.
1. Carefully place drainage fill against tree trunk approximately 2 inches (50 mm) above elevation of finish grade and extend not less than 18 inches (450 mm) from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches (150 mm) below elevation of grade.
 2. Place filter fabric with edges overlapping 6 inches (150 mm) minimum.
 3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.
- E. Move Fence to Install Walkways: Where walkways are shown through tree protection fence areas, do not remove the entire fence. Move fence the minimum distance necessary to install walkways.

3.5 TREE PRUNING

- A. Prune existing trees and shrubs to remain, protect or preserve only where directed by the Architect.
1. Season: Prune in dormant condition if possible. Do not prune in late fall until plants are dormant. Obtain acceptance of season by Landscape Architect prior to pruning plants not in dormant state.
 2. Remove Dead Wood: Remove all dead wood, suckers and broken branches from all existing trees and shrubs. After pruning for dead wood is complete, inspect trees for injury, improper pruning and insect infestation and take corrective measures.
 3. Other Pruning: Review all existing trees and shrubs with Landscape Architect to determine extent of aesthetic pruning and structural enhancement. Remove crossing or rubbing branches and growth which interferes with the natural form of the plant. Do not cut tree leaders. Do not tip-prune or shear trees or plants. No more than 30% of the mass of each tree or shrub shall be removed during aesthetic pruning. Drop crotch all limbs in excess of 2" inches.
 4. Pruning Due to Damage: Damage to root zones shall be balanced with pruning of an equivalent amount of top vegetative growth, as determined by the Landscape Architect, within one week of damage.
 5. Use clean sharp pruning implements at all times. Do not break or chop branches. Disinfect between cuts if pruning out fireblight or other spreadable disease.
- B. Provide subsequent maintenance during Contract period as recommended by qualified arborist.
- C. Pruning Standards: Prune branches for aesthetic effect and structural enhancement per referenced standards. Prune trees according to ANSI A300 as follows:
1. Type of Pruning: Crown cleaning.

2. Type of Pruning: Crown thinning.
3. Type of Pruning: Crown raising.
4. Type of Pruning: Crown reduction.
5. Type of Pruning: Vista pruning.
6. Type of Pruning: Crown restoration.

D. Remove all branches and remains from removed trees.

E. Root Pruning: If construction is to occur within the root zone of existing plants, perform root pruning, using a mechanical root pruning saw acceptable to the Landscape Architect.

1. Perform work by certified arborist.
2. Cleanly cut and remove damaged root ends where roots are to remain exposed during construction. Do not leave smashed or frayed root ends unattended.
3. Whenever roots become damaged, immediately restore soil to area and mulch area with 3 inches specified bark mulch.

3.6 MAINTENANCE AND REMOVAL OF PROTECTION FENCE:

A. Maintain Fences and Other Protections: Maintain protection fences and other protection devices throughout the construction period. Make repairs and replacements if fence or other devices become damaged or missing.

B. Remove Fences and Other Protections: Remove protection fences and other protection devices after construction in the area is complete and just prior to substantial completion of the landscape work. Refer to Section 32 93 11.

C. Remove all tree protection as directed by the Landscape Architect. Ensure the final site conditions are equal to the original condition of the tree protection area upon removal of fencing, including all grading, topsoil, and landscaping, sod and mulch to match adjacent site conditions as the end of the project.

D. Tree Protection Deficiencies: The protection of trees is extremely important. Tree Protection deficiencies are determined by the Owner's Representative and may include but is not limited to:

1. Tree Protection not in place at the start of construction.
2. Tree Protection fencing is damaged or down.
3. Unauthorized removal of Tree Protection fencing.
4. Contractor vehicles or equipment or personal vehicles driving or parking under trees.
5. Any encroachment in Tree Protection fencing.
6. Placement of any materials within the Tree Protection fencing or tree drip lines.
7. Damage to any tree.
8. Unauthorized removal of trees.
9. Unauthorized changes in grade.

3.8 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of a certified arborist. On active construction sites, it is recommended that trees be inspected every 7 days for compliance. Inspection should include a listing of trees with:

1. Damage to trunks.
 2. Mounding of soil around the trunk.
 3. Evidence of root damage.
 4. Evidence of improper pruning.
- B. In the event that a tree or plant is damaged by the Contractor's operation or personnel, the Contractor shall be responsible for repairs or remediation of the damage as determined by the Owner's Representative.
- C. In the event that the damage to a tree or plant is beyond repair and requires removal determined by the Architect, replace the tree.
1. Any damaged trees and plants shall be replaced in kind, inch for inch; plant and maintain as specified in Section 32 93 11.

3.5 REPAIR, CLEANING AND DISPOSAL OF MATERIALS:

- A. Repair: Repair any work to remain that is damaged during performance of work of this Section.
- B. Clean-up: Clean up area of all unused material and debris resulting from work.
- C. Disposal of Materials: Remove all excess material, removed trees, branches, debris, soil and excess chips and mulch from Owner's property. Legally dispose of all cleared and removed materials.

END OF SECTION 31 13 00

SECTION 31 22 00 – GRADING**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Removal and storage of topsoil.
- B. Rough grading the site.
- C. Finish grading.

1.2 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. See Section 01 81 13 - LEED Sustainable Design Requirements, when required.
- C. Project Record Documents: Accurately record actual locations of utilities remaining by horizontal dimensions, elevations or inverts, and slope gradients.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Topsoil: Conforming to project specifications and in compliance with Section 31 23 23 - Acceptance of Backfill, Topsoil, and CU Structural Soil.
 - 1. Topsoil may be excavated on site if it meets specified requirements.
- B. Other Fill Materials: See Section 31 23 23 – Acceptance of Backfill, Topsoil, and CU Structural Soil and Section 31 23 23.01 - Fill.

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.
- B. Verify the absence of standing or ponding water.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Stake and flag locations of known utilities.

- C. Provide temporary means and methods to remove all standing or ponding water from areas prior to grading.

3.3 ROUGH GRADING

- A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.
- B. Do not remove topsoil when wet.
- C. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.
- D. Do not remove wet subsoil unless it is subsequently processed to obtain optimum moisture content.
- E. When excavating through roots, perform work by hand and cut roots with sharp axe.
- F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.
- G. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack surface water control.
- H. Uniformly grade the area, including adjacent transition areas. Smooth finished surfaces within specified tolerances, compact with uniform levels or slopes between elevation points, or between such points and existing grades.

3.4 SOIL REMOVAL

- A. All soils, fill and topsoil requiring removal from the site shall be handled in accordance with Section 31 23 18.13 "Soil, Fill, Backfill, CU Structural Soil & Construction".
- B. Stockpiles: Use areas designated on site; pile depth not to exceed 8 feet; protect from erosion. Removal of stockpiles of soil material off property as waste material shall be handled in accordance with the Contract Specifications.

3.5 FINISH GRADING

- A. Before Finish Grading:
 - 1. Verify building and trench backfilling have been inspected.
 - 2. Verify subgrade has been contoured and compacted.
- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.
- C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- D. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

- E. Grassed Areas: Finish areas to receive topsoil to within not more than 0.10' above or below the required subgrade elevations, compacted as specified, and free from irregular surface changes to prevent ponding of water after rains.
- F. Walks: Shape the surface of areas under walks to line, grade and cross section, with the finish surface not more than 0.00' above or 0.10' below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.
- G. Pavements: Shape the surface of the areas under pavement to line, grade and cross section, with the finish surface not more than 1/4" above or below the required subgrade elevation, compacted as specified, and graded to prevent ponding of water after rains.
- H. Maintain stability of topsoil during inclement weather. Replace topsoil in areas where surface water has eroded thickness below specifications.

3.6 REPAIR AND RESTORATION

- A. Protect newly graded areas from traffic and erosion and keep free of trash and debris and growth of weeds.
- B. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.
- C. Reconditioning Compacted Areas: Where completed compacted areas are disturbed by subsequent construction operations or adverse weather scarifies the surface, reshape, and compact to the required density prior to further construction.
- D. Restoration: Restore all areas affected by construction both on and off Owner's property to original condition.

3.7 FIELD QUALITY CONTROL

- A. See Section 31 23 23 - Acceptance of Backfill, Topsoil, and CU Structural Soil for compaction density testing.

3.8 CLEANING

- A. Remove unused stockpiled topsoil. Grade stockpile area to prevent standing water.
- B. Leave site clean and raked, ready for further construction.

END OF SECTION 31 22 00

SECTION 31 23 16 – EXCAVATION

PART 1 - GENERAL

1.1 SUMMARY

- A. Excavating for building volume below grade, footings, pile caps, slabs-on-grade, paving, and site structures.
- B. Trenching for utilities outside the building to utility main connections.
- C. Related Requirements:
 - 1. Sections 01 01 40 “Erosion and Sedimentation Control” and 01 57 23 “Temporary Storm Water Pollution Control” for erosion control measures.

1.2 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.

1.3 PROJECT CONDITIONS

- A. Verify that survey benchmark and intended elevations for the Work are as indicated.
- B. Site Information
- C. Traffic: Conduct operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.
- D. Protection of Existing Improvements:
 - 1. Provide barricades, coverings, or other types of protection necessary to prevent damage to existing improvements to remain in place.
 - 2. Restore damaged improvements to their original condition, as acceptable to the Owner and other parties or authorities having jurisdiction.
- E. Improvements on Public Property: Obtain authority for performing removal and alteration Work on public property.
- F. Existing Utilities:
 - 1. Locate existing underground utilities in the areas of Work before starting earthwork operations. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 2. Contact D.I.G.G.E.R. (312-744-7000) to verify locations of existing underground utilities before starting excavation.

3. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Architect immediately for directions as to procedure.
 4. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation.
 5. Demolish and completely remove from the site underground utilities indicated to be removed. Coordinate with local utility companies for shutoff of services if lines are active.
- G. Protect existing improvements on and off the site from damages caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- H. Use of Explosives: The use of explosives shall not be permitted.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that survey benchmark and intended elevations for the work are as indicated.

3.2 PREPARATION

- A. Identify required lines, levels, contours, and datum locations.
- B. Before mobilizing and starting Work on the site, institute, expand as necessary, and maintain throughout the project a sediment and erosion control system specific to site that complies with Section 01 01 40 Erosion and Sedimentation Control.
1. Control erosion and sediment damage to roadways, adjacent properties and water resources through the use of basins, ditch checks, temporary ditches, mulch barriers, mulches, grasses, silt filter fences, hay or straw bales, aggregate barriers, inlet and pipe protection and other appropriate means.
 2. Remove and legally dispose of debris resulting from the project when no longer required in accordance with Section 31 23 18.13 - Soil, Fill, Backfill, CU Structural Soil & Construction & Demolition Debris Removal.
- C. Protect utilities that remain and protect from damage.
- D. Grade top perimeter of excavation to prevent surface water from draining into excavation. Provide temporary means and methods, as required, to maintain surface water diversion until no longer needed, or as directed by Architect.

3.3 CLEARING

- A. Environmental Hazards: Before starting Work and thereafter as appropriate, report conditions indicative of environmental hazards to the Owner's Representative and proceed as directed.
- B. See Section 31 22 00 - Grading for soil removal from surface of site.
- C. Remove vegetation, improvements, or obstructions that interfere with installation of new construction. Removal includes new and old stumps and their roots.
- D. Carefully and cleanly cut roots and branches of vegetation to be left standing, where such roots and branches obstruct new construction.
- E. Comply with the environmental protection and safety requirements of all authorities having jurisdiction. Keep dust to a minimum. Maintain streets free of mud, dirt and debris at all times.
- F. Topsoil Removal:
 - 1. Topsoil is defined as friable clay loam surface soil found in a depth of not less than 4". Satisfactory topsoil is reasonably free of subsoil, clay lumps, stones, and other objects, and without weeds, roots, and other objectionable material.
 - 2. Strip topsoil to whatever depths encountered, and in such manner so as to prevent intermingling with the underlying subsoil or other objectionable material. Remove heavy growths of grass from areas before stripping.
 - 3. Where vegetation is to be left standing, stop topsoil stripping a sufficient distance from such vegetation to prevent damage to the main root system.
 - 4. Stockpile top soil in storage piles for reuse or remove from the site in compliance with other Division 31 Sections. Construct storage piles to freely drain surface water. Cover storage piles if required to prevent windblown dust.
- G. Removal of Improvements: Remove improvements that interfere with construction.

3.4 EXCAVATING

- A. Comply with the requirements of other Division 31 Sections.
- B. Excavate to accommodate new structures and construction operations.
 - 1. Excavation consists of the removal and disposal of materials encountered when establishing the required grade elevations. Such excavation is unclassified regardless of the materials encountered and all materials to be disposed of in accordance with other Division 31 Sections.
 - 2. Unauthorized excavation consists of removal of materials beyond indicated or required elevations. Replace unauthorized excavation by backfilling and compacting as specified for select fill at no cost to Owner.

3. Excavate under Building to the extent required to establish subgrades.
 4. Excavate under pavements as required to comply with cross sections, elevations and grades.
 5. Excavate elsewhere as required to establish new finish grades, allowing not less than 4" for topsoiling.
 6. Cap and remove abandoned underground piping or conduit.
- C. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- D. Dewatering: Prior to commencing work, the Contractor shall provide a storm water management plan. This plan shall stipulate provisions for dewatering, pumping, collection, temporary storage, and discharge or disposal of storm water, perched water and other liquids, contaminated and/or uncontaminated, at the site so as to facilitate soil removal and minimize disposal costs for contaminated fluids.
1. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey the water away from the site.
 2. Convey water removed from excavations and rainwater to collecting or run-off areas acceptable to authorities having jurisdiction. Do not use trench excavations for site utilities as temporary drainage ditches.
 3. Comply with requirements of authorities having jurisdiction, including but not limited to, the City of Chicago and the Water Reclamation District of Greater Chicago.
- E. Stability of Excavations: Slope the side of excavations to comply with local codes, authorities having jurisdiction, and the City of Chicago, and maintain same. Secure, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.
1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- F. Shoring and Bracing: Provide shoring and bracing to comply with local codes, authorities having jurisdiction and the City of Chicago.
1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable conditions.
 2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.

- G. **Material Storage:** Stockpile excavated materials classified as satisfactory soil material in accordance with other Division 31 Sections until required for backfill or fill. Place, grade and shape stockpiles for proper drainage. Stockpile soil materials without intermixing. Place, grade, and shape stockpiles for proper drainage. Cover to prevent windblown dust. Stockpile soil materials away from edge of excavations. Do not store within drip line of trees to remain.
 - H. **Excavation for Structures:** Excavate to the subgrade elevations required within a tolerance of plus or minus 0.10' to balance, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.
 - 1. Take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before concrete is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.
 - I. **Excavation for Pavements:** Cut the surface under pavements to comply with cross sections, elevations and grades.
 - J. **Removal of Unsatisfactory Soil Materials:** Excavate unsatisfactory soil materials encountered that extend below the required elevations, to the additional depth established by the Design-Builder's testing agency and approved by Owner.
 - 1. If excavated unsatisfactory materials are to be removed from the property, all such materials shall be disposed of in accordance with other Division 31 Sections.
 - 2. Such additional excavation, provided it is not due to the fault or neglect of the Contractor, will be measured and paid for as a change in the work if approved by Owner.
 - K. **Closing Abandoned Underground Utilities:** Close open ends of abandoned underground utilities, which are to remain permanently, and with sufficiently strong closures to withstand pressures which may result after closing.
 - L. **Cold Weather Protection:** Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 degrees F. Maintain excavation free of water, ice and snow.
- 3.5 **PROOF ROLLING**
- A. Proof Roll entire area under building and pavements with a pneumatic roller or heavily loaded dump truck (minimum 25 tons).
 - B. Make at least 2 passes (second at right angle to first) in the presence of a representative of the Design-Builder's testing agency.
- 3.6 **FIELD QUALITY CONTROL**
- A. Design-Builder will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during earthwork operations.

See Section 31 23 23.01 - Fill, for field inspection and testing requirements for all earthwork activities.

- B. Excavate unsatisfactory soil materials encountered to the additional depth established by the Design-Builder's testing agency and approved by Owner.
- C. Perform no further work until slab subgrades are acceptable to the representative of the Design-Builder's testing agency.

END OF SECTION 31 23 16

SECTION 31 23 17 – EXCAVATING, BACKFILLING, AND COMPACTING FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes trenching for all utilities outside the building including: water, sanitary sewer, site drainage, and storm sewer lines to the public utility location.
- B. Compacted bed and compacted fill over utilities to subgrade elevations.
- C. Compaction.

1.2 REFERENCE STANDARDS

- A. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012, with Editorial Revision (2015).
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.
- D. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth); 2005.
- E. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth); 2017.
- F. 35 ILL. ADM CODE 740 APPENDIX A Target Compound List (TCL) parameters and Appendix B., Section 742, Table A.; Tiered Approach To Corrective Action Objectives (TACO): 35 Ill .Adm. Code 742.
- G. Illinois Department of Transportation (IDOT): IDOT Specifications for Road and Bridge Construction including all addenda.

1.3 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.

1.4 QUALITY ASSURANCE

- A. Tests and analysis of fill materials will be performed in accord with ASTM D1557, and with General Conditions and testing required by other Division 31 Sections for acceptability as fill material.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. In accordance with the soil report the Design-Builder's testing agency representative shall determine if the excavated material is suitable for backfill. The suitable trench excavated material shall be used for trench backfill.
- B. Provide all backfill materials from off site in accordance with other Division 31 Sections.
- C. Granular Fill Type A:
 - 1. Material for granular fill shall be CA-6/CA-16/FA-6 in compliance with SSRBC IDOT 2016, Section 1003 and with other Division 31 Sections
 - 2. Bedding Material: Material for bedding shall be CA-6/CA-11/CA-16 in compliance with SSRBS IDOT 2016, Section 1004 and with other Division 31 Sections.
- D. Fill Material Type D: Fill material shall be cohesive soil obtained from on-site required excavations and approved by the Design-Builder's testing agency representative as suitable backfill material in accordance with ASTM D2487 and with other Division 31 Sections. It shall be used to backfill excavations where the excavated material is unsuitable for backfill.
- E. Fill Material Type E: Fill under landscaped areas shall be free from alkali, salt shall not exceed Appendix B, Section 742, Table A; Tiered Approach to Corrective Action Objectives (TACO); Ill Adm. Code 742 values for 35 ILL. ADM CODE 740 APPENDIX A Target Compound List (TCL) parameters. This fill shall be approved by the Design-Builder's testing agency representative as suitable material.
- F. Fill Material Type X: Off-site borrow material shall comply to soil types GP, GW, SC and CL in accordance with ASTM D2487, Uniform Soils Classification System and with other Division 31 Sections. It shall be used where needed under structural slabs, roads, pavement and landscaped areas. Landscaped areas must meet the testing requirements stated for Fill Material Type E above

PART 3 - EXECUTION**3.1 EXAMINATION**

- A. Verify that survey benchmarks and intended elevations for the work are as indicated.
- B. Verify stockpiled fill to be reused as approved in writing by Architect.
- C. Verify foundation perimeter drainage installation has been inspected and approved in writing by Architect.
- D. Verify and confirm in writing that areas to be backfilled are free of debris, snow, ice or water, and surfaces are not frozen.

3.2 PREPARATION

- A. Identify specified lines, levels, contours and data.
- B. Compact subgrade surfaces to density specified for backfill materials.

3.3 EXCAVATION

- A. Cut trenches wide enough to enable utility installation and allow inspection.
- B. Hand trim excavation and leave free of loose matter. Hand trim for bell and spigot pipe joints.
- C. Excavation shall not interfere with normal 45 degree bearing splay of foundations.
- D. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.
- E. Dewatering: Prior to commencing work, the Contractor shall provide a storm water management plan. This plan shall stipulate provisions for dewatering, pumping, collection, temporary storage, and discharge or disposal of storm water, perched water and other liquids, contaminated and/or uncontaminated, at the site so as to facilitate soil removal and minimize disposal costs for contaminated fluids.
 - 1. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of subgrades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey the water away from the site.
 - 2. Convey water removed from excavations and rainwater to collecting or run-off areas acceptable to authorities having jurisdiction. Do not use trench excavations for site utilities as temporary drainage ditches.
 - 3. Comply with requirements of authorities having jurisdiction, including but not limited to, the City of Chicago and the Water Reclamation District of Greater Chicago.
- F. Stability of Excavations: Slope the side of excavations to comply with local codes, authorities having jurisdiction, and the City of Chicago, and maintain same. Secure, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated.
 - 1. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
- G. Shoring and Bracing: Provide shoring and bracing to comply with local codes, authorities having jurisdiction and the City of Chicago.

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable conditions.
 2. Maintain shoring and bracing in excavations regardless of the time period excavations will be open. Carry down shoring and bracing as the excavation progresses.
- H. Locate and retain reusable excavated materials away from the edge of excavation.
- I. Close open ends of abandoned underground utilities with plugs, which are to remain permanently, and with sufficiently strong closures to withstand pressures which may result after closing. If required, abandoned utilities may also need to be filled with grout or injected with flowable fill

3.4 BACKFILLING

- A. Support pipes, and conduits during placement and compaction of bedding fill.
- B. Backfill trenches to contours and elevations shown. Backfill systematically, as early as possible to allow maximum time for natural settlement. Do not backfill over porous, wet or spongy subgrade surfaces.
- C. Place compact fill materials in continuous layers as specified in Section 31 23 23.01 - Fill.
- D. Use a placement method that will not disturb or damage utilities in trenches, perimeter drainage.
- E. Maintain optimum moisture content of backfill materials, determined by laboratory analysis, to obtain specified compaction density.

3.5 FILL TYPES AND COMPACTION

- A. Compact all fill and backfill to specified values based on Modified Proctor Test in accordance with Section 31 23 23.01 - Fill.

3.6 COLD WEATHER PROTECTION

- A. Quality Control Testing During Construction: An independent inspection and testing agency employed by the Design-Builder shall inspect and approve each subgrade and fill layer before further backfill and fill work is performed.
1. The inspection and testing agency shall perform field and laboratory density tests in accordance with either ASTM D1556/D1556M or ASTM D1557 as applicable.
 2. Field density tests may also be performed by the nuclear method in accordance with ASTM D6938. The calibration curves shall be periodically checked and adjusted to correlate to tests performed using ASTM D1556/D1556M. In conjunction with each density calibration check, the calibration curves furnished with the moisture gauges shall be checked in accordance with ASTM D3017.

3. If field tests are performed using nuclear methods, the inspection and testing agency shall make calibration checks on both density and moisture gauges at beginning of work, on each different type of material encountered, and at intervals as specified by the equipment manufacturer.
4. If, in the opinion on the Design-Builder testing agency representative, based on the inspection and testing agency reports and inspections, subgrade or fills have been placed by specified density, the Contractor shall perform additional compaction and retesting until specified density is achieved. Contractor to pay for all retesting work.
5. The Contractor shall assist the inspection and testing agency by providing access to the excavation and fill areas, and by removing loose materials from compacted soil layers prior to testing.

3.7 CLEANING

- A. Remove surplus backfill materials and materials unsuitable for backfill from the site to a permitted Subtitle D Landfill as per Section 31 23 18.13 - Soil, Fill, Backfill, CU Structural Soil & Construction & Demolition Debris Removal.

END OF SECTION 31 23 17

**SECTION 31 23 18.13 – SOIL, FILL, BACKFILL, CU STRUCTURAL SOIL AND
CONSTRUCTION AND DEMOLITION DEBRIS REMOVAL**

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. This specification section applies to Contaminated Soil and General Construction & Demolition Debris that does not meet the definition of the Clean Construction or Demolition Debris (CCDD), Uncontaminated Soil or Hazardous Waste.
2. Description of Work: This specification is for the excavation, stockpiling, loading, hauling, removal, and disposal of any materials including soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, and general construction and demolition debris. Locations of non-special waste and non-hazardous special waste on the project site shall be determined by the Design-Builder. The Contractor shall perform the work under this section in accordance with all applicable local, county, IEPA, USEPA, and OSHA regulations. The Work shall include the following:
 - a. Removal and disposal
 - 1) Prior to excavation of any soil (including non-special waste soils and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, and general construction and demolition debris material, obtain authorization for ultimate disposition of materials from an open and active Subtitle D facility approved by the Design-Builder. The Subtitle D facility shall be permitted to accept both Non-Hazardous Special Waste and Special Waste.
 - 2) The waste characterization analytical must be sent to the Design-Builder for approval prior to sending the profile to the landfill.
 - 3) Perform the analytical testing required by the landfill for waste stream authorizations as necessary to secure all required disposal permits for all materials. All costs associated with collecting waste stream samples and performing analytical tests shall be at Contractor's own expense.
 - 4) Obtain authorization from an open and active Permitted Subtitle D landfill indicating acceptance of materials at the facility. The Authorization must be signed by the owner of the open and active Permitted Subtitle D landfill and state that the facility complies with all local zoning codes and all local, state, and federal rules and regulations, that all required laboratory analyses has been received by the facility, and that the facility has agreed to accept the soils (including non-special waste soils, and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, and general construction and demolition debris materials. The Authorization shall further state that the soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, general construction and demolition debris materials are being

accepted for permanent placement on site under the cap, and that the material will not be removed from the site unless required by a local, state or federal regulations.

- 5) Prepare daily reports, transport manifests, weight tickets and receipts (as applicable) prior to starting any soil removal activities.

- 6) Excavation of soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, and general construction and demolition debris materials to the depth required to complete the proposed site preparation/construction work activities as specified in the Contract Documents.
- 7) Load and transport all materials to the approved open and active Permitted Subtitle D landfill into approved containers or vessels.
- 8) Provide copies of all daily reports, signed transport/waste manifest, signed weight tickets, and disposal receipts (as applicable) to the Design-Builder on a daily basis documenting proper disposal of soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, and general construction and demolition debris materials.

1.2 DEFINITIONS

- A. Agency: Illinois Environmental Protection Agency (IEPA).
- B. Backfill: granular or cohesive material used to fill the excavation to design grade as referenced in design plans and specifications.
- C. CU Structural Soil: a uniformly blended mixture of crushed stone, clay, loam and hydrogel by weight consisting of approximately 83% crushed limestone (3/4 to 1.5 inch, highly angular with limited fines), 17% clay loam and hydrogel (1 oz. per 200 pounds of stone).
- D. Fill: any earthen or non-earthen materials including but not limited to any sediment, granular or cohesive non-native earthen materials, cinders, ash, wood, and brick, concrete, and asphalt fragments, glass, and building debris encountered above naturally occurring undisturbed soils or bedrock in built-up areas.
- E. General Construction and Demolition (C&D) Debris: non-hazardous, uncontaminated materials resulting from construction, remodeling, repair, and demolition of utilities, structures, and roads as defined in Public Act 92-0574, the Environmental Protection Act, 415 ILCS 5 Section 3.160 and regulated under Title 35: Environmental Protection; Subtitle G: Waste Disposal; Chapter I: Pollution Control Board; Subchapter i: Solid Waste and Special Waste Hauling. General Construction and demolition (C&D) debris may include soil, wall coverings, reclaimed asphalt pavement, rock, plaster, glass, non-hazardous painted wood, drywall, plastics, non-hazardous coated wood, non-asbestos insulation, bricks, wood products, roofing shingles, concrete, and general roof coverings.

- F. Open and Active Permitted Subtitle D Landfill: any open and active solid waste landfill facility in any state licensed and permitted to accept non-hazardous waste including both non-special waste soils and non-hazardous special waste soils, fill, general construction and demolition debris are to be deposited. If the landfill facility is located in Illinois, the landfill must be licensed/ open, active and permitted by the Illinois Environmental Protection Agency and other applicable local regulatory agencies as applicable. If the landfill is located outside of Illinois, the landfill facility must be open, active and permitted by applicable state and local regulatory agencies.
- G. IEPA: Illinois Environmental Protection Agency.
- H. IDOT: Illinois Department of Transportation.
- I. Manifest: the form provided or prescribed by IEPA and used for identifying name, quality, routing, and destination of special waste during its transportation from point of generation to the point of disposal, treatment, or storage.
- J. MSDS: Material Safety Data Sheet, required by OSHA for any substances that are toxic, caustic, or otherwise potentially hazardous to workers.
- K. OSHA means Occupational Safety and Health Administration.
- L. Remediation Area: any area on site where underground storage tanks, non-special waste and/or non-hazardous special waste, or soil that do not meet Tier 1 SROs for residential properties is present.
- M. Soil: any granular or cohesive materials designated for removal as specified in the Architect/Engineer drawings and specifications and includes soils that are determined to be non-special and special waste.
- N. Special Waste: any wastes as defined in Title 35: Environmental Protection; Subtitle G: Waste Disposal; Chapter I: Pollution Control Board; Subchapter i: Solid Waste and Special Waste Hauling; Part 808: Special Waste Classifications; Subpart A: General Provisions; Section 808.110, AND Any wastes as defined in Title 35: Environmental Protection; Subtitle G: Waste Disposal; Chapter I: Pollution Control Board; Subchapter i: Solid Waste and Special Waste Hauling; Part 809: Non Hazardous Special Waste Classifications; Subpart A: General Provisions; Section 809.103.
- O. SROs: Soil Remediation Objectives for various exposure routes identified in 35 Illinois Administrative Code 742: Tiered Approach To Corrective Action Objectives (TACO).
- P. Stormwater: water deposited at the site in the form of rain, snow or other natural weather event.
- Q. TACO: TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO) per 35 Illinois Administrative Code 742.
- R. Top Soil: soils placed to design grade and used to promote vegetative growth and which meets Top Soil criteria (percentages of organic matter, inorganic matter (silt,

clay, and sand)), deleterious material, pH, and mineral and plant-nutrient content as referenced in the contract specifications and drawings.

- S. Uncontaminated Soil: soil generated during construction, remodeling, repair or demolition of utilities, structures and roads that does not contain contaminants in concentrations that pose a threat to human health and safety and the environment. [415 ILCS 5/3.160(c)]
- T. USEPA: United States Environmental Protection Agency.
- U. User or User Agency: the entity for which or on whose behalf the Board has undertaken to cause the Work to be performed.

- V. Work: the obligations of the Contractor under the Contract Documents. Work includes, unless specifically excepted by the Contract Documents, the furnishing of all materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, superintendence, permits, inspections, occupancy approvals, insurance, taxes, and all other services, facilities and expenses necessary for the full performance and completion of the requirements of the Contract Documents. Work also means that which is furnished, produced, constructed, or built pursuant to the Contract Documents.

1.3 ACTION SUBMITTALS

- A. Copies of the following submittals shall be prepared and submitted to the Design-Builder at Contractor's own cost and within ten (10) days prior to start of Work:
 - 1. Refer to Section 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for Stormwater Management Plan submission requirements.
 - 2. Refer to Section 01 56 11 – GENERAL DUST, FUME, AND ODOR CONTROL for requirements for managing dust on site.
 - 3. Contractor's Site Specific Health and Safety Plan for all workers engaged in excavation, stockpiling, loading, hauling, removal, and disposal of any soils (including non-special waste soils and non-hazardous special waste soils), fill, general construction and demolition debris from the property. The plan shall comply with all OSHA requirements utilizing information attained in existing environmental reports. The Work shall be performed under the direct supervision of a trained experienced site supervisor. The plan should at a minimum include the following:
 - a. Name of key personnel and alternates responsible for site safety.
 - b. Describe the risks associated with each operation conducted.
 - c. Describe chemical contaminants to be encountered by employees on work site and specific hazards if any to the workers as required by OSHA.

- d. Type of personnel training and responsibilities and to handle the specific hazardous situations they may encounter.
 - e. Describe the protective clothing and equipment to be worn by personnel during various site operations.
 - f. Describe any site-specific medical surveillance requirements.
 - g. Describe the program for the periodic air monitoring, personnel monitoring, and environmental sampling if needed.
 - h. Describe the actions to be taken to mitigate existing hazards to make the work environment less hazardous.
 - i. Define site control measures including a site map.
 - j. Establish procedures for personnel and equipment and transporting trucks to ensure that impacted soils are not tracked off site on to non-impacted areas of the site.
 - k. Set forth the site Standard Operating Procedures (SOPs). SOPs are those activities that can be standardized (i.e., decontamination procedures and respirator fit testing).
 - l. Set forth a Contingency Plan for the safe and effective response to emergencies.
4. Soil Management Plan outlining proposed excavation work sequences and procedures to separate each type of material to be removed from the site from clean materials. The Soil Management Plan shall show the locations of each type of material to be stored on site, location of clean materials to be stored at the site for reuse, and location of material to be stored on site for future disposal. The Design-Builder must review and approve this plan.
 5. Disposal Facility Information Name, address and telephone number of the open and active Permitted Subtitle D Landfill facility where soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, top soil, CU Structural Soil, and general construction and demolition debris materials are to be deposited. The Subtitle D facility shall be permitted to accept both Non-Hazardous Special Waste and Special Waste.
 - a. This submittal must be made thirty days (30) prior to removal of any materials from the site. This information should include, at a minimum, the following:
 - 1) Facility Name and Address and Telephone Number.
 - 2) Site Contact.
 - 3) Facility Identification Number issued by Illinois, U.S. EPA, or other state licensing agencies for Special Waste Disposal facility.
 - 4) State and/or Local Operational Permit Number(s) for the impacted Construction and Demolition Debris Disposal sites.
 6. The Contractor shall fill out the waste profile including the waste characterization laboratory results to be utilized for landfill requirements and send it to the MEC for approval. The MEC will forward the waste profile to the Board Representative designee for signature. The Contractor shall assume this signature process will take five (5) business days to accomplish.
 7. Waste Stream authorization and/or permit from the Subtitle D Landfill facility where soils (including non-special waste soils and non-hazardous special waste

soils), fill, general construction and demolition debris are to be deposited prior to removal from the site. The authorization must be signed by the Subtitle D landfill facility representative and state that the facility complies with all local zoning codes and all local, State, and Federal rules and regulations, that all required laboratory analyses has been received by the facility, and that the facility has agreed to accept the soils (including non-special waste soils, and non-hazardous special waste soils), fill, and general construction and demolition debris materials. The Authorization shall further state that the soils (including non-special waste soils and non-hazardous special waste soils), fill, general construction and demolition debris fill materials are being accepted for permanent placement on site, and that the material will not be removed from the site unless required by a local, state or federal Authority.

8. Analytical Testing Laboratory including the name, address, and State of Illinois Environmental Protection Agency accreditation in accordance with the Illinois Administrative Code, Title 35, Subtitle A Chapter II, Part 186, for the laboratory which will be utilized by the Contractor to perform analytical testing prior to the start of Work.
9. Copies of Special/Hazardous Waste Hauler Licenses/Permits for each proposed transporter prior to removal of soil from the site, pursuant to 35 IAC 809. Include current copy of IEPA and/or USEPA approval letter/permit, and details of haul route(s) from site to the disposal facilities.
10. Copies of Waste Disposal Manifests and Weight Tickets to the Design-Builder on a daily basis. Manifests and weight tickets must be fully executed by the generator, transporter, and designated disposal/recycling facility. These shall be presented in dated order with attached summary table. All manifests and weight tickets must be received by the Design-Builder within ten (10) working days of completion of the project.
11. Daily Reports/Logs summarizing excavation activities generating waste, locations of where the disposed materials derived, any temporary stockpile locations, transporter information, equipment, and labor. Contractor shall submit these records on weekly basis.
12. Air Sampling Data collected during the course of the Work, including OSHA compliance air monitoring, as applicable.

1.4 SUBMITTAL REVIEW

- A. See Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Review of submittals or any comments made does not relieve the Contractor from compliance with the requirements of the drawings and specifications. The purpose of this check is to review for general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions;

electing techniques of construction; coordinating the Work; and performing the Work in a safe and satisfactory manner.

- C. The Contractor must not begin any Work applicable to this section until all required submittals have been reviewed and accepted by the Design-Builder.

1.5 NOTIFICATIONS

- A. The Contractor shall notify the Design-Builder no less than forty-eight (48) business hours prior to loading and transporting any materials from the site.

1.6 RECORDKEEPING

- A. The Contractor shall provide documentation of labor, equipment, materials, tickets, manifests, and disposal laboratory analysis used for soil removal, when requested by the Design-Builder.

1.7 COORDINATION

- A. The Contractor shall coordinate and schedule the Work so as to cause the least possible disruption to the daily site activities, if any.
- B. The Contractor shall cooperate with and coordinate work progress with the Design-Builder and any other contractors working on site. Excavated soil shall be stockpiled near the excavation or at an area deemed suitable by the Design-Builder. The Contractor shall assist the Design-Builder with its machinery and operator to inspect and obtain soil samples, if necessary, from the open excavation(s) at no additional cost to the project.

1.8 PROJECT CONDITIONS

- A. The Contractor shall perform all Work without creating hazardous conditions anywhere on site.
- B. All excavation, truck loading, grading, and backfilling operations will be conducted so as to ensure minimum interference with traffic. Roads, streets, walks, and other adjacent occupied and used facilities shall not be closed or obstructed without permission from the applicable governing agency and the User. Alternate routes around closed or obstructed traffic ways must be provided if required by the governing agency.
- C. Any damage caused to adjacent pavement, utilities, or facilities by earth work operations will be promptly replaced or repaired at no additional cost to the Design-Builder or Owner and to the satisfaction of the Design-Builder, Owner, or Authorities Having Jurisdiction.

PART 2 - PRODUCTS

- 2.1 REMOVAL OF SOIL, FILL, BACKFILL, CU STRUCTURAL SOIL, AND CONSTRUCTION AND DEMOLITION DEBRIS
- A. The Contractor shall furnish all necessary means, products, tools, and equipment required to remove soil (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris from the site as directed by the Design-Builder.
 - B. The Contractor shall also furnish all necessary means, products, tools, and equipment required to fulfill the scope of work described in the contract specifications and drawings. The Contractor, by submitting a bid for the Work, represents itself as knowledgeable and an expert in the performance of the Work, and includes all things usually and customarily necessary to provide a complete and finished job, whether specifically mentioned or not.
 - C. The Contractor must have a complete plan for the entire process of soil removal and disposal in accordance with the project requirements. Contractor must provide schedule of all Work activities in accordance with the approved construction schedule.

PART 3 - EXECUTION

- 3.1 AUTHORIZATIONS
- A. Obtain authorization from the open and active Permitted Subtitle D landfill owner where soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris are to be deposited. The Authorization must be signed by the User and shall state that the User has received a copy of one or more laboratory analyses of representative sample(s) collected from the site by the contractor and has agreed to accept the material. The Authorization shall further state that the site owner agrees to accept the material for permanent placement on their site and that the material will not be removed from their site unless required by a local, state or federal rules and regulations. The Authorization further shall state that the site complies with all local zoning codes, and local, state and federal laws, rules, and regulations.
 - B. Obtain prior authorization from Design-Builder to backfill excavations and utility lines, and apply top soil. All backfill, CU Structural Soil, and top soil shall comply with other Division 31 Sections.
 - C. Haulers for transportation shall hold a current, valid hauling permit for materials being transported off-site. Haulers shall hold, and present upon request, a current valid Commercial Driver's License (CDL). Non-hazardous special wastes and hazardous wastes must be hauled by an IDOT-approved, licensed, and permitted transporter and must be valid during transportation.

- D. Obtain prior authorization from Design-Builder on the Waste Profile at least (5) days in advance of removing waste materials.

3.2 MATERIAL SAMPLING

- A. Soil, Fill, Backfill, CU Structural Soil, Construction and Demolition debris
 - 1. The Contractor shall collect sufficient amount of representative sample(s) from each type of material being removed from the site for analytical testing to obtain authorization for the ultimate disposition of the materials. The Contractor is responsible to provide the proper collection, handling and transportation of the samples to the laboratory. The Contractor is responsible for acquisition of any required permits and payment of all fees.
 - 2. The Contractor shall be responsible for obtaining liquid samples as needed for characterization for liquid disposal offsite or disposition onsite as applicable. The Contractor is responsible to the acquisition of any required disposal permits and the payment of any fees associated with liquid disposal.
 - 3. The Contractor shall submit the soil and liquid samples (as applicable) to the laboratory and pay for the cost of analyzing the constituents required for the ultimate disposition of soils and liquids.
 - 4. The Design-Builder, under special circumstances, may collect samples for laboratory analysis or field Photo-ionization Detector (PID) screening, or liquid samples for laboratory analysis. The Contractor shall provide the necessary equipment and manpower to assist the Design-Builder to collect materials to be sampled at no additional cost to the project.
 - 5. The Contractor shall immediately notify the Design-Builder if any materials, (solid or liquid) requiring special handling (i.e., stained soil, soil with odors, or liquids) are encountered in areas other than those identified in the contract drawings and referenced documents. No further work shall proceed in the area until approval is provided by the Design-Builder.
 - 6. All excavated soils, liquids, and other material shall be removed from the site in accordance with applicable specifications, and local, state and federal requirements and guidelines.

3.3 EXCAVATION

- A. Prior to starting any excavation work at the site, the contractor shall layout an alpha-numeric grid in 25-foot intervals which designates rows and columns around the perimeter of the site. Columns shall be labeled numerically along the east fence line,

beginning on the north side of the site, in 25-foot intervals towards the south side of the site. Rows shall be labeled alphabetically along the north fence line, beginning on the east side of the site, in 25-foot intervals towards the west side of the site. 12"x12", waterproof placards, showing the row number or column letter shall be placed on fence posts at the 25-foot intervals around the perimeter of the site. Placards shall be secured at a height of 4 feet above the ground and shall be maintained throughout the duration of the project. The contractor shall repair or replace placards if they become damaged or illegible.

- B. The Contractor shall perform excavation of soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris to the extent shown on the contract drawings, as necessary to complete the Work and/or as directed by the Design-Builder.
- C. All excavation shall be performed in accordance with the design drawings and local, state and federal requirements and guidelines.
- D. All excavation, truck loading, grading, and backfilling operations will be conducted so as to ensure minimum interference with traffic. Roads, streets, walks, and other adjacent occupied and used facilities shall not be closed or obstructed without permission from the applicable governing agency and the Design-Builder. Alternate routes around closed or obstructed traffic ways must be provided if required by the governing agency
- E. Any damage caused to adjacent pavement, utilities, or facilities by earth work operations will be promptly replaced or repaired at no additional cost to the Design-Builder or Owner and such work shall be performed to the satisfaction of the Design-Builder, Owner, or Authority Having Jurisdiction.
- F. The Contractor is responsible for keeping the soils/materials which are classified differently separated during excavation activities. If Contractor commingles soils/materials, the Contractor must properly dispose of the all commingled soils/materials at their own expense.
- G. If an underground storage tank (UST), drum or other unknown container is discovered during excavation activities, the Contractor must stop excavation work and immediately inform the Design-Builder. The Design-Builder will assess the site conditions and instruct the Contractor how to proceed with the Work. Contractor may be asked by the Design-Builder to perform further limited excavation in the area in order to gather information on size and/or quantity of newly discovered item(s). Contractor shall perform this limited excavation work at no additional cost.

3.4 LOADING

- A. The Contractor shall load soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris materials directly from the site or from temporary stockpiles into hauling trucks for subsequent transportation and ultimate disposal.

- B. Conduct all excavation, truck loading, grading, and backfilling operations so as to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities. Do not close or obstruct roads, streets or walks without permission from the applicable Authority Having Jurisdiction and the Design-Builder. Alternate routes around closed or obstructed traffic ways must be provided by Contractor if required by the governing agency.
- C. The Contractor shall maintain streets clean and free of mud and dirt generated from their Work and operations.
- D. The Contractor is responsible for complying with State and local road/street weight limits.

3.5 HAULING

- A. The Contractor shall remove soils, dusts, rocks, etc. from the exterior of trucks, trailers, or other heavy equipment leaving the site before they leave the site.
- B. The Contractor shall clean the tractor-trailers or trucks that are loaded with materials for off-site placement/salvage by removing clinging soils, or rocks from the exterior of the equipment.
- C. The Contractor shall not create dust and shall maintain adequate dust suppression equipment on site if conditions warrant.
- D. The Contractor shall maintain streets clean and free of mud and dirt.
- E. The Contractor shall conduct soil (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris removal in a manner that ensures minimum interference with roads; streets, walks and other adjacent occupied and used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Authority Having Jurisdiction and Design-Builder. Provide alternate routes around closed or obstructed traffic ways if required by the governing agency.

3.6 TRANSPORTATION

- A. The Contractor shall remove soils, dusts, rocks, etc. from the exterior of trucks, trailers, or other heavy equipment leaving the site before they leave the site. The Contractor shall provide and complete copies of all daily reports, weight tickets and receipts (as applicable) for transportation and ultimate off-site disposal of materials removed from the property to the Design-Builder.
- B. All soil/materials must be transported directly to the designated disposal facility from the site. Intermediate storage is not permitted.
- C. The Contractor shall provide complete copies of disposal documentation for removal of all soil/materials to the Board for review and signature as required. The Contractor

shall provide completed manifests and/or other waste removal documentation to the Design-Builder a minimum of two (2) days prior to shipment, if signature is required.

- D. The Transporter shall present evidence of special or hazardous waste hauling permits and CDL upon request by the Design-Builder, as applicable.
- E. The soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris materials shall be transported by a hauler licensed in the State of Illinois to transport applicable soils/materials.
- F. The Contractor shall have properly signed manifests or disposal documentation in hand prior to leaving the site with materials to a landfill.

3.7 STOCKPILING

- A. Contractor may temporarily stockpile soils (including non-special waste soils and non-hazardous special waste soils), fill, backfill, CU Structural Soil and construction and demolition debris on site for a maximum of five (5) working days, unless otherwise approved by the Design-Builder.
- B. The Contractor shall be responsible for keeping such stockpiles separated. If soils/materials designated separately are commingled by Contractor, the Contractor shall dispose of such soil/material newly designated at his own expense. The Contractor will be responsible for sampling and analysis costs associated with characterization of newly designated soil/materials.
- C. Acceptable locations for soil stockpiles shall be approved by the Design-Builder and it shall be in accordance with the City of Chicago requirements. The maximum height of the stockpile shall not exceed 10 feet. The Contractor shall containerize or place special waste, non-hazardous waste, or hazardous waste soils on 6 mil plastic sheeting, covered with 6 mil plastic sheeting, and protect with 12-inch to 18-inch berms until subsequent loading, transportation, and disposal. Base sheeting shall overlap the dike/berm.
- D. The Contractor shall not allow runoff from stockpiled soil or material to enter storm drains or leave the site.

3.8 DUST CONTROL

- A. Refer to section 01 56 11 – GENERAL DUST, FUME, AND ODOR CONTROL

3.9 LIQUID (WATER) MANAGEMENT

- A. The Contractor shall subscribe to a weather notification system and manage the Work so as not to accumulate storm water on the site during excavation.

- B. Prior to commencing Work, the Contractor shall provide a Stormwater Management Plan. This plan shall stipulate provisions for dewatering, pumping, collection, temporary storage, and discharge or disposal of storm water, perched water and other liquids, contaminated and/or uncontaminated, at the site so as to facilitate soil removal and minimize disposal costs for contaminated fluids.
- C. The Contractor shall ensure that contamination of water, perched water and previously uncontaminated water or perched water does not occur by preventing the contact of such liquid with materials that exceed Title 35: Environmental Protection Subtitle G: Waste Disposal Chapter I: Pollution Control Board Subchapter F: Risk Based Cleanup Objectives, Part 742, Tiered Approach To Corrective Action Objectives, Appendix B, Table A values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. Earthen berms, plastic (polyethylene) sheeting, pumping, and other such means, as specified in the approved Stormwater Management Plan, may be used.
- D. If the Contractor, through negligence, allows stormwater to contact materials that exceed Title 35: Environmental Protection Subtitle G: Waste Disposal Chapter I: Pollution Control Board Subchapter F: Risk Based Cleanup Objectives, Part 742, Tiered Approach To Corrective Action Objectives, Appendix B, Table A values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters, the water must be disposed of as water that exceeds Title 35: Environmental Protection Subtitle G: Waste Disposal Chapter I: Pollution Control Board Subchapter F: Risk Based Cleanup Objectives, Part 742, Tiered Approach To Corrective Action Objectives, Appendix B, Table A values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. The Contractor will be responsible for the additional costs incurred for any disposal analysis and disposal costs.
- E. Stormwater Run-on /Run-off, Groundwater, and Dewatering: Contractor shall manage and remove water from site excavation in accordance with the City of Chicago and MWRDGC's requirements. The Contractor shall not discharge onsite water into the City of Chicago sewer without first obtaining all required permits in accordance with the following procedures:
1. If there is no evidence of water contamination as determined by the Design-Builder, Contractor shall obtain pumping permit from the City of Chicago Building Department.
 2. If the Design-Builder determined the presence of contaminated water at the site, Contractor shall collect and analyze representative water sample in accordance with MWRDGC Environmental Remediation Wastewater (ERW) Ordinance requirements. Submit a copy of the analytical result to the Design-Builder within seven (7) working days of sample collection.

3. If the analytical result of the water sample is below the maximum concentrations acceptable for discharge of ERW into sewerage system. The Contractor shall perform the following:
 - a. Secure a special discharge authorization from the MWRDGC for discharging contaminated water into the sewer system.
 - b. Install and operate flow meters for measuring the volume of water discharged into the sewer system at each discharging manhole. Flow meters can be either installed on the settling tank, if used, or at each discharging manhole. The flow meter must meet the MWRDGS's requirements including a non-resettable totalizer and must be equipped with recorder charts. Totalizers must be read a minimum of once per week and a log of such readings, with the appropriate conversion factors, and recorder charts must be provided to the Design-Builder. The flow-measurement devices must be calibrated monthly and prior to its initial use. The accuracy of the device must be certified by a factory-authorized representative with documentation of this certification provided to the Design-Builder and submit to the MWRDGC.
 - c. Collect and analyze representative water samples on monthly basis for the parameters required by the MWRDGC ERW special authorization. Analytical results and Sample Collection, Analysis and Report Certification shall be provided to Design-Builder within 7 working days of sample collection.

4. If the analytical results of the water exceed the MWRDGC ERW ordinance requirements, water should be either pumped into a holding tank for future transportation and disposal at treatment facility, or pumped directly into vacuum truck for disposal at a treatment facility as non-hazardous special waste. Prior to pumping and transporting water into the treatment facility, the Design-Builder may collect confirmation water samples to verify that the analytical results do not meet the MWRDGC's requirements. The Contractor shall provide all required equipment and access to collect such samples.

3.10 QUALITY CONTROL

- A. Visual inspections and damage repairs shall be made daily by the Contractor and/or as directed by the Design-Builder to assure that erosion, drainage and containment control measures are functioning properly.
- B. The Contractor shall take all necessary precautions to protect structures, equipment, pavement, walks and utilities against movement or settlement during the course of Work.
- C. Damages: Promptly replace or repair any damage caused to adjacent pavement, utilities or facilities by removal operations at no additional cost. Work shall be performed to the satisfaction of the Design-Builder.
- D. Submittal Timeframe Compliance: The Contractor shall ensure that all required submittals are in compliance with time frames specified.



- E. Utility Services: Maintain existing utilities and protect against damage during removal operations.

END OF SECTION 31 23 18.13

SECTION 31 23 18.14 – CLEAN CONSTRUCTION OR DEMOLITION DEBRIS AND UNCONTAMINATED SOIL DISPOSAL

PART 1 - GENERAL

1.1 Related Requirements:

- A. SECTION 01 50 00 – TEMPORARY FACILITIES AND CONTROLS for Stormwater Management Plan requirements.

1.2 SUMMARY

- A. This Section includes the following:

1. This section applies to all demolition, construction and renovation projects that require removal and off-site transfer of Clean Construction or Demolition Debris (CCDD) and Uncontaminated Soil as defined in this Specification.
2. This specification is for the excavation, loading and off-site transfer of CCDD and Uncontaminated Soil to permitted CCDD fill sites for use as fill. The Contractor shall perform the Work in accordance with all applicable local, state, and federal regulations. The Work shall include the following for CCDD Disposal:
 - a. All CCDD shall be taken to a permitted CCDD fill site. Uncontaminated asphalt, clean concrete and/or brick that are free of other soil/fill or debris shall be taken to Design-Builder approved recycling facilities for recycling.
 - b. The Contractor shall identify the selected CCDD fill site and/or recycling facility. Once identified in the formal submittals, the Contractor may not change the CCDD fill site or recycling facility without written authorization from the Design-Builder.
 - c. The Contractor shall identify the hauler or haulers to be used for the transportation of CCDD. Once identified in the formal submittals, the Contractor may not change the haulers without written authorization from the Design-Builder.
 - d. At least 48 hours prior to commencing any excavation activities, the Contractor shall contact the Design-Builder for field oversight and documentation of CCDD removal and disposal.
 - e. The Contractor shall excavate, load, and transport identified CCDD to the identified CCDD fill site or recycling facility.
 - f. The Contractor shall provide copies of CCDD fill site receipts to the Design-Builder. The fill site receipts shall be per-truck, and shall be legible. The receipts must include the date and time of transfer, the name of the hauler, the receiving fill site, and the volume of CCDD material transferred per truck. The Contractor shall also provide a Daily Report to the Design-Builder. The Daily Report shall include, at a minimum, the name of hauler, the name of the receiving fill site, and the volume of CCDD disposed of or recycled that day. The fill site receipts shall be attached to the Daily Report.
 - 1) Uncontaminated Soil Disposal:
 - a) At present the site has not identified CCDD material on site, Contractor may undertake post excavation stockpile sampling to identify a discrete volume of soil that meets the MACs and is

accepted by a CCDD facility. Contractor shall be responsible for determining additional sampling and signing form 663 as the PE.

- b) The Contractor shall excavate, load and transport the identified Uncontaminated Soil to the selected CCDD fill site.
- 2) Other Materials:
- a) Material removed from the site that is not identified as CCDD or Uncontaminated Soil should be managed in accordance with Section 31 23 18.13 Soil, Fill, Backfill, CU Structural Soil & Construction & Demolition Debris Removal, and/or Section 01 52 40 Construction Waste Management and Disposal, as applicable.

1.3 DEFINITIONS

- A. Clean Construction or Demolition Debris (CCDD): any of the following materials, alone or in combination, that (i) have been generated from construction or demolition activities and (ii) are uncontaminated:
 - 1. Broken concrete without protruding metal bars,
 - 2. Bricks,
 - 3. Rock,
 - 4. Stone,
 - 5. Reclaimed or other asphalt pavement
 - 6. Uncontaminated soil which is comingled with any of the above materials is also considered CCDD.
- B. General Construction and Demolition (C&D) Debris: non-hazardous, uncontaminated materials resulting from construction, remodeling, repair, and demolition of utilities, structures, and roads as defined in Section 3.160 of the Environmental Protection Act, 415 Illinois Compiled Statutes (ILCS) 5/3.160 and regulated under Title 35: Environmental Protection; Subtitle G: Waste Disposal; Chapter I: Pollution Control Board; Subchapter i: Solid Waste and Special Waste Hauling. C&D debris may include soil, wall coverings, reclaimed asphalt pavement, rock, plaster, glass, non-hazardous painted wood, drywall, plastics, non-hazardous coated wood, non-asbestos insulation, bricks, wood products, roofing shingles, concrete, and general roof coverings.
- C. IEPA: Illinois Environmental Protection Agency.
- D. LPE: licensed professional engineer.
- E. MWRDGC: Metropolitan Water Reclamation District of Greater Chicago.
- F. OSHA: the federal agency with responsibility for worker safety, the Occupational Safety and Health Administration.
- G. Soil: any granular or cohesive materials designated for removal as specified in the bid documents and includes soils and soil-like materials, such as clay, that are determined to be Uncontaminated Soil, Contaminated Soil, and Special and/or Hazardous Waste soil.

- H. Stormwater: water deposited at the site in the form of rain, snow or other natural weather event.
- I. TACO: TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES in accordance with 35 ILLINOIS ADMINISTRATIVE CODE (ILL. ADM. CODE) Part 742.
- J. Uncontaminated Soil: soil generated during construction, remodeling, repair or demolition of utilities, structures and roads that does not contain contaminants in concentrations that pose a threat to human health and safety and the environment. [415 ILCS 5/3.160(c)] User or User Agency means the entity for which or on whose behalf the Board has undertaken to cause the Work to be performed.
- K. Work: the obligations of the Contractor under the Contract Documents. Work includes, unless specifically excepted by the Contract Documents, the furnishing of all materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, superintendence, permits, inspections, occupancy approvals, insurance, taxes, and all other services, facilities and expenses necessary for the full performance and completion of the requirements of the Contract Documents. Work also means that which is furnished, produced, constructed, or built pursuant to the Contract Documents.

1.4 ACTION SUBMITTALS

- A. The Contractor shall ensure that submittals are provided in compliance with specified time frame(s) to avoid delays in Work.
- B. The Contractor shall prepare and submit the following documents to the Design-Builder for the off-site removal and transfer of CCDD:
 - 1. Name, address and telephone number of the CCDD fill site where CCDD to be transported. This submittal must be made at least 15 working days prior to removal of any materials from the site. Once this submittal is made, the Contractor cannot change the fill site without written authorization from the Design-Builder. This information should include, at a minimum, the following.
 - a. CCDD fill site name and address and telephone number;
 - b. Site contact information, including contact person and phone number;
 - c. Fill Site Identification number assigned by the IEPA;
 - d. Executed CCDD Acceptance Agreement from the facility, setting forth its agreement and authorization to accept the identified material.
 - 2. Name of Haulers to be used for the transportation of CCDD and Recycled Material. This submittal must be made at least 15 working days prior to removal of any materials from the site. This information shall include, at a minimum, the following.
 - a. Hauler name, address, contact information, including name and telephone number of authorized representative.
 - 1) Any relevant transportation license numbers.
 - 3. Soil Management Plan (SMP). Prior to commencing any Work, the Contractor shall provide a SMP outlining proposed excavation Work sequences and procedures to separate each type of material to be removed from the site, separating any contaminated materials from any uncontaminated materials, and

shall ensure that haulers are fully informed as to the appropriate destination for the materials. The SMP shall show the locations of each type of material to be stored on site, pending reuse as specified in the Contract Documents, or off-site transfer to appropriate location.

4. Reports and Other Submissions. The Contractor shall provide the Design-Builder with the following on a weekly basis:
 - a. Copies of all fully executed CCDD facility receipts, which shall be legible and dated and shall contain a complete description of the material taken per truck.
 - b. Copies of daily reports providing information regarding hauler names and volume or weight of material removed, and location taken, per truck.
- C. Contractor shall submit the following for each Recycling Facility:
 1. Name, Address, and Contact Information for each proposed Recycling Facility.
 2. Copy of document (license, permit, etc.) that indicates that the facility is authorized to operate a recycling operation for proposed material(s).
 3. Copies of recycling facility receipts for each load of material transported to the approved recycling facility.

1.5 SUBMITTAL REVIEW

- A. See Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Review of submittals or any comments made does not relieve the Contractor from compliance with the requirements of the drawings and specifications. The purpose of this check is to review for general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; electing techniques of construction; coordinating the Work; and performing the Work in a safe and satisfactory manner, in compliance with all contract documents, specifications, and applicable laws and regulations.
- C. The Contractor must not begin any Work applicable to this section until all required submittals have been reviewed and accepted by the Design-Builder.
- D. In order to ensure appropriate oversight of removal activities, the Contractor shall provide notification to the Design-Builder no less than forty-eight (48) business hours prior to excavating, loading and transporting of any materials from the site.

1.6 RECORDKEEPING

- A. The Contractor shall maintain and provide all records provided for in this Section. The Contractor shall also provide documentation of labor, equipment, and materials used for the CCDD and Uncontaminated Soil removal as required to fulfill the scope of work described in the Contract Document or as requested by the Design-Builder.

PART 2 - PRODUCTS

2.1 CLEAN CONSTRUCTION OR DEMOLITION DEBRIS AND UNCONTAMINATED SOIL DISPOSAL

- A. The Contractor shall furnish all necessary means, products, tools, and equipment required to remove and dispose CCDD and Uncontaminated Soil from the site as directed by the Board Representative.
- B. The Contractor shall also furnish all necessary means, products, tools, and equipment required to fulfill the scope of work described in the contract specifications and drawings. The Contractor, by submitting a bid for the Work, represents itself as knowledgeable and an expert in the performance of the Work, and includes all things usually and customarily necessary to provide a complete and finished job, whether specifically mentioned or not.
- C. The Contractor must have a complete plan for the entire process of soil removal and disposal in accordance with the project requirements. Contractor must provide schedule of all Work activities in accordance with the approved construction schedule.

PART 3 - EXECUTION

3.1 AUTHORIZATIONS

- A. The Contractor shall obtain appropriate authorization from the permitted CCDD fill site or from the authorized recycling facility where the material will be taken.

3.2 MATERIAL SAMPLING

- A. As directed by the Design-Builder, the Contractor shall provide the necessary equipment and manpower to assist the Design-Builder in any necessary field verifications to complete these activities at no additional cost to the Owner or Design-Builder.
- B. The Contractor shall not perform any field sampling or testing without a written authorization from the Design-Builder.

3.3 EXCAVATION

- A. The Contractor shall perform all site excavation in accordance with the Contract Documents.

- B. The Contractor shall perform excavation of materials in accordance with all applicable regulations and project specifications. All excavation shall be performed in accordance with OSHA requirements and guidelines.
- C. The Contractor shall immediately notify the Design-Builder if any materials, (solid or liquid) requiring special handling (i.e., contaminated soil, soil with odors, or liquids) are encountered during excavation. Such materials shall be separately stockpiled and shall not be loaded into hauling trucks without a written authorization from Design-Builder.
- D. The Contractor shall coordinate all soil excavation and hauling from the site activities with the Design-Builder. The Contractor must provide a written notification to the Design-Builder at least 48-hour prior to starting any soil excavation and hauling from the site.
- E. The Contractor shall review all of the Contract Documents to become familiar with locations of materials designated as Uncontaminated Soils, Clean Construction or Demolition Debris, General Construction or Demolition Debris, Contaminated Soils, Special Waste, or Hazardous Waste. The Contractor shall excavate each type of material separately as practical and consistent with the Contractor's SMP, and shall clean excavation equipment prior to excavating CCDD and Uncontaminated Soil.
- F. The Contractor shall be responsible for maintaining the structural integrity of all surrounding streets, underground utilities, buildings, and structures (walkways, sidewalks, underground tunnels, etc.)
- G. The Contractor shall secure, shore, and brace where sloping is not possible either because of space restrictions or stability of material excavated. Excavations shall be braced or sloped in compliance to the latest OSHA requirements and shall comply with local codes, authorities having jurisdiction, and the City of Chicago, and maintain same. Maintain sides and slopes of excavations in a safe condition until completion of backfilling. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross braces, in good serviceable conditions. Maintain shoring and bracing in excavations regardless of the time period excavations will remain open. Carry down shoring and bracing as the excavation progresses.

3.4 STOCKPILING

- A. The Contractor may stockpile excavated materials on site as approved by the Design-Builder and as set forth in the Contractor's approved SMP. The location of the stockpile area shall be approved by the Design-Builder and it shall be in accordance with the City of Chicago requirements, including Section 13-32 & 125 of the Municipal Code. The maximum height of the stockpile is 10 feet, provided appropriate setbacks, as set forth in the Code, are met.
- B. The Contractor shall be responsible for keeping CCDD and Uncontaminated Soil separated from Contaminated Soils and General Construction and Demolition Debris, Special Waste, and Hazardous Waste. If CCDD and Uncontaminated Soil come in contact with Contaminated Soils or General Construction or Demolition Debris, Special

Waste or Hazardous Waste, the former CCDD and Uncontaminated Soils will now be considered contaminated materials, and the Contractor shall dispose of newly designated soils as contaminated soils at his own expense in accordance with Section 31 23 18 13 as applicable. The Contractor will be responsible for any sampling analysis costs associated with characterization of soil that has become contaminated pursuant to this Subsection.

3.5 LOADING

- A. The Contractor shall notify the Design-Builder 48 hours in advance of soil loading and hauling activities. No soil shall be removed from the site without the presence of the Design-Builder.
- B. Prior to loading, the Contractor shall prepare and provide hauler with appropriately marked CCDD tracking receipts, for acceptance and confirmation at the receiving site.
- C. The Contractor shall load excavated materials directly from the site or from temporary stockpiles into hauling trucks equipped with tarp for direct transportation to the approved CCDD fill site or recycling facility.
- D. The Contractor shall conduct operations in a manner that minimizes interference with roads, streets, walks and other adjacent occupied and used facilities. The Contractor shall not close or obstruct streets, walks or other occupied or used facilities without permission from the applicable governing agency and the Design-Builder. If required by the appropriate governmental entity, the Contractor shall provide alternate routes around closed or obstructed traffic ways.
- E. The Contractor shall ensure compliance with all State and local Road/Street weight limits.

3.6 TRANSPORTATION

- A. All trucks shall be properly covered prior to leaving the site as required by the City of Chicago Municipal Code.
- B. All CCDD and Uncontaminated Soil shall be transported directly to the approved CCDD fill site or recycling facility on a daily basis. No off-site temporary storage is allowed. All materials not transported to the CCDD fill operation or recycling facility shall be returned to the project site for overnight storage.
- C. The Contractor shall immediately notify the Design-Builder if any CCDD or Uncontaminated Soil loads are rejected by the CCDD fill operation. A field order allowing for a change in transfer, to an appropriate facility, will be executed.
- D. The Contractor shall provide completed and executed copies of disposal/recycling CCDD tracking receipts to the Design-Builder on a weekly basis.
- E. Drivers shall hold, and present upon request, a current valid Commercial Driver's License (CDL).

3.7 STORMWATER RUNOFF AND GROUNDWATER MANAGEMENT

- A. Refer to Section 01 50 00 – TEMPORARY FACILITIES AND CONTROLS

3.8 DUST CONTROL

- A. Refer to Section 01 56 11 – GENERAL DUST, FUME, AND ODOR CONTROL

3.9 NOISE CONTROL

- A. The Contractor shall not start any Work activities prior to the time specified in the City of Chicago Noise Ordinance.
- B. The Contractor shall control the noise, in accordance with the City of Chicago Noise Ordinance, or as directed by the Design-Builder where there are sensitive project-specific concerns, such as during school operating hours at school construction projects.

3.10 QUALITY CONTROL

- A. Visual inspections and damage repairs shall be made daily by the Contractor to assure that erosion, drainage and containment control measures are functioning properly.
- B. The Contractor shall take all necessary precautions to protect structures, equipment, pavement, walks and utilities against movement or settlement during the course of Work.
- C. Damage: The Contractor shall promptly replace or repair any damage caused to adjacent pavement, utilities or facilities by removal operations at no additional cost to the Design-Builder or Owner. Work shall be performed to the satisfaction of the Design-Builder, Owner, or Authority Having Jurisdiction.
- D. Submittal Timeframe Compliance: The Contractor shall ensure that all required submittals are in compliance with time frames specified.

Utility Services: The Contractor shall maintain existing utilities and protect against damage during removal operations.

END OF SECTION 31 23 18.14

SECTION 31 23 23.01 – FILL

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes filling, backfilling, and compacting for building volume below grade.
- B. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.2 REFERENCE STANDARDS

- A. ASTM D1556/D1556M - Standard Test Method for Density and Unit Weight of Soil in Place by Sand-Cone Method; 2015, with Editorial Revision (2016).
- B. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700 kN m/m³)); 2012, with Editorial Revision (2015).
- C. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method; 2015.
- D. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System); 2011.

1.3 SUBMITTALS

- A. See Section 01 33 00 - Submittal Procedures.
- B. Copies of environmental analytical results of all backfill material, topsoil, and CU structural soil verifying that these materials meet all the requirements outlined in Section 31 23 23 "Acceptance of Backfill, Topsoil & CU Structural Soil".

1.4 QUALITY ASSURANCE

- A. Soil Testing and Inspection Agency:
 - 1. The Design-Builder will engage a soil testing and inspection agency, to include testing soil materials proposed for use in the Work and initial quality control testing during fill operations. The Contractor is responsible for payment of all Backfill, Top Soil and CU Structural Soil sampling, historical data and analytical fees.
 - 2. Furnish soil survey for satisfactory soil materials and samples of soil materials to the testing agency.
 - 3. The date of the environmental analysis of the backfill shall be within 60 days of importing such materials to the site. The contractor shall immediately be

responsible for removing any material from the site not complying with this requirement.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. When necessary, store materials on site in advance of need.

PART 2 - PRODUCTS

2.1 FILL MATERIALS

- A. All Materials: Comply with requirements listed in Section 31 23 23 "Acceptance of Backfill, Topsoil & CU Structural Soil."
- B. General Fill: Provide soil materials conforming to ASTM D2487 soil groups GW, GR, GM, SW, SP or SM or a combination that are free of debris, waste, frozen materials, vegetable, organic and other deleterious matter and having maximum particle size of 2" in all dimensions.
- C. Select Fill: Clean natural or crushed stone or gravel conforming to State of Illinois, Department of Transportation Gradation CA 6.
- D. Underbed Material: Naturally or artificially graded mixture of natural or crushed stone or gravel conforming to State of Illinois, Department of Transportation Specifications for Gradation CA 8, or CA 7, or CA 6.
- E. Use Contractor supplied off-site material except that general fill may be used from excavation if found acceptable by the Design-Builder's testing agency provided that all off-site and general fill material meets all requirements of Section 31 23 23 "Acceptance of Backfill, Topsoil & CU Structural Soil". Provide all materials required to complete the Work in the Contract.

2.2 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.
- B. Where fill materials are specified by reference to a specific standard, testing of samples for compliance will be provided before delivery to site.
- C. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that survey benchmarks and intended elevations for the Work are as indicated.
- B. Identify required lines, levels, contours, and datum locations.

- C. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.
- D. Verify areas to be filled are not compromised with surface or groundwater.

3.2 PREPARATION

- A. Prepare excavations per 31 23 16 - Excavation.
- B. Compaction: Control soil compaction during construction, providing the minimum percentage of density specified.
 - 1. Percentage of Maximum Density Requirements: Provide not less than the following percentages of density of soil material compacted at + 2% optimum moisture content, for the actual density of each layer of soil material-in-place:
 - a. Compact top 12" of subgrade and each layer of backfill or fill material to 75% relative density for cohesionless soils (ASTM D 4253 & D 4254) and 95% maximum density for cohesive soil per ASTM D1557.
 - 2. Moisture Control:
 - a. Where the subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface of subgrade, or layer of soil material, to prevent free water appearing on the surface during or subsequent to compaction operations.
 - b. Remove and replace, to scarify and air dry, soil material that is too wet to permit compaction to specified density.

3.3 FILLING

- A. Backfill excavations as promptly as the Work permits, but not until completion of the following:
 - 1. Review of construction below finish grade.
 - 2. Code required inspection, testing, approval, and recording locations of underground utilities.
 - 3. Removal of concrete formwork.
 - 4. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in manner to prevent settlement of the structure or utilities or leave in place if required.
 - 5. Removal of trash and debris.
 - 6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

- B. Ground Surface Preparation: Remove vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow, strip, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material bonds with existing surface.
1. When the existing ground surface has a density less than that specified under "Compaction" for the particular area classification, break up the ground surface, pulverize, bring moisture condition to the optimum moisture content, and compact to the required depth and percentage of maximum density.
- C. Placement and Compaction: Place backfill and fill materials to required grades in layers not more than 8" in loose depth for materials compacted by heavy compaction equipment and not more than 4" in loose depth for materials compacted by hand operated tampers. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the soil material. Compact each layer to the required percentage of density.
1. Place backfill and fill materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
 2. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
 3. Backfill and fill under Building slabs to an elevation required to allow for thickness of underbed shown or a minimum of 6" if not shown.
 - a. Use select fill material.
 4. Backfill and fill under pavements as required to comply with cross sections, elevations and grades shown.
 - a. Use select fill material, except below 3-foot, general fill may be used.
 5. Fill and backfill under footings where not on undisturbed ground using select fill material.
 6. Backfill and fill elsewhere as required to establish new finished grades, allowing not less than 4" for top soiling using select fill except below 3-foot, general fill may be used.
- D. Under Bed: Place and compact underbed material under all slabs-on-grade.
- E. Slope grade away from building minimum 2 inches in 10 feet, unless noted otherwise. Make gradual grade changes. Blend slope into level areas.
- F. Reshape and re-compact fills subjected to vehicular traffic.
- G. Maintain temporary means and methods, as required, to remove all water while fill is being placed as required, or until directed by the Architect. Remove and replace soils deemed unsuitable by classification and which are excessively moist due to lack of dewatering or surface water control.

3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.
- B. Design-Builder will engage a qualified independent testing and inspecting agency to sample materials, perform tests, and submit test reports during earthwork operations.
 - 1. The Design-Builder's testing agency must inspect and approve sub-grades and fill layers before further construction work is performed thereon.
 - 2. If, in the opinion of the Design-Builder's testing agency, based on reports of the testing agency and inspection, the subgrade or fills which have been placed are below the specified density, additional compaction and testing shall be required until satisfactory results are obtained at no additional cost to Design-Builder. In such event, retesting shall be paid by the Contractor.
- C. Contractor's Responsibilities
 - 1. Notify Design-Builder's testing agency sufficiently in advance of operations to allow for assignment of personnel and scheduling of tests.
 - 2. Coordinate with Agencies' personnel; provide access to Work, to manufacturer's operations.
 - 3. Provide preliminary representative samples of materials to be tested, in required quantities.
 - 4. Furnish casual labor and facilities to provide access to Work to be tested to obtain and handle samples at the site to facilitate inspections and tests, and storage and curing of tests.
 - 5. Arrange with laboratory, pay for, additional samples and tests required when initial tests indicate Work does not comply with Contract Documents.
- D. Tests for Proposed Soil Materials:
 - 1. Test soil materials proposed for use in the Work and promptly submit test result reports. Soil samples shall be provided by Contractor.
 - 2. Provide one optimum moisture-maximum density curve for each type of cohesive soil. Determine maximum densities in accordance with ASTM D1557.
 - 3. Determine the suitability of materials to be used as fill and backfill.
 - 4. Perform a mechanical analysis (AASHTO T88), plasticity index (AASHTO T91), and frost susceptibility analysis.
- E. Verification of Footing Subgrades:
 - 1. Provide one optimum moisture-maximum density curve for each type of soil encountered.

2. For each strata of soil on which footings are to be placed, conduct at least one test to verify the required design bearing capacities. Subsequent verification and approval of each footing subgrade may be based on a visual comparison of each subgrade with the related tested strata.

F. Compaction Testing:

1. Inspect, test, and approve each lift of fill and backfill before next lift is placed. Test in accordance with ASTM D1556/D1556M or ASTM D2167 as appropriate.
2. Take a field density test for each 2,000 sq. ft. of backfill and fill under slabs and pavements.
3. Take a field density test at 100-foot intervals along the inside of continuous footings, but not less than one (1) test per 20-foot run.
4. Take a field density test for each four (4) isolated footings.
5. Take a field density test at 50-foot intervals along utility trench backfill under slabs and pavements.

G. Proofrolling Observation:

1. Provide continuous observation of proofrolling of entire building area. Four passes shall be made.
2. Approve subgrade or make recommendations for removal.

H. Submittals: Submit copies of the following reports:

1. Report and certification of granular fill and drainage fill.
2. Test reports on fill and backfill material.
3. Verification of each footing subgrade.
4. Field density test reports.
5. One optimum moisture-maximum density curve for each type of soil encountered.
6. Report of actual unconfined compressive strength and/or results of plate bearing tests of each strata tested.
7. Other tests' and materials' certificates, as required.

- I. If tests indicate work does not meet specified requirements, remove work, replace and retest.

3.5 CLEANING

- A. Burning is not permitted on the Owner's property.

END OF SECTION 31 23 23.01

SECTION 31 23 23.25 – ACCEPTANCE OF BACKFILL, TOPSOIL, AND CU STRUCTURAL SOIL**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes the following:
1. This section applies for all demolition, construction and renovation projects that require the importation of backfill material
 2. This specification is for the importation and acceptance of clean backfill. All imported material must meet the requirements presented in this specification. No proposed imported material will be accepted for use prior to its pre-approval from the Design-Builder. Where there is a conflict between the contract documents and actual site conditions, the Contractor shall comply with any appropriate field order changes directed by the Design-Builder. The Contractor shall perform the work under this section in accordance with all local, state, and federal rules and regulations including but not limited to Illinois EPA, United States Environmental Protection Agency (USEPA), Illinois Department of Transportation, and Occupational Safety and Health Agency (OSHA) regulations.

1.2 DEFINITIONS

- A. Agency: Illinois Environmental Protection Agency (IEPA).
- B. Backfill: granular or cohesive material used to fill the excavation to design grade as referenced in design plans and specifications IEPA: Illinois Environmental Protection Agency.
- C. CU Structural Soil: a uniformly blended mixture of crushed stone, clay, loam and hydrogel by weight consisting of approximately 83% crushed limestone (3/4 to 1.5 inch, highly angular with limited fines), 17% clay loam and hydrogel (1 oz. per 200 pounds of stone).
- D. IEPA: Illinois Environmental Protection Agency
- E. Managing Environmental Consultant (MEC): the entity with overall responsibility for the direction and control of the environmental investigations, assessments, designs, and supervision of remediation work.
- F. Topsoil: any soils placed to design grade and used to promote vegetative growth. All topsoil shall not exceed Title 35: Environmental Protection Subtitle G: Waste Disposal Chapter I: Pollution Control Board Subchapter F: Risk Based Cleanup Objectives, Part 742, Tiered Approach To Corrective Action Objectives (TACO), Appendix B, Table A values for 35 Illinois Administrative Code (Ill. Adm. Code) 740 Appendix A Target Compound List (TCL) parameters.
- G. User: the entity for which or on whose behalf the Board has undertaken to cause the Work to be performed.

- H. Work: the obligations of the Contractor under the Contract Documents. Work includes, unless specifically accepted by the Contract Documents, the furnishing of all materials, labor, equipment, supplies, plant, tools, scaffolding, transportation, superintendence, permits, in sections, occupancy approvals, insurance, taxes, and all other services, facilities and expenses necessary for the full performance and completion of the requirements of the Contract Documents. Work also means that which is furnished, produced, constructed, or built pursuant to the Contract Documents.

1.3 ACTION SUBMITTALS

- A. Copies of environmental analytical results of all backfill material, topsoil and CU Structural Soil verifying that these materials do not exceed APPENDIX B, SECTION 742, TABLE A; TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO): 35 ILL. ADM. CODE 742 values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. For samples from virgin sources material must be analyzed for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. For virgin sources, Contractor shall submit a certification letter from the Owner of the source that all imported material is virgin material mined directly from the source quarry. For samples from recycled sources material must be analyzed for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. For recycled sources, the Contractor must identify the source of the recycled material including the owner, the address, imported fill environmental history, and a written demonstration that the property source is not in any regulated environmental related cleanup program. All materials must be sampled at least 1 per 1,000 tons of material and testing shall be within 60 days of import.
- B. Name and address and telephone number of the laboratory that will be used by the Contractor to perform the environmental analytical testing for backfill, topsoil and CU Structural Soil samples prior to starting Work. The laboratory performing the analysis must be an IEPA accredited laboratory.
- C. Copies of all daily reports, transport records and receipts to the Design-Builder on a daily basis.

1.4 SUBMITTAL REVIEW

- A. See Section 01 33 00 – SUBMITTAL PROCEDURES.
- B. Review of submittals or any comments made does not relieve the Contractor from compliance with the requirements of the drawings and specifications. The purpose of this check is to review for general conformance with the design concept of the project and general compliance with the information given in the contract documents. The Contractor is responsible for confirming and correlating all quantities and dimensions; electing techniques of construction; coordinating the Work; and performing the Work in a safe and satisfactory manner, in compliance with all contract documents, specifications, and applicable laws and regulations.

PART 2 - PRODUCTS

2.1 BACKFILL, TOPSOIL, CU STRUCTURAL SOIL

- A. The Contractor shall supply only backfill, topsoil and CU Structural Soil that does not exceed APPENDIX B, SECTION 742, TABLE A; TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO): 35 ILL. ADM. CODE 742 values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. For samples from virgin sources, where applicable, one representative sample must be analyzed for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. Material sources will not be accepted from sources that have had applications of biosolids that were obtained from publicly owned sewage treatment works. For virgin sources, where applicable, Contractor shall submit a certification letter from the Owner of the source that all imported material is virgin material mined directly from the source quarry. For samples from recycled sources, where applicable, material must be analyzed for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. For recycled sources, the Contractor must identify the source of the recycled material including the owner, the address, imported fill environmental history, and a written demonstration that the property source is not in any regulated environmental related cleanup program. All materials must be sampled at least 1 per 1,000 tons of material and testing shall be within 60 days of import.

PART 3 - EXECUTION

3.1 AUTHORIZATIONS

- A. Haulers for transportation of backfill, topsoil or CU Structural Soil shall hold and present upon request a current, valid Commercial Driver's License (CDL).

3.2 MATERIAL SAMPLING

- A. The Contractor shall collect sufficient amount of representative (no composite samples) backfill, topsoil and CU Structural Soil sample(s) for analytical testing sufficient to verify that these materials do not exceed APPENDIX B, SECTION 742, TABLE A; TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO): 35 ILL. ADM. CODE 742 values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. The Contractor is responsible for payment of all backfill, topsoil and CU Structural Soil sampling and analytical fees.
- B. The Design-Builder may collect backfill, topsoil or CU Structural Soil samples for laboratory analysis on behalf of the Contractor at no additional cost to the project.
- C. The Design-Builder may collect samples for laboratory analysis or field Photo-ionization Detector (PID) screening, or liquid samples for laboratory analysis. The Contractor shall provide the necessary equipment and manpower to assist the Design-Builder to collect materials to be sampled at no additional cost to the project and in compliance with OSHA and all other Rules and Regulations.

3.3 HAULING

- A. The Contractor shall not create dust and shall maintain adequate dust suppression equipment on site if conditions warrant.
- B. The Contractor shall maintain streets clean and free of mud and dirt.
- C. The Contractor shall place backfill, topsoil and CU Structural Soil to ensure minimum interference with roads; streets, walks and other adjacent occupied and used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the applicable Authority Having Jurisdiction and the Design-Builder. Provide alternate routes around closed or obstructed traffic ways if required by the Authority Having Jurisdiction.

3.4 TRANSPORTATION

- A. The Contractor shall provide and complete copies of all daily reports, weight tickets, and receipts (as applicable) for transportation and ultimate placement of the backfill, topsoil, and CU Structural Soil to the Design-Builder for review and signature within 5 business days or as directed by the Design-Builder.

3.5 BACKFILL

- A. The backfill material shall be granular or cohesive material that meets the project specified requirements.
- B. For each off-site source of backfill materials, the Contractor shall provide to the Design-Builder as required, environmental laboratory analyses and certification that the imported backfill does not exceed APPENDIX B, SECTION 742, TABLE A; TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO): 35 ILL. ADM. CODE 742 values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. For samples from virgin sources, samples must be analyzed for Appendix B, Section 742 Table A parameters. For virgin sources, Contractor shall submit a certification letter from the owner of the source that all imported material is virgin material mined directly from the source quarry. For samples from recycled sources, samples must be analyzed for Appendix B, Section 742 Table A parameters. For recycled sources, the Contractor must identify the source of the recycled material including the owner, the address, imported fill environmental history, and a written demonstration that the property source is not in any regulated environmental related cleanup program. All materials must be sampled at least 1 per 1,000 tons of material and testing shall be within 60 days of import.
- C. The Contractor shall not place backfill material without approval of the Design-Builder. If the Contractor backfills the excavation area without obtaining approval from the Design-Builder, the backfill materials shall be excavated, if required, at the Contractor's expense.

3.6 TOPSOIL

- A. The Topsoil material shall meet the project specified requirements.
- B. For each off-site source of Topsoil, the Contractor shall provide to the Board Representative and/or MEC, as required, environmental laboratory analyses and certification that the imported materials do not exceed APPENDIX B, SECTION 742, TABLE A; TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO): 35 ILL. ADM. CODE 742 values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. The Contractor must identify the source of the material including the owner, the address, imported fill environmental history, and a written demonstration that the property source is not in any regulated environmental related cleanup program. All materials must be sampled at least 1 per 1,000 tons of material and testing shall be within 60 days of import.
- C. The Contractor shall not place topsoil without approval of the Design-Builder. If the Contractor places topsoil without obtaining approval from the Design-Builder, the topsoil shall be excavated, if required, at the Contractor's expense.

3.7 STRUCTURAL SOIL

- A. CU Structural Soil shall meet the project specified requirements.
- B. For each off-site source of CU Structural Soil, the Contractor shall provide to the Board Representative and/or MEC, as required, environmental laboratory analyses and certification that the imported materials do not exceed APPENDIX B, SECTION 742, TABLE A; TIERED APPROACH TO CORRECTIVE ACTION OBJECTIVES (TACO): 35 ILL. ADM. CODE 742 values for 35 ILL. ADM. CODE 740 APPENDIX A Target Compound List (TCL) parameters. The Contractor must identify the source of the material including the owner, the address, imported fill environmental history, and a written demonstration that the property source is not in any regulated environmental related cleanup program. All materials must be sampled at least 1 per 1,000 tons of material and testing shall be within 60 days of import.
- C. The Contractor shall not place CU Structural Soil without approval of the Design-Builder. If the Contractor places CU Structural Soil without obtaining approval from the Design-Builder, the CU Structural Soil shall be excavated, if required, at the Contractor's expense.

3.8 DUST CONTROL

- A. The Contractor shall control dust by all necessary means, including but not limited to covering trucks, stockpiles and open materials, watering haul roads, sweeping paved roads, and limiting the speed of all on-site vehicles.

3.9 QUALITY CONTROL

- A. The Contractor shall take all necessary precautions to protect structures, equipment, pavement, walks and utilities against movement or settlement during the course of Work.
- B. The Contractor shall promptly replace or repair any damage caused to adjacent pavement, utilities or facilities by removal operations at no additional cost to the Design-Builder or Owner. Work shall be performed to the satisfaction of the Design-Builder, Owner, or Authority Having Jurisdiction.
- C. The Contractor shall maintain existing utilities and protect against damage during removal operations.

END OF SECTION 31 23 23.25

SECTION 31 63 29 – DRILLED CONCRETE SHAFTS**PART 1 - GENERAL****1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1. Dry-installed drilled shafts.

1.3 UNIT PRICES

- A. Drilled shafts: Actual net volume of drilled shafts in place and approved. Actual length, shaft diameter, and bell diameter if applicable, may vary, to coincide with elevations where satisfactory bearing strata are encountered. These dimensions may also vary with actual bearing value of bearing strata determined by an independent testing and inspecting agency. Adjustments are made on net variation of total quantities, based on design dimensions for shafts and bells.
 - 1. Base bids on indicated number of drilled shafts and, for each shaft, the design length from top elevation to bottom of shaft, extended through the bell, if applicable, and the diameter of shaft and bell.
 - 2. Unit prices include labor, materials, tools, equipment, and incidentals required for excavation, trimming, shoring, casings, dewatering, reinforcement, concrete fill, testing and inspecting, and other items for complete drilled-shaft installation.

1.4 PREINSTALLATION MEETINGS

- A. Preinstallation Conference: Conduct conference at Project site.
 - 1. Review methods and procedures related to drilled shafts including, but not limited to, the following:
 - a. Review geotechnical report.
 - b. Discuss existing utilities and subsurface conditions.
 - c. Review coordination with temporary controls and protections.
 - d. Review measurement and payment of unit prices.

1.5 ACTION SUBMITTALS

- A. Product Data: For each type of product.

- B. Design Mixtures: For each concrete mixture. Submit alternative design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Shop Drawings: For concrete reinforcement, detailing fabricating, bending, supporting, and placing.

1.6 INFORMATIONAL SUBMITTALS

- A. Qualification Data: For Installer land surveyor.
- B. Material Certificates: From manufacturer, for the following:
 - 1. Cementitious materials.
 - 2. Admixtures.
 - 3. Steel reinforcement and accessories.
- C. Material Test Reports: For each material below, by a qualified testing agency:
 - 1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.
- D. Field quality-control reports.

1.7 CLOSEOUT SUBMITTALS

- A. Record drawings.

1.8 QUALITY ASSURANCE

- A. Installer Qualifications: An experienced installer that has specialized in drilled-shaft work.
- B. Testing Agency Qualifications: Qualified according to ASTM C 1077, ASTM D 3740, and ASTM E 329 for testing indicated.

1.9 FIELD CONDITIONS

- A. Existing Utilities: Locate existing underground utilities before excavating drilled shafts. If utilities are to remain in place, provide protection from damage during drilled-shaft operations.
 - 1. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, adapt drilling procedure if necessary to prevent damage to utilities. Cooperate with Owner and utility companies in keeping services and facilities in operation without interruption. Repair damaged utilities to satisfaction of utility owner.
- B. Interruption of Existing Utilities: Do not interrupt any utility to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility according to requirements indicated:

1. Notify Owner no fewer than two days in advance of proposed interruption of utility.
 2. Do not proceed with interruption of utility without Owner's written permission.
- C. Project-Site Information: A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from this data.
1. Make additional test borings and conduct other exploratory operations necessary for drilled shafts.
 2. The geotechnical report is included elsewhere in the Project Manual.
- D. Survey Work: Engage a qualified land surveyor or professional engineer to perform surveys, layouts, and measurements for drilled shafts. Before excavating, lay out each drilled shaft to lines and levels required. Record actual measurements of each drilled shaft's location, shaft diameter, bottom and top elevations, deviations from specified tolerances, and other specified data.
1. Record and maintain information pertinent to each drilled shaft and indicate on record Drawings. Cooperate with Owner's testing and inspecting agency to provide data for required reports.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

- A. Drilled-Shaft Standard: Comply with ACI 336.1 except as modified in this Section.

2.2 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.
- B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Deformed-Steel Wire: ASTM A 496/A 496M.
- D. Joint Dowel Bars: ASTM A 615/A 615M, plain. Cut bars true to length with ends square and free of burrs.

2.3 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of same type, brand, and source, throughout Project:
1. Portland Cement: ASTM C 150/C 150M, Type I or Type I/II.
 - a. Fly Ash: ASTM C 618, Class C or Class F.
 - b. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
- B. Normal-Weight Aggregate: ASTM C 33/C 33M, graded, Maximum 1-inch.

1. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.
- D. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 2. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 3. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 4. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.4 REINFORCEMENT FABRICATION

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.5 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
1. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, vibration, and other hazards created by drilled-shaft operations.

3.2 EXCAVATION

- A. Unclassified Excavation: Excavate to bearing elevations regardless of character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions.
1. Obstructions: Unclassified excavated materials may include removal of unanticipated boulders, concrete, masonry, or other subsurface obstructions. Payment for removing obstructions that cannot be removed by conventional augers fitted with soil or rock teeth, drilling buckets, or underreaming tools attached to drilling equipment of size, power, torque, and downthrust necessary for the Work is according to Contract provisions for changes in the Work.
- B. Prevent surface water from entering excavated shafts. Conduct water to site drainage facilities.

- C. Excavate soils for drilled shafts to indicated elevations. Remove loose material from bottom of excavation.
 - 1. Excavate bottom of drilled shafts to level plane within 1:12 tolerance.
 - 2. Remove water from excavated shafts before concreting.

- D. Temporary steel casings will be necessary during drilling in order to maintain stability of the soils during construction. Casings shall extend through fill material and extend a minimum of two feet into cohesive soils. Refer to geotechnical report for additional information.

- E. Notify and allow testing and inspecting agency to test and inspect bottom of excavation. If unsuitable bearing stratum is encountered, make adjustments to drilled shafts as determined by A/E.
 - 1. Payment for additional authorized excavation is according to Contract provisions for changes in the Work.

- F. End-Bearing Drilled Shafts: The bearing surface of each drilled shaft shall be inspected by the testing and inspection agency. The inspector may probe with auger to a depth below bearing elevation, equal to diameter of the bearing area of drilled shaft. Determine whether voids, clay seams, or solution channels exist.
 - 1. Test first three drilled shafts and one of every six drilled shafts thereafter.
 - 2. Contractor shall fill auger-probe holes with grout.

- G. Tolerances: Construct drilled shafts to remain within ACI 336.1 tolerances.
 - 1. If location or out-of-plumb tolerances are exceeded, provide corrective construction. Submit corrective construction proposals to A/E for review before proceeding.

3.3 STEEL REINFORCEMENT INSTALLATION

- A. Comply with recommendations in CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

- B. Clean reinforcement of loose rust and mill scale, earth, and other materials that reduce or destroy bond with concrete.

- C. Fabricate and install reinforcing cages symmetrically about axis of shafts in a single unit.

- D. Accurately position, support, and secure reinforcement against displacement during concreting. Maintain minimum cover over reinforcement.

- E. Use templates to set anchor bolts, leveling plates, and other accessories furnished in work of other Sections. Provide blocking and holding devices to maintain required position during final concrete placement.

- F. Protect exposed ends of extended reinforcement, dowels, or anchor bolts from mechanical damage and exposure to weather.

3.4 CONCRETE PLACEMENT

- A. Place concrete in continuous operation and without segregation immediately after inspection and approval of shaft by a qualified Special Inspector.
 - 1. Construct a construction joint if concrete placement is delayed more than one hour. Level top surface of concrete and insert joint dowel bars. Before placing remainder of concrete, clean surface laitance, roughen, and slush concrete with commercial bonding agent or with sand-cement grout mixed at ratio of 1:1.
- B. Dry Method: Place concrete to fall vertically down the center of drilled shaft without striking sides of shaft or steel reinforcement.
 - 1. Where concrete cannot be directed down shaft without striking reinforcement, place concrete with chutes, tremies, or pumps.
 - 2. Vibrate top 60 inches of concrete.
- C. Screed concrete at cutoff elevation level and apply scoured, rough finish. Where cutoff elevation is above the ground elevation, form top section above grade and extend shaft to required elevation.
- D. Protect concrete work, according to ACI 301, from frost, freezing, or low temperatures that could cause physical damage or reduced strength.
 - 1. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 - 2. Do not use calcium chloride, salt, or other mineral-containing antifreeze agents or chemical accelerators.
- E. If hot-weather conditions exist that would seriously impair quality and strength of concrete, place concrete according to ACI 301 to maintain delivered temperature of concrete at no more than 90 deg F.
 - 1. Place concrete immediately on delivery. Keep exposed concrete surfaces and formed shaft extensions moist by fog sprays, wet burlap, or other effective means for a minimum of seven days.

3.5 FIELD QUALITY CONTROL

- A. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections:
 - 1. Drilled shafts.
 - 2. Excavation.
 - 3. Concrete.
 - 4. Steel reinforcement inspection.
 - 5. Anchor bolt placement.
- B. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.
- C. Drilled-Shaft Tests and Inspections: For each drilled shaft, before concrete placement.

1. Soil Testing: Bottom elevations, bearing capacities, and lengths of drilled shafts indicated have been estimated from available soil data. Actual elevations and drilled-shaft lengths and bearing capacities are determined by testing and inspecting agency. Final evaluations and approval of data are determined by the A/E.
 - a. Bearing Stratum Tests: Testing agency takes undisturbed rock core samples from drilled-shaft bottoms; tests each sample for compression, moisture content, and density; and reports results and evaluations.

- D. Concrete Tests and Inspections: ASTM C 172/C 172M except modified for slump to comply with ASTM C 94/C 94M.
 1. Slump: ASTM C 143/C 143M; one test at point of placement for each compressive-strength test but no fewer than one test for each concrete load.
 2. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below and 80 deg F and above, and one test for each set of compressive-strength specimens.
 3. Compression Test Specimens: ASTM C 31/C 31M; one set of four standard cylinders for each compressive-strength test unless otherwise indicated. Mold and store cylinders for laboratory-cured test specimens.
 4. Compressive-Strength Tests: ASTM C 39/C 39M; one set for every three drilled shafts but not more than one set for every three truck loads. Test one specimen at seven days, test two specimens at 28 days, and retain one specimen in reserve for later testing if required.
 5. Strength of each concrete mixture is satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
 6. Report test results in writing to A/E, concrete manufacturer, and Contractor within 48 hours of testing. List Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests in reports of compressive-strength tests.
 7. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but not be used as sole basis for approval or rejection of concrete.
 8. Additional Tests: Testing and inspecting agency to make additional tests of concrete if test results indicate that slump, compressive strengths, or other requirements have not been met, as directed by Architect.
 - a. Continuous coring of drilled shafts may be required, at Contractor's expense, if temporary casings have not been withdrawn within specified time limits or if observations of placement operations indicate deficient concrete quality, presence of voids, segregation, or other possible defects.
 9. Perform additional testing and inspecting, at Contractor's expense, to determine compliance of replaced or additional work with specified requirements.
 10. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

- E. An excavation, concrete, or a drilled shaft will be considered defective if it does not pass tests and inspections.

- F. Prepare test and inspection reports for each drilled shaft as follows:
1. Actual top and bottom elevations.
 2. Actual drilled-shaft diameter at top and bottom.
 3. Description of soil materials.
 4. Description, location, and dimensions of obstructions.
 5. Final top centerline location and deviations from requirements.
 6. Variation of shaft from plumb.
 7. Shaft excavating method.
 8. Design and tested bearing capacity of bottom.
 9. Levelness of bottom and adequacy of cleanout.
 10. Ground-water conditions and water-infiltration rate, depth, and pumping.
 11. Description, purpose, length, wall thickness, diameter, tip, and top and bottom elevations of temporary or permanent casings. Include anchorage and sealing methods used and condition and weather tightness of splices if any.
 12. Date and time of starting and completing excavation.
 13. Inspection report.
 14. Condition of reinforcing steel and splices.
 15. Position of reinforcing steel.
 16. Concrete placing method, including elevation of consolidation and delays.
 17. Locations of construction joints.
 18. Concrete volume.
 19. Concrete testing results.
 20. Remarks, unusual conditions encountered, and deviations from requirements.

3.6 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property or as directed by the A/E.

END OF SECTION 31 63 29

SECTION 32 12 16 – ASPHALT PAVING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes asphalt pavement, sidewalks, and other asphalt pavement indicated.
- B. Aggregate base course.
- C. Single course bituminous concrete paving.
- D. Double course bituminous concrete paving.
- E. Pavement Marking

1.2 REFERENCE STANDARDS

- A. AASHTO M 288 - Standard Specification for Geosynthetic Specification for Highway Applications; 2017.
- B. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- C. ASTM D1073 - Standard Specification for Fine Aggregate for Asphalt Paving Mixtures; 2016.
- D. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples; 2007.
- E. ASTM D2041/D2041M - Standard Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures; 2011.
- F. ASTM D2726/D2726M - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures; 2017.
- G. ASTM D2950/D2950M - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods; 2014.
- H. ASTM D3549/D3549M - Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens; 2017.
- I. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal; 2015.
- J. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements; 2015.
- K. ASTM D979 - Standard Practice for Sampling Bituminous Paving Mixtures; 2015.

1.3 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers. Review methods and procedures related to hot-mix asphalt paving including, but not limited to, the following:
1. Ensure required submittals have been provided with sufficient time for review prior to scheduling the Preinstallation Meeting.
 2. Review proposed sources of paving materials, including capabilities and location of plant that will manufacture hot-mix asphalt.
 3. Review condition of subgrade and preparatory work.
 4. Review requirements for protecting paving work, including restriction of traffic during installation period and for remainder of construction period.
 5. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
 6. Require attendance by all affected installers including but not limited to
 - a. Contractor's Superintendent
 - b. Installer
 - c. Manufacturer/Fabricator Representative
 - d. Other affected Subcontractors
 - e. Architect
 - f. Owner's Representative
 7. Record minutes and distribute copies within 5 days after meeting to participants as well as Architect, Owner and those affected by decisions made.

1.4 SUBMITTALS

- A. LEED Submittals: Comply with submittal requirements as detailed in Section 01 81 13.
- B. Product Data: Provide product data for each product specified.
- C. Job-Mix Designs: For each job mix proposed.
1. Job-mix design documentation shall include the amount of RAP material, by percentage of total mix, to be utilized.
 2. Job-mix design documentation shall clearly indicate source/origin of RAP material.

- D. Qualification Data: For IDOT qualified manufacturer and installer.
- E. Material Certificates: For each paving material, from manufacturer.
- F. Material Test Reports: For each paving material and mix.

1.5 QUALITY ASSURANCE

- A. Perform Work in accordance with Illinois Department of Transportation "Standard Specifications for Road and Bridge Construction " (IDOT SSRBC).
 - 1. Measurement and payment provisions and safety program submittals included in IDOT Standard Specifications do not apply to this Section.
- B. Obtain materials from same source throughout.
- C. Manufacturer Qualifications: Hot mix asphalt manufacturer shall have valid and current IDOT approvals for materials and work specified.

1.6 DELIVERY, STORAGE, AND HANDLING

- A. Deliver pavement marking materials to project site in in original packages with seals unbroken and bearing manufacturer's labels containing brand name and type of material, date of manufacture, and directions for storage.
- B. Store pavement-marking materials in a clean, dry, protected location within temperature range required by manufacturer. Protect stored materials from direct sunlight.

1.7 FIELD CONDITIONS

- A. Do not apply asphalt materials if subgrade is wet or excessively damp, if rain is imminent or expected before time required for adequate cure, or if the following conditions are not met. Temperatures are to be taken in the shade, away from exposed pavement and stone aggregate fill and other artificial heat sources.
 - 1. Prime Coat: Minimum surface temperature of 60 deg F.
 - 2. Slurry Coat: Comply with weather limitations in ASTM D3910.
 - 3. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 4. Asphalt Binder Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 5. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS**2.1 MATERIALS**

- A. Aggregate for Base Course: Complying with requirements of IDOT Standard Specifications, Section 311, for type B base course with gradation CA-6 crushed stone.
- B. Hot-mix Asphalt Surface Course: Complying with IL-9.5L, Ndes = 30 of the IDOT Standard Specifications. Hot-mix Asphalt Surface Course for City Streets restoration work shall comply with CDOT Rules and Regulations for Construction in Public Way, Latest Edition.
- C. Hot-Mix Asphalt Binder Course: Complying with IL-19L, Ndes = 30 of the IDOT Standard Specifications. Hot-mix Asphalt Binder Course for City Streets restoration work shall comply with CDOT Rules and Regulations for Construction in Public Way, Latest Edition.
- D. Reclaimed Asphalt Pavement (RAP): RAP, complying with IDOT Standard Specifications, specifically 9/17/17 Memorandum "Special Provision for Reclaimed Asphalt Pavement (RAP) and Reclaimed Asphalt Shingles (RAS)" as applies to work in this section.
 - 1. RAP material shall be free of contamination, including, but not limited to, dirt, sand, brick, debris, concrete, sheet asphalt, sealant materials, and clean stone.
- E. Herbicide: Commercial chemical for weed control, registered by the Environmental Protection Agency (EPA). Provide in granular, liquid, or wettable powder form.
- F. Paving Geotextile: AASHTO M 288, nonwoven polypropylene; resistant to chemical attack, rot, and mildew; and specifically designed for paving applications.
- G. Joint Sealant: ASTM D6690, Type II or III, hot-applied, single-component, polymer-modified bituminous sealant.
- H. AUXILIARY MATERIALS:
 - 1. Pavement Marking Paint- Parking lot markings, including parking bays, crosswalks, arrows, handicapped symbols, curb markings and No Parking" curb painting in project property according to Section 780 of the IDOT SSRBC.
 - 2. Pavement Marking Thermoplastic – Crosswalks, stop bar, lane and center-lane markings, pavement markings and symbols in City right of way, CTA Access Drive, and driveways in project property according to Section 780 of the IDOT SSRBC.
 - 3. Pavement Marking Colors: As indicated below. For items not indicated below, provide color(s) as indicated on the Drawings or, if not indicated, as required by the Architect.

- a) Standard Parking Stalls: White.
- b) Accessible Parking Stalls and Access Aisles: Yellow.
- c) International Symbol of Accessibility: Blue field with international symbol of accessibility either yellow or white.
- d) Stop Lines, Cross Walk and Other Traffic Symbols: White.
- e) Lane markings- Yellow, white per standards.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.
- B. Verify gradients and elevations of base are correct.
- C. Proceed only after unsatisfactory conditions have been corrected. Commencement of work in this section will be an indication of the acceptance of sub-grade and the Contractor will be held responsible for the satisfactory execution and results of the finished work.

3.2 BASE COURSE

- A. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces.
- B. Place and compact base course. Base course shall have a minimum Illinois Bearing Ratio (IBR) of 2.5 and comply with requirements of IDOT Standard Specifications, Section 301. Subgrade shall be proof-rolled in accordance with Section 31 23 23.01 - Fill.
- C. Herbicide Treatment: Where required or as directed by Architect, apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted aggregate base before applying paving materials.
 - 1. Mix herbicide with prime coat if formulated by manufacturer for that purpose.

3.3 PREPARATION - PRIMER

- A. Apply primer in accordance with manufacturer's instructions.
- B. Apply primer on aggregate base or subbase at uniform rate of 0.25 - 0.50 gal/sq yd. Apply enough material to penetrate and seal, but not flood surface. Allow prime coat to cure before applying hot-mix asphalt paving.
- C. Use clean sand to blot excess primer. Remove loose sand before pavement is placed and after volatiles have evaporated.

3.4 PREPARATION - TACK COAT

- A. Apply tack coat in accordance with manufacturer's instructions.
- B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.1 gal/sq yd.
- C. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillages and clean affected surfaces.
- D. Allow tack coat to cure undisturbed before applying hot-mix asphalt paving.
- E. Prohibit traffic across tack coat for period not less than that required by manufacturer.

3.5 PLACING ASPHALT PAVEMENT - SINGLE COURSE

- A. Install Work in accordance with Illinois Department of Transportation (IDOT) "Standard Specifications for Road and Bridge Construction" Section 406 and 407.
- B. Machine-place asphalt within 24 hours of applying primer or tack coat.
- C. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt surface coat in single lift.
 - 2. Spread mix at minimum temperature of 250 deg F.
 - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- D. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - 1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
- E. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.6 PLACING ASPHALT PAVEMENT - DOUBLE COURSE

- A. Install Work in accordance with Illinois Department of Transportation (IDOT) "Standard Specifications for Road and Bridge Construction" Section 406 and 407.
- B. Machine-place asphalt binder course within 24 hours of applying primer or tack coat.

- C. Machine-place wearing course within two hours of placing binder course.
- D. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Place hot-mix asphalt base course/wearing course in two lifts and thicknesses indicated.
 - 2. Spread mix at minimum temperature of 250 deg F.
 - 3. Begin applying mix along centerline of crown for crowned sections and on high side of one-way slopes unless otherwise indicated.
 - 4. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
 - 5. Place paving in consecutive strips not less than 10 feet wide unless infill edge strips of a lesser width are required.
 - a. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete a section of asphalt base course before placing asphalt surface course.
 - 6. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.7 JOINTS

- A. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions, with same texture and smoothness as other sections of hot-mix asphalt course. Joints between successive days' work shall be constructed to ensure thorough and continuous bond between the newly and previously placed paving.
 - 1. Clean contact surfaces and apply tack coat to joints.
 - 2. Offset longitudinal joints, in successive courses, a minimum of 6 inches.
 - 3. Offset transverse joints, in successive courses, a minimum of 24 inches.
 - 4. Construct transverse joints at each point where paver ends a day's work and resumes work at a subsequent time. Construct these joints using either "bulkhead" or "papered" method according to the Asphalt Institute MS-22, "Construction of Hot-Mix Asphalt Pavements," for both "Ending a Lane" and "Resumption of Paving Operations."
 - 5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

6. Compact asphalt at joints to a density within two percent (2%) of specified course density.

3.8 COMPACTION

- A. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or with vibratory-plate compactors in areas inaccessible to rollers.
 1. Complete compaction before mix temperature cools to 185 deg F.
- B. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D2041/D2041M, but not less than 90 percent nor greater than 96 percent.
- D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while asphalt is still hot; compact thoroughly.
- F. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.
- G. Frames of subsurface structures:
 1. Coat surfaces of new and existing frames with oil to prevent bond with asphalt paving.
 2. Set cover rings to be flush with finish surface and surround with a ring of compacted asphaltic concrete to one inch below top of frame. Adjust as required to meet paving.
 3. Provide temporary covers over openings until completion of rolling operations
- H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and sufficiently hardened, as determined by the Architect.
- I. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.9 TOLERANCES

- A. Flatness: Maximum variation of 1/4 inch measured with 10-foot straight edge.
- B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.
- C. Variation from True Elevation: Within 1/2 inch.

3.10 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.
- B. Design-Builder will engage a qualified testing agency to perform quality assurance tests and inspections as follows:
 - 1. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D3549/D3549M.
 - 2. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with specified tolerances.
 - 3. In-Place Density: Testing agency will take samples of uncompacted paving mixtures and compacted pavement according to ASTM D979.
 - a. Reference maximum theoretical density will be determined by averaging results from four samples of hot-mix asphalt-paving mixture delivered daily to site, prepared according to ASTM D2041/D2041M, and compacted according to job-mix specifications.
 - b. In-place density of compacted pavement will be determined by testing core samples according to ASTM D1188 or ASTM D2726/D2726M.
 - 1) Take one core sample for every 1,000 square yards or less of installed pavement, with no fewer than three (3) core samples taken.
 - 2) Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D2950/D2950M and correlated with ASTM D1188 or ASTM D2726/D2726M.
 - 4. Testing agency shall perform quality control testing per IDOT specifications and provide test reports.
- C. Replace and compact hot-mix asphalt where core tests were taken.
- D. Remove and replace and/or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.11 PAVEMENT MARKING

- A. Do not apply pavement-marking until layout, colors, and placement have been verified with the Architect. Pavement marking shall be provided per Section 780 of IDOT SSRBC.

END OF SECTION 32 12 16

SECTION 32 13 13 – CONCRETE PAVING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes Concrete Paving including the following:

1. Driveways.
2. Roadways.
3. Parking lots.
4. Curbs and gutters.
5. Sidewalks and walkways.

B. Related Requirements:

1. Illinois Department of Transportation (IDOT) Standard Specifications for Road and Bridge Construction, latest edition.
2. Section 32 12 16 "Asphalt Paving" for pavement markings.

1.2 DEFINITIONS

A. Cementitious Materials: Portland cement alone or in combination with one or more of blended hydraulic cement, fly ash, slag cement, and other pozzolans.

B. W/C Ratio: The ratio by weight of water to cementitious materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Design Mixtures: For each concrete pavement mixture.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified installer, ready-mix concrete manufacturer and testing agency.

B. Material Certificates: For the following, from manufacturer:

1. Cementitious materials.
2. Steel reinforcement and reinforcement accessories.
3. Fiber reinforcement.
4. Admixtures.
5. Curing compounds.
6. Applied finish materials.
7. Bonding agent or epoxy adhesive.
8. Joint fillers.
9. Joint sealers.

- C. Field quality-control reports.

1.5 QUALITY ASSURANCE

- A. Ready-Mix-Concrete Manufacturer Qualifications: A ready mix plant registered with and approved by IDOT.
- B. Laboratory and Personnel Qualifications: Qualified according to IDOT Policy Memorandum "Minimum Private Laboratory Requirements for Construction Materials Testing or Mix Design".

1.6 PRECONSTRUCTION TESTING

- A. Preconstruction Testing Service: Engage a qualified independent testing agency to perform preconstruction testing on concrete paving mixtures.

1.7 FIELD CONDITIONS

- A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.
- B. Concrete Placement: Concrete placement shall be performed in accordance with the applicable portions of the Illinois Department of Transportation Standard Specifications for Road and Bridge construction, latest edition, Article 420.07.

PART 2 - PRODUCTS

2.1 CONCRETE, GENERAL

- A. Comply with the applicable portions of the Illinois Department of Transportation Standard Specifications for Road and Bridge construction, latest edition.
- B. Use paving materials with a three-year aged solar reflectance (SR) value of at least 0.28. If the three-year aged value information is not available, use materials with an initial SR of at least 0.33 at installation.

2.2 FORMS

- A. Form Materials: Meeting the requirements of the applicable portions of Article 424.05 of the Standard Specifications for Road and Bridge Construction, latest edition.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

2.3 STEEL REINFORCEMENT

- A. Plain-Steel Welded-Wire Reinforcement: Meeting the requirements of the applicable portions of Article 1006.10 of the Standard Specifications for Road and Bridge Construction, latest edition.

- B. Epoxy-Coated Welded-Wire Reinforcement: Meeting the requirements of the applicable portions of Article 1006.10 of the Standard Specifications for Road and Bridge Construction, latest edition.
- C. Reinforcing Bars: Meeting the requirements of the applicable portions of Article 1006.10 of the Standard Specifications for Road and Bridge Construction, latest edition.
- D. Epoxy-Coated Reinforcing Bars: Meeting the requirements of the applicable portions of Article 1006.10 of the Standard Specifications for Road and Bridge Construction, latest edition.
- E. Epoxy-Coated Joint Dowel Bars: Meeting the requirements of the applicable portions of Article 1006.11 of the Standard Specifications for Road and Bridge Construction, latest edition.
- F. Epoxy-Coated Tie Bars: Meeting the requirements of the applicable portions of Article 1006.10 of the Standard Specifications for Road and Bridge Construction, latest edition.
- G. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete of greater compressive strength than concrete, and as follows:
 - 1. Equip wire bar supports with sand plates or horizontal runners where base material will not support chair legs.
 - 2. For epoxy-coated reinforcement, use epoxy-coated or other dielectric-polymer-coated wire bar supports.
- H. Epoxy Repair Coating: Liquid two-part epoxy repair coating, compatible with epoxy coating on reinforcement.

2.4 CONCRETE MATERIALS

- A. Portland Cement Concrete: Meeting the requirements of the applicable portions of Article 1020 of the Standard Specifications for Road and Bridge Construction, latest edition.
- B. Coarse Aggregate: Meeting the requirements of the applicable portions of Section 1004 of the Standard Specifications for Road and Bridge Construction, latest edition.
- C. Fine Aggregate: Meeting the requirements of the applicable portions of Section 1003 of the Standard Specifications for Road and Bridge Construction, latest edition.
- D. Air-Entraining Admixture: Meeting the requirements of the applicable portions of Section 1021.02 of the Standard Specifications for Road and Bridge Construction, latest edition.
- E. Chemical Admixtures: Meeting the requirements of the applicable portions of Section 1021 of the Standard Specifications for Road and Bridge Construction, latest edition.
- F. Water: Potable and complying with ASTM C94/C94M.

2.5 CURING MATERIALS

- A. Meeting the requirements of Section 1022 of the Standard Specifications for Road and Bridge Construction, latest edition.

2.6 RELATED MATERIALS

- A. Preformed Expansion Joint Fillers: Meeting the requirements of the applicable portions of Section 1051 of the Standard Specifications for Road and Bridge Construction, latest edition.
- B. Poured Joint Sealers: Meeting the requirements of the applicable portions of Section 1050 of the Standard Specifications for Road and Bridge Construction, latest edition.

2.7 CONCRETE MIXTURES

- A. Utilize mix designs meeting the requirements of Section 1020 of the Standard Specifications for Road and Bridge Construction, latest edition.

2.8 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, and mix concrete materials and concrete according to the requirements of Section 1020 of the Standard Specifications for Road and Bridge Construction, latest edition. Furnish batch certificates for each batch discharged and used in the Work.
- B. Project-Site Mixing: Measure, batch, and mix concrete materials and concrete according to the requirements of Section 1103 of the Standard Specifications for Road and Bridge Construction, latest edition.

PART 3 - EXECUTION**3.1 GENERAL**

- A. Comply with materials, workmanship, and other applicable requirements according to the requirements of Section 420 of the Illinois Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.
 - 1. Measurement and payment provisions and safety program submittals included in standard specifications do not apply to this Section.

3.2 INSTALLATION OF DETECTABLE WARNINGS

- A. Blockouts: Form blockouts in concrete for installation of detectable paving units per approved list on CDOT's website (www.cityofchicago.org).
 - 1. Tolerance for Opening Size: Plus 1/4 inch, no minus.
- B. Cast-in-Place Detectable Warning Tiles: Form blockouts in concrete for installation of tiles. Screed surface of concrete where tiles are to be installed to elevation, so that edges of installed tiles will be flush with surrounding concrete paving. Embed tiles in fresh concrete to comply with CDOT Rules and Regulations for Construction in the Public Way immediately after screeding concrete surface.

3.3 FIELD QUALITY CONTROL

- A. Testing Agency: The Design-Builder will employ a separate testing laboratory to perform tests and inspections.
- B. Testing Services: Testing and inspecting of composite samples of fresh concrete shall be obtained and performed according to Section 1020 of the IDOT Standard Specifications for Road and Bridge Construction, latest edition; and Special Provisions for "Quality Control of Concrete Mixtures at the Plant" and "Quality Control/Quality Assurance of Concrete Mixtures".

3.4 REPAIR AND PROTECTION

- A. Remove and replace concrete paving that is broken, damaged, or defective or that does not comply with requirements in this Section. Remove work in complete sections from joint to joint unless otherwise approved by Architect.
- B. Drill test cores, where directed by Architect, when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory paving areas with portland cement concrete bonded to paving with epoxy adhesive.
- C. Protect concrete paving from damage. Exclude traffic from paving for at least 14 days after placement. When construction traffic is permitted, maintain paving as clean as possible by removing surface stains and spillage of materials as they occur.
- D. Maintain concrete paving free of stains, discoloration, dirt, and other foreign material. Sweep paving not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 32 13 13

SECTION 32 31 00 - ORNAMENTAL METAL FENCING**PART 1 - GENERAL****1.1 SUMMARY****A. Section Includes:**

1. Remove existing fencing to accommodate new gates, and connect all new gates with new fencing, as described below
2. New fusion welded and rackable ornamental steel picket fence system, including all components such as posts, top, couplings, rails, braces, bars, panels, gates, tracks, uprights, bracing, pickets, hardware, fittings, fasteners, finish hardware, locks, accessories and all other incidental components necessary thereto, including required screening. See Drawings for fence extensions required.
3. All new matching, automated, industrial sliding gate system, including components described above; with warning signs; screening; _____; and others as described in these specifications, manufactured and installed to comply with both current versions of UL 325 and ASTM F2200.
3. All new pedestrian gates, with accessible push bar and all components described above, installed in compliance with both current versions of UL 325 and ASTM F2200.
4. Renovate the existing sliding gate so that it complies with both current versions of UL 325 and ASTM F2200.
5. Pedestrian gates with push bar.
6. See Drawings for all system accessories and components required.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern work under this specification section.
2. Applicable provisions of “owner” General and Detailed Technical Specifications utilized for this project.
3. Section 01 81 13 - LEED Sustainable Design Requirements
4. Section 01 81 13B – LEED Materials Submittal Form V4.
5. Division 03 – Concrete.
6. Division 31 – Earthwork.
7. Section _____ -- Retaining Walls
7. Section _____ -- Electrical (for all electrical components? OR ANOTHER SECTIONJ BY JRA?????)
8. Section _____ -- Technology (for all video, voice, sensors, detector loops, etc.)
9. Refer to Civil Drawing and Specification Section for all grading, pavement and curb additions and modifications required for compliance with applicable UL 325 and ASTM F2200 safety standards.

1.2 ACTION SUBMITTALS

- A. LEED Submittals: Product Data as required to show compliance with LEED MR Credit Sourcing of Raw Materials, meeting all documentation requirements, including back-up documentation.
- C. Manufacturer's Data: Submit manufacturer's data, including catalog cuts, materials compliance and specified options to Design Builder prior to construction. Submit manufacturer's warranty to Owner at Substantial Completion.
 - 1. The manufacturer's submittal package shall include gate elevations, hardware details, and installation details shall be submitted prior to installation.
- D. Shop Drawings: Submit three copies of Shop Drawings prior to construction. Shop Drawings shall include plans which show layouts of fences and gates with dimensions and elevations at not less than 1"=1'-0" scale; and details or sections of component accessories, finishes, post foundations, anchorages and connections at not less than 3"=1'-0".
 - 1. Note all step-downs due to elevation changes on shop drawings.

1.3 QUALITY ASSURANCE

- A. Qualifications: A single installer with a minimum of 5 years of experience on a comparable project building fences of similar materials, of similar length.
- B. Finish Quality: The finish fence shall stand straight, plumb, level, and true to line and grade. Finished fences shall cleanly meet building or other fences, as shown on the Drawings, leaving no gaps that could allow a person to penetrate security function.
- C. References for Fence:
 - 1. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.
 - 2. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
 - 3. ASTM D523 - Test Method for Specular Gloss.
 - 4. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.
 - 5. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
 - 6. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
 - 7. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 - 8. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 - 9. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
 - 10. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.
- D. References for Automated Sliding Gates:
 - 1. UL 325 – Standard to Which Vehicular Gate Operators are Manufactured and Tested. Deviations from these standards are not acceptable.

2. ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction. Deviations from these standards are not acceptable.
 3. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.
 4. ASTM B221 - Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles and Tubes.
 5. ASTM D523 - Test Method for Specular Gloss.
 6. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.
 7. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.
 8. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.
 9. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
 10. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.
 11. ASTM F1184 – Industrial & Commercial Horizontal Slide Gates
- E. Other Referenced Specification: See tables in Manufacturer’s specifications for specific product specified.
- F. Manufacturer’s Product Warranties: All structural fence and gate components (i.e. rails, pickets, posts and gates) shall be warranted within specified limitations, by the manufacturer for a period of 20 years from the date of original purchase. Warranty shall cover any defects in the material finish, including cracking, peeling, chipping, blistering or corroding.
1. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of the manufacturer’s warranty shall be guaranteed for five (5) years from date of original purchase.

1.4 PRODUCT HANDLING

- A. Upon receipt at the job site, check all materials to ensure that no damage occurred during shipping or handling.
- B. Store materials in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft.

1.5 JOB CONDITIONS

- A. Coordination: Coordinate work with concrete and paving installers to assure proper alignment and leveling of fence and gates.
- B. Utilities: Determine whether utilities will be encountered, and if so, notify Commissioner immediately of obstructions to the work.
- C. Sequencing: Where possible, install fences and renovate existing chain link fence prior to landscape planting installation.

PART 2 - PRODUCTS**2.1 MANUFACTURERS**

- A. **Manufacturer's Qualifications:** Manufacturer shall have a minimum of five years of experience manufacturing ornamental picket fencing of fences which have equal design, size, gauge of metal parts and fabrication.
1. **Basis of Design Manufacturer:** Ameristar, Tulsa, Oklahoma; or approved equivalent. (Phone: 888.333.3422)
- B. **Fence Style and Height:** Ameristar Industrial Montage II Genesis style with the extended flat pickets at top; with two rails on top and one on bottom; with screening; 6 feet height as designated on the Drawings; or equivalent.
- C. **Automated Sliding Gate Style:** Automated Industrial cantilever gate system such as _____, without extended uprights, with 4" square posts; with screening; 6 feet height as designated on the Drawings; or equivalent.
1. Match surrounding fence as designated on the Drawings.
 2. Total Length: Submit Shop Drawings with gate lengths for approval.
 3. Self-latching and self-locking, automated opening and closing, with all accessories as components described on the Drawings, and specified in this Section.

2.2 FENCE AND GATE MATERIALS

- A. **Ornamental Fence:** Ornamental fence shall be heavy duty industrial grade ornamental iron fence, in the style as shown on the Drawings, finished as specified below, with the following components:
1. **General:** Metal surfaces shall be smooth, free of surface blemishes, including pitting, seam marks, roller marks, trade names and roughness.
 2. **Fence Panels and Posts:** Steel material for fence panels and posts shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa) and a minimum zinc (hot-dip galvanized) coating weight of 0.90 oz/ft² (276 g/m²), Coating Designation G-90.
 3. **Pickets:** Material for pickets shall be 1" square x 14 Ga. tubing. The rails shall be steel channel, 1.75" x 1.75" x .105". Picket holes in the rail shall be spaced 4.715" o.c. Fence posts and gate posts shall meet the minimum size requirements of Table 1 of manufacturer's specification.
- B. **Fence Fabrication:**
1. Pickets, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept pickets.

2. Pickets shall be inserted into the pre-punched holes in the rails and shall be aligned to standard spacing using a specially calibrated alignment fixture. The aligned pickets and rails shall be joined at each picket-to-rail intersection by Ameristar's proprietary fusion welding process, thus completing the rigid panel assembly (Note: The process produces a virtually seamless, spatter-free good-neighbor appearance, equally attractive from either side of the panel).
3. The manufactured fence system shall be capable of meeting the vertical load, horizontal load, and infill performance requirements for Industrial weight fences under ASTM F2408.

C. Pedestrian Gate Materials:

D. Sliding Gate:

1. The materials used for cantilever gate framing (i.e., uprights, diagonal braces and pickets or pales) shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with a yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish. The TransPort® Fast-Trak™ rails shall be manufactured from ASTM B221 aluminum (designation 6063-T-6) with minimum yield strength of 25,000 PSI, a tensile strength of 30,000 PSI and a standard mill finish.
2. Material for diagonal bracing and uprights shall be 2" sq. x ¼" aluminum. The design of the top and bottom enclosed track shall conform to the manufacturers 5" x 2" Fast-Trak system. Material for chain link infill shall be per specification.
3. Internal roller truck assembly shall be self-aligning swivel ball-and-socket type running on four bearing wheels. Internal roller truck assembly shall be affixed to the hanger bracket by means of a 5/8" diameter industrial-grade rod end/center bolt, with a minimum static load rating of 10,000 pounds. Attachment of the center bolt to the truck body shall be by means of a swivel joint to ensure equivalent and consistent loading on all bearing wheels and internal track surfaces throughout the travel of the gate.

E. Gate Fabrication:

- A. Enclosed track, uprights and diagonal bracing shall be pre-drilled and labeled for easy assembly. All components shall be pre-cut to specified lengths.
- B. Top and bottom rail extrusions shall be mechanically fastened to vertical uprights and reinforced with diagonal braces, as required by drawing.

2.3 FENCE AND GATE FINISHES

- A. Polyester Powder Coat Finish: After components have been galvanized to provide maximum corrosion resistance, galvanized surfaces shall be pretreated, cleaned and prepared to assure complete adhesion of finish coat.
 1. Fence System: The manufactured panels and posts shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils

(0.058 mm). The coated panels and posts shall be capable of meeting the performance requirements for each quality characteristic shown in Table 2 of Manufacturer's Specification for the specified fence which meet or exceed the coating performance criteria of ASTM F2408.

2. Gate System: For color coating, the manufactured components shall be subjected to the Ameristar thermal stratification coating process (high-temperature, in-line, multi-stage, and multi-layer) including, as a minimum, a six-stage pretreatment/wash and an electrostatic spray application of a polyester finish. The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 1 of Manufacturer's Specification for the specified gate.

3. Color: Black.

2.4 SETTING MATERIAL

- A. Concrete: Concrete shall have minimum 28 day compressive strength of 3,000 psi.

2.5 SECURITY LOCKING MECHANISM

- A. Provide heavy duty industrial grade lock and 6 sets of keys for gates.

2.6 GATE OPERATOR

2.7 SCREENING

2.8 ACCESSORIES

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verification: Verify areas to receive fencing are completed to final grades and elevations, and ensure that property lines and legal boundaries of work are clearly established.
 1. Where slopes occur, step fence up or down to meet grades and provide security.
 2. Confirm that concrete gutters have been installed for the proper function of the sliding gates, prior to fence and gate installation.
- B. Layout and Field Measuring: Stake layout of fence and gate for Design Builder's review and take field measurements prior to preparation of shop Drawings and fabrication, to assure proper fitting of work. Do not delay progress of work; allowing time for fitting and trimming in field if necessary.
- C. Anchoring: Furnish inserts, templates, anchoring devices or other incidentals for the setting into concrete footings where shown on the Drawings.

- D. Pre-Assembly: Preassemble items in shop to greatest extent possible to minimize field splicing and assembly at site and disassemble units only to extent necessary for shipping and handling. Units shall be clearly marked for reassembly and the Contractor shall coordinate installation.
- E. Gate Preparation:
 - 1. All hardware shall be installed in accordance with the Transport installation instructions. Transport cantilever gates shall be installed so they comply with current ASTM F2200 & UL325 standards.
 - 2. Gate stops shall be installed on each track in a way that conforms to current ASTM F2200 standards.

3.2 INSTALLATION

- A. Manufacturer's Instructions: Install fence, gates and all accessories in accordance with manufacturer's instructions, in locations shown on Drawings.
- B. Installing Fence: Install fence true to line, plumb and level and with accurate angles and surfaces and straight sharp edges. Accommodate changes of grade at posts by stepping up or down, and accommodate any angles as shown on the Drawings.
- C. Spacing Posts: Fence post shall be spaced according to Manufacturer's Table 3 of the Manufacturer's Specification for the specified fence, plus or minus ½". For installations that must be raked to follow sloping grades, the post spacing dimension must be measured along the grade.
- D. Concrete Set Posts: Drill holes into firm, undisturbed or compacted soil to depths and widths as specified, place concrete around posts in continuous pour and trowel finish around post, sloping to direct water away from posts.
 - 1. Posts shall be set in concrete footers having a minimum depth of 36" or greater depth).
- E. Installing Panels: Fence panels shall be attached to posts with brackets supplied by the manufacturer. Align fence panels between posts and firmly attach rail brackets to posts with 1/4" bolt and lock nut, ensuring panels and posts remain plumb.
- F. Check Alignment: Check each post and gate post for vertical and top alignment, and maintain in position during placement and finishing operation.
- G. Fence Installation: When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces.
 - 1. Remove all metal shavings from cut area.
 - 2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry.
 - 3. Apply 2 coats of custom finish paint matching fence color. Failure to seal exposed

surfaces per steps 1-3 above will negate warranty.

4. Manufacturer's spray cans or paint pens shall be used to prime and finish exposed surfaces; it is recommended that paint pens be used to prevent overspray.
 5. Do not use non-manufacturer's parts or components as they will negate the manufacturer's warranty.
- H. Finish Accessories: Install post caps and other accessories to complete the fence.
- I. Securing Fence: Provide additional anchorages and accessories as necessary for adequate support for intended use as safety fence.
- J. Gate Installation: Install gates true to line, plumb, level, and secure for full opening without interference.
1. Gate posts shall be spaced according to the manufacturer's gate drawings, dependent on standard out-to-out gate dimensions and gate hardware selected.
 2. Gate post shall be spaced according to specified gate elevation.
 3. Posts shall be set in concrete footers having a minimum depth of 48" with a minimum diameter of 12".
- K. Gate Hardware: The manufacturer's gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations. Attach and adjust all hardware for smooth operation and by means which will prevent unauthorized removal.
- L. Install _____.

3.3 RENOVATE EXISTING SLIDING GATE TO REMAIN

- A. Preparation: Straighten bent sections to the extent reasonably possible. Reattach panels

3.4 REPAIR AND CLEANING

- A. General: Perform final quality control work, repair and cleaning with specified materials and methods. Finish and color on repairs shall exactly match.
- B. Repair: Perform touch-up painting on abraded areas and repair or replace defective work.
- C. Clean-Up: Remove all resultant debris and unused material, including post hole excavation, and dispose of legally off site.

END OF SECTION 32 31 00

SECTION 32 31 11 -- GATE OPERATORS**PART 1 - GENERAL****1.1 SECTION INCLUDES**

- A. Electric Gate Operator: One gate operator which is designed to open and close the specified automated sliding gate, in conformance with UL325 and ASTM F2200.
- B. The Owner/Operator (End User) or facility architect shall assume responsibility for providing traffic and safety engineering, including all necessary safety features to be used at each automated vehicular gate location, including, but not limited to: sidewalks for pedestrian traffic, sufficient roadway lighting, entrapment protection devices, warning signage, traffic lights, audible warning alerts, visual warning alerts, secondary traffic control devices, guard/control booths or centers and other required accessories, components or elements required by UL3215 and F2200.
- C. Utilize all forms of safety equipment to the maximum extent possible. Such safety equipment includes, but is not limited to, entrapment protection devices, proper lighting, warning signs, traffic lights, gate arms and/or audible alarms.
- D. Sensors and controls.

1.2 RELATED SECTIONS

- A. Division 03 - Concrete
- B. Division 28 – Electronic Safety and Security
- C. Division 31 - Earthwork
- D. Division 32 – Exterior Improvements
- E. Division 34 – Transportation
- F. Section/Division _____ -- Technology

1.3 REFERENCES

- A. Underwriters Laboratories (UL): UL 325 – Standard for Safety for Door, Drapery, Gate, Louver, and Window Operators and Systems.
- B. Canadian Standards Association (CSA): CSA C22.2 No. 247.
- C. Underwriters Laboratories (UL): UL 991 – Standard for Tests for Safety Related Controls Employing Solid-State Devices.
- D. American Society Testing Materials (ASTM): ASTM F2200 – Standard Specification for Automated Vehicular Gate Construction.

- E. National Electrical Manufacturers Association (NEMA): NEMA ICS 6 – Industrial Control Systems: Enclosures.

1.4 SUBMITTALS

- A. Submit under provisions of Section 01 30 00 – Administrative Requirements.
- B. Product Data: Manufacturers data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements.
 - 3. Installation methods.
- C. Shop Drawings: Submit shop drawings showing layout, profiles, and product components, including anchorage, edge connections, and accessories.
 - 1. Operation, installation, and maintenance manuals including wire diagrams.
 - 2. Risers, layouts, and special wiring diagrams showing any changes to standard drawings.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, and handle materials and products in strict compliance with manufacturer's instructions and industry standards.
- B. Store products indoors in manufacturer's original containers and packaging with labels clearly identifying product name and manufacturer. Protect from damage.

1.6 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Substantial transformation and final assembly shall occur in the United States of America per Section 1605 of the ARRA-09.
- B. Installer Qualifications: Installation performed by factory authorized dealer contractor specifically trained in gate operator systems of the type found within this section; a qualified gate operator technician who is certified by the Institute of Dealer Education and Accreditation (IDEA) or the American Fence Association (AFA).
 - 1. Provide documentation of maintenance and repair service availability for emergency conditions.
 - 2. Provide quarterly maintenance for one year following Substantial Completion of the Project.
- C. This vehicular automated gate system has been carefully planned with safety as a paramount concern. This products specified are designed to control vehicle traffic.
 - 1. Provide review of system by a traffic safety engineer before installation.
 - 2. All forms of safety equipment shall be utilized to the maximum extent possible. Such safety equipment includes, but is not limited to, entrapment protection devices, proper lighting, warning signs, traffic lights, gate arms and/or audible alarms.

1.7 WARRANTY

- A. Manufacturers standard five (5) year warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Basis of Design: DoorKing, Inc.; 120 S. Glasgow Ave; Inglewood, CA 90301; Toll-Free Tel: 800-826-7493; Tel: 310-645-0023; Fax: 310-641-1586; Email: ghendrix@doorking.com; The 9024 series system shall consist of one (or multiple) 9024 vehicular slide gate operator and additional items, as specified, or equivalent in compliance with UL325 and ASTM F2200.
- B. Substitutions: All substitutions must meet requirements of UL325 and ASTM 2200, and be operable and compatible with all required accessories and components necessary for the complete automation of the sliding gate.
- C. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 – Product Requirements.

2.2 SLIDING GATE OPERATORS

- A. Microprocessor based solid-state control board interacting with card readers, RF transmitters, access control systems, ticket machines, other activating devices as required, external devices (photo-eyes, contact edges) for entrapment protection and vehicle (loop) sensing systems. Control board shall include built-in close timer (1-25 seconds), built-in ports for two (2) plug-in loop detectors, partial open input, programming switches to set various operating modes, inherent current sensing reverse system.
 - 1. Compliance: Compliant to UL 325, UL 991 and CSA C22.2 No. 247 and listed by Intertek Testing Laboratories NA, Inc. (ETL), a Nationally Recognized Testing Laboratory.
 - a. This model is intended for use in IV vehicular slide gate applications.
 - 2. Warranty: Five (5) year manufacturer's standard warranty.
 - 3. Maximum Gate Length: 40 feet.
 - 4. Maximum Gate Weight: 1000 Lbs
 - 5. Operator speed: approximately 10-inches per second.
 - 6. Enclosure: polypropylene, 0.125 inch (3.175 mm) 390 texture gray.
 - 7. Configuration: Left or right hand mount; front, center or rear mounting configurations.
 - 8. Mounting: Pad or post mount.
 - 9. Electrical Power Requirements: 115/230 VAC or 24 VDC.
 - 10. Motor: 24 VDC Continuous Duty Motor.
 - 11. Manual Operation: Upon loss of primary (AC) power, a T-handle release is engaged allowing the gate to be manually pushed open.
 - 12. Primary Reduction: 30:1 gear reduction, single cog belt drive train.
 - 13. Pulling Medium: #40 roller chain

14. Mechanically set Limit Switches.
15. Operating Switches: Built-in AC and DC power (on-off), reset and operating switches.
16. Convenience Outlets: Two (2) 115 VAC for accessory transformers (115/230 VAC models only).
17. Entrapment Protection:
 - a. Photo-electric eye (non-contact sensor).
 - b. Sensing edge (contact sensor).
18. Accessories: Provide the accessories listed below.
 - a. Traffic control signal (red / green) mounted painted on metal post, with 2 yellow painted pipe bollards protecting the signals, each.
 - b. Thermostatically controlled heater kit.
 - c. Base Plate: Provide if post mount application.
 - d. Chain tray kit: Provide for roller support if required for specified 24' gate.
 - e. Plug-in loop detectors.
 - f. Electric reversing edge: Provide for reverse direction of gate on contact with an obstruction.
 - g. Photo-electric beams: Provide for reverse direction of gate if the light beam is obstructed.
 - h. Gate Tracker Expansion – provides time and date stamped electronic record of cycles, input errors, loop detector input errors, obstruction hits and power cycles.
 - 1) Basis of Design: Requires companion DoorKing 1830 Series access controller, or equivalent subject to compliance with UL 325 and ASTM F2200 standards.

PART 3 - EXECUTION

3.1 COORDINATION

- A. Coordinate with all required trades installing all portions of adjacent installations so that all safety requirements are met prior to substantial completion and final automation of the sliding gate.

3.2 INSTALLATION

- A. Gate operator shall be mounted, firmly secured, plumb and level, as required.
- B. Wiring shall be uniform and in accordance with national electric codes and manufacturer's instructions.
- C. All splices shall be in easily accessible junction boxes or on terminal boards.
- D. All cable runs in all junction boxes shall be tagged and identified.
- E. Coordinate all work with other effected trades and contractors.

3.3 SYSTEM INITIALIZING AND PROGRAMMING

- A. System shall be turned on and adjustment made to meet requirements of specifications and on-site conditions.
- B. System shall function as specified.

3.4 SYSTEM TEST PROCEDURES

- A. System shall be completely tested to assure that all components and accessories are hooked-up and in working order.
- B. System shall be pre-tested by contractor and certified to function in accordance with plans and specifications.
- C. System shall be tested in presence of owner's representative.

3.4 OWNER INSTRUCTIONS

- A. Installation contractor shall conduct up to (1) hour of instruction in use and operation of the system to designated owner representatives, within (30) days of acceptance.
- B. Installation contractor shall conduct up to (1) hour of technical training, in troubleshooting and service of the system, to designated owner representatives within (90) days of system acceptance.

3.5 MANUALS AND DRAWINGS

- A. Contractor shall provide owner with (2) copies of standard factory prepared operation, installation and maintenance manuals. Manuals shall include typical wiring diagrams.
- B. Contractor shall provide owner with (2) copies of any risers, layouts, and special wiring diagrams showing any changes to standard drawings, if required on project.

3.6 MAINTENANCE

- A. Provide periodic maintenance at one (1), three (3) and 12 month intervals as described in the installation and maintenance manual, for one year starting after Owner Training.
- B. Check external reversing devices at least once a month.

END OF SECTION 32 31 11

SECTION 32 31 20 - METAL FENCE SCREENING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Perforated aluminum fence panels attached to existing ornamental metal fence, polyester powercoat finish, including all attachment accessories necessary thereto.

B. Related Sections:

1. Applicable provisions of Division 01 – General Requirements shall govern work under this specification section.
2. Applicable provisions of “Owner” General and Detailed Technical Specifications utilized for this project.
3. Section 01 81 13 “Sustainable Design Requirements” for sustainable design requirements.

1.2 SUBMITTALS

- A. LEED Submittals: Product Data as required to show compliance with LEED MR Credit Sourcing of Raw Materials, meeting all documentation requirements, including back-up documentation.

- B. Manufacturer’s Data: Submit manufacturer's data, including catalog cuts, materials compliance and specified options to Architect prior to construction. Submit manufacturer’s warranty to Owner at Substantial Completion.

1. The manufacturer’s submittal package shall include gate elevations, hardware details, and installation details. Package shall be submitted prior to installation.

- C. Shop Drawings: Submit three copies of Shop Drawings prior to construction. Shop Drawings shall include plans which show layouts of fences and gates with dimensions and elevations at not less than 1"=1'-0" scale; and details or sections of component accessories, finishes, post foundations, anchorages and connections at not less than 3"=1'-0".

1. Note all step-downs due to elevation changes on shop drawings.

- D. Shop Drawings: Submit shop drawings for approval.

- E. Manufacturer’s Data: Submit manufacturer’s data regarding fence panel product, such that it conforms in every respect to the basis of design.

1.3 QUALITY ASSURANCE

- A. Qualifications: A single installer with a minimum of 5 years of experience on comparable projects building fences with screening materials, of similar length.
- B. Finish Quality: The finish fence panels shall be installed straight, plumb, level, and true to line and grade and securely attached to posts and each other. Finished fence panels shall cleanly meet each other and posts, as shown on the Drawings, leaving no gaps larger than 5.56 mm.
- C. Manufacturer's Product Warranties:
 - 1. Panel Manufacturer's Standard Warranty: Certify that panels are free from defects in material and workmanship. Provide a 20 year limited warranty for the galvanized polyester powder coated finish against cracks, peels, or blisters.
 - 2. Reimbursement for labor necessary to restore or replace components that have been found to be defective under the terms of manufacturer's warranty shall be guaranteed for five (5) years from date of original purchase.

1.4 PRODUCT HANDLING

- A. Upon receipt at the job site, check all materials to ensure that no damage occurred during shipping or handling.
- B. Store materials indoors in such a manner to ensure proper ventilation and drainage, and to protect against damage, weather, vandalism and theft. Do not store materials on site.
- C. When transporting panels to site, protect panel finishes so they are not damaged in transit.

1.5 JOB CONDITIONS

- A. Coordination: Coordinate work with other installers working in the area to avoid conflicts.
- B. Field Measurement: Field measure all fence sections (post to post) to order panels of proper size. Some panels shall be custom fabricated so that there are no gaps or overlaps.
- C. Utilities: Determine whether utilities will be encountered, and if so, notify Commissioner immediately of obstructions to the work.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Manufacturer's Qualifications: Panel manufacturer shall have a minimum of five years of experience manufacturing aluminum panels which have equal design, size, gauge, perforation size and pattern, and capable of powder coating panels in-house.
 - 1. Fence Panel Basis of Design: Ametco Manufacturing Corporation, Willoughby, Ohio; or approved equivalent. (Phone: 440.951.4300)

2.2 MATERIALS

- A. Fence Panels: Perforated aluminum infill panels, .125" thick, with 3/16" round holes on 1/4" staggered centers, and approximately 51% opening.
 - 1. Size: 48" by 72" panels, except where custom panels are needed to fit tightly without gaps.
 - 2. Two panels per fence section, tightly abutted, typical, except where custom panels are needed to fit tightly without gaps.
 - 3. Finished edges, four sides, with 2" margins on three sides and 1/2" margin where panels meet in center of fence section. Margins shall apply to standard and to custom panels.

2.3 PANEL FINISHES

- A. Polyester Powder Coat Finish: After components have been galvanized to provide maximum corrosion resistance, galvanized surfaces shall be pretreated, cleaned and prepared to assure complete adhesion of finish coat.
 - 1. The manufactured panels shall be subjected to an inline electrodeposition coating (E-Coat) process consisting of a multi-stage pretreatment/wash (with zinc phosphate), followed by a duplex application of an epoxy primer and an acrylic topcoat. The minimum cumulative coating thickness of epoxy and acrylic shall be 2 mils (0.058 mm). Meet or exceed the coating performance criteria of ASTM F2408.
 - 2. Powder coated standard color: Black Velvet.

2.4 FASTENERS

- A. Rivets: Stainless steel rivets, 3/16" diameter, with domed head, sized appropriately to securely attach aluminum panels to posts, to C Channel rails and to angle irons. Paint black to match fence after installation.
- B. Angle Irons: Stainless steel L Straps, pre-drilled with two holes; painted black to match fence.

- C. Zip Ties: Use only if approved by Architect. If approved, zip ties shall be Grade 304 stainless steel, cable zip ties, manufactured for outdoor use; flame resistant; temperature performance range of 112 degrees to 1000 degrees Fahrenheit; 200 lbs. tensile strength; with self-locking mechanism for secure attachments.
1. Sizes: .18" width. Zip ties come in various sizes; use appropriate length to wrap completely around rails and through panel with margins, or to abut panel to panel, with at least 2" to spare before trimming.
 2. Basis of Design: Uline Model numbers #S-13605 and #S-13606, or approved equivalent.
 3. Painted black to match fence.

PART 3 - EXECUTION

3.1 PREPARATION

- A. Verification: Verify areas to receive fence panels are completed.
- B. Field Measuring: Take accurate field measurements prior to preparation of Shop Drawings, ordering and fabrication, to assure proper fitting of work. Do not delay progress of work; allowing time for fitting.

3.2 INSTALLATION

- A. Installing Panels: Install fence panels true to line, plumb and level, with edges of all panels tightly abutting each other.
 1. Some panels may need to be bent when post is out of alignment. Determine angle and precisely bend panel to post for secure installation.
 2. Finished panel installation shall leave no gaps larger than 5.56 mm.
- B. See Drawings for rivet placements, spacing and alignments. Installed rivets and ties shall align with each other, vertically and horizontally.
- C. Check Alignment: Check each panel for vertical and top alignment and maintain in position during placement and attachment operation.
- D. Securing Panels to Posts:
 1. Precisely align panels so that panel vertical edges are centered on posts.
 2. Pre-drill holes in panels, posts and rails to receive rivets.

3. Securely attach panels to posts with rivets.

4. Install rivets by inserting them through pre-drilled holes in both materials to be joined, and then deforming the end opposite the head to create a bond. Use a rivet gun designed to install rivet and pop off tail end.

5. If rivets cannot be installed in some circumstances, describe the circumstances with pictures and dimensions, and obtain Architect's approval to use zip ties.

E. Securing Panels to Rails:

1. After securing panels to posts, attach panels to top and bottom rails with rivets.

2. If the use of zip ties is approved, precisely tighten, tension and cut ties with a stainless steel cable tie gun. Cut ties cleanly leaving no sharp edges.

3.3 REPAIR AND CLEANING

A. General: Perform final quality control work, repair and cleaning with panel manufacturer recommended materials and methods. Finish and color on repairs shall exactly match.

B. Repair and Replacement: Perform touch-up painting on scratched or abraded areas under one inch length or under 1/2 inch diameter area, per manufacturer's recommendations. Panels with large abrasions shall be replaced at no additional cost to Owner.

C. Clean-Up: Remove all resultant debris and unused material and dispose of them legally off site.

END OF SECTION 32 31 20

SECTION 32 92 01 – SOD AND SEED**PART 1 - GENERAL****1.1 SUMMARY**

- A. This Section includes all replacement sod needed to re-sod disturbed areas which were previously sodded in the parking lot of JPSTC, and seeded areas indicated on the Drawings, as required by the Drawings and Specifications.

1. Water Supply: Provide all temporary water supply from source(s) on or off site. See Drawings.
2. Warranty: Warranty replacement sod through three mowings.
3. Warranty native seeded areas for one year, after a full stand is achieved, and including three mowings approximately 4-6 weeks apart.
4. Initial Maintenance: Maintain replacement sod through Substantial Completion of the landscape work. Maintain native seeded areas through three mowings, approximately 4-6 weeks apart after full germination.
5. First Year Maintenance First Year Maintenance: Provide landscape maintenance of work covered by this Section of the specifications for all seeded areas shown on the Drawings, for a period of approximately one year commencing with Substantial Completion of the landscape work and coinciding and terminating exactly with the First Year landscape maintenance of the plant materials. Provide continued maintenance of the seeded areas from the last required mowing through to the termination of all First Year Maintenance.

- B. Related Sections include the following:

1. Applicable provisions of Division 01 – General Requirements shall govern work under this specification section.
2. Applicable provisions of “owner” General and Detailed Technical Specifications utilized for this project.
3. Section 01 81 13 - LEED Sustainable Design Requirements
4. Section 01 81 13B – LEED Materials Submittal Form V4.
5. Section 31 13 00 - Landscape Removal, Pruning & Protection.
6. Section 32 93 11 – Landscape Plantings.

1.2 SUBMITTALS

- A. LEED Submittals: Product Data as required to show compliance with LEED MR Credit Sourcing of Raw Materials, meeting all documentation requirements, including back-up documentation.
- B. Source: Submit supplier name and certification of sod and seed content to Architect, including location of supplier.
- C. Review: The Architect reserves the right to review sod and seed for specified quality and variety, upon delivery to the site or during the progress of the work. All sod and seed furnished for the work will conform in every respect to the reviewed samples. Sod which does not conform will be removed from the site and immediately replaced with conforming material at the Contractor's expense.

- D. Certificates: Furnish required certificates accompanying shipments.
- E. Required Maintenance Instruction: Submit a report detailing recommended maintenance practices for the second year following seeding.

1.3 QUALITY ASSURANCE

A. Installer Qualifications:

1. For Sod: Installer shall be an approved landscape contractor who shall be the same installer as performing the landscape planting, having a minimum of five years of experience installing sod on projects of comparable scale and complexity.
2. For Seeded Areas: A firm specializing in the seeding of native plants, with a minimum of ten (10) years of experience on comparable projects which have seeded native prairies. Firms which are pre-qualified include Cardno, Pizzo, McGinty and Tallgrass. Equivalent firms shall show evidence of equivalent qualifications.
3. All installers shall use experienced crews who specialize in the creation of turf establishment and who recognize weeds and invasive species.

- B. Compliance: Comply with State and Federal laws with respect to inspection for plant diseases and insect infestation. Any inspection certificates required by law shall accompany each shipment and on arrival shall be filed with the Architect. The Contractor shall notify the Department of Agriculture, Division of Plant Industries, and furnish the following information:

Name of the supplier.

The amount of sod or seed to be used.

Location of sod field. Location of job site.

Approximate distance of sod field from job site.

Date of cutting.

- C. Seed Certificates: Obtain from seed supplier a statement which certifies that all seed is pure live seed, guaranteed to be true to name and varieties specified.

- D. Warranty: The Contractor shall and hereby does warranty that all work in this section shall be free from defects of materials and workmanship, and that sodded turf areas meet a green uniform standard of appearance, until the Contractor has maintained the sodded turf from substantial completion through three mowings. No-mow Native seeding areas shall be warranted to have a full stand of specified plants for one year from substantial completion through final acceptance by the Owner (coinciding with warranty period for landscape plantings). The Contractor shall correct any imperfect work whenever discovered until termination of warranty obligations. When the work is accepted in part, the warranty periods extend from each partial acceptance to the terminal date of the last warranty period. Thus the plant and seeded areas have warranty periods that terminate on the same date.

E. Acceptance Procedure:

1. Completion of Work: Upon completion of the work, a review will be made by the Architect upon written notice requesting such a review submitted by the Contractor at least ten (10) days in advance of the anticipated date. The purpose of the review shall be to determine whether or not the Contractor has completed all of the work of this contract, including maintenance of all sodded and hydroseeded areas.
2. Review for Substantial Completion: This review shall take place at the same time as the

maintenance review after a viable stand of sod and seeded turf has been achieved, and after at least one mowing of turf. The Architect will make a review to begin the warranty of turf areas on the date requested by the Contractor, as above specified, or as soon thereafter as possible. If the work is found to be in compliance with the Contract Documents, the Architect will notify in writing the Contractor and Owner of the beginning of the warranty period. The Contractor shall prepare an initial punch list for the Architect's review, noting any areas of sod or seed not in healthy condition at this time, recommending changes in maintenance procedures and creating a list of replacement areas. The Contractor and Architect shall then review the work together on-site.

3. Maintenance Review: Maintenance review and substantial completion review shall take place simultaneously, if possible. If turf areas are found to be defective, make necessary replacements, continue initial maintenance for at least another set of mowings, and request another inspection.
4. Warranty Period: Make periodic inspections during the warranty period to determine what changes should be made to the maintenance program. Submit in writing to the Architect any recommended changes. Upon completion of the warranty period submit a request for a review at least ten (10) days in advance of the anticipated date.
5. Review for Final Acceptance: The Architect will make a review for Final Acceptance of the Contract work, including maintenance but exclusive of replacements. If the work is found to be compliant, the Architect will recommend acceptance by the Owner, exclusive of replacement turf or seed subject to warranty. If there are any deficiencies in the maintenance, the Contractor will be notified of these deficiencies in writing and the work shall be subject to re-review before acceptance.

1.4 PRODUCT HANDLING

- A. Sod Handling: Transport sod either in a closed van or in an open truck properly covered. Deliver and install within a period of 48 hours. Do not harvest or transplant when moisture content (excessively dry or wet) may adversely effect sod survival. Protect sod from exposure to sun, wind and freezing prior to placing. Sod shall be in a moist condition at the time of cutting and until it is placed. Any sod that has dried out shall be immediately removed from the job site and replaced per specifications.
- B. Handling Seed: Seed shall be delivered in the original sacks received from the producer, and each sack shall be tagged in accordance with the Agricultural Seed Laws of the United States and local state ordinances. Store per supplier's or manufacturer's recommendation.
- C. Fertilizers: Deliver in standard size bags, showing weight, analysis and name of processor, and store in weatherproof storage place and kept dry so that its effectiveness is not impaired.
- D. Maintenance Materials: Deliver insecticide spray in the manufacturer's containers; mix and spray according to manufacturer's directions. Deliver fungicide in manufacturer's containers; mix and apply according to manufacturer's directions only with the acceptance of the Architect. Deliver herbicide in the manufacturer's containers; apply per manufacturer's directions, only with the acceptance of the Architect.

1.5 JOB CONDITIONS

- A. Acceptance of Site: Thoroughly review the site to determine if all grading, soil preparation, and irrigation installation has been satisfactorily achieved. Report unsatisfactory conditions to the Architect and make repairs prior to start of work.

- B. Confirm Water Source: Provide all required temporary water supply from source(s) provided by Owner. See Drawings for hose bib, quick coupler locations or other permanent sources of supply.
- C. Protection of the Work: Protect the entire project area against traffic, damage, erosion or other use by means accepted by the Architect. The Contractor shall not be responsible for repairing damage caused by Acts of God or acts of vandalism or malicious intent. Any barricades or temporary fencing and signs shall be maintained until acceptance. Upon final acceptance of the work, remove said barricades or temporary fences, or leave them if so desired by the Owner. Damage to existing structures, utilities, trees, lawns, shrubs, pavements or other property caused by the Contractor shall be restored to original conditions at the Contractor's expense.
- D. Weather: Do not sow seed or hydroseed during high winds.
- E. Coordination: Coordinate with all other installers working in the area.
 - 1. Coordinate with installers and installation of transformers to minimize replacement of existing prairie seeding. When transformers are installed, have the Contractor mark the path of any conduit traversing the existing landscape area.
 - 2. Coordinate with installers to minimize destruction or compaction of existing sod or seed areas and areas of new prairie seeding
 - 3. Schedule a meeting with the Architect to determine any additional damaged seeded or sodded areas to be replaced.
- F. Permits: Obtain, fill out and submit Highway Permit Forms and Highway Permit Bonds for Illinois Department of Transportation (IDOT), or other local governing agency, and obtain approval to plant or perform other operations in the right-of-way.
- G. Notices Required: Prior to or immediately following application of lawn care products, post all points of entry a white marker consisting of a 4" x 5" sign attached to a dowel or supporting device, at least 12" above the turf. The marker shall state with application -- Stay off Grass until Dry -- For information, Contact: (Insert your name and business phone number).
- H. Planning: Plan ahead for hydroseeding of native no-mow areas which require operations over several months.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Replacement Sod: This specification is for the replacement of sod which may become damaged with the work of this Project. All sod shall conform as follows:
 - 1. Variety: Salt Tolerant Sod, mineral grown with the following percentages of seed: 30% Buffalo Grass, 20% Amigo or Galway Turf Type Tall Fescue, 15% Dawson Creeping Red Fescue, 15% Scaldis Hard Fescue, Fufts Puccinella Distans, and 5% Rugby Kentucky Bluegrass.
 - 2. Quality: The sod used shall be mineral grown grass that is native to the locality of work. It shall be either nursery-grown or field grown and be well rooted. Sod that has been grown on soil high in organic matter, such as peat sod, is not acceptable quality. The consistency of adherent soil shall be such that it shall not break, crumble, or tear during handling and placing of sod. Each piece of sod shall be well covered with turf grass,

free from noxious weeds and other objectionable plants, and shall not contain substances injurious to growth. The grass shall be cut to a length of not less than 1-1/2", nor more than 4" before the sod is cut.

3. **Size, Thickness and Strength:** Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths is 5%. Sod pads shall not be broken, torn or have uneven ends. Sod shall be machine cut at a uniform soil thickness of 3/4", plus or minus 1/4", at the time of cutting. Measurement for thickness shall exclude top growth and thatch. Standard size sections of sod shall be strong enough to support weight and retain size and shape when suspended vertically from a firm grasp on the upper 10% of the section.

B. Seed Mixes: All seed shall conform as follows:

1. **Quality:** All seed shall be pure live seed, guaranteed by the vendor in writing to be true to name and variety. Supply all inoculants recommended by seed vendor.
 - a. **Source:** All grass seed shall be obtained from local sources which occur in USDA Zone 5A or Zone 4, USDA Plant Hardiness Zone Map, January 1990 edition.
2. **No Mow Native Seed Mix:** See Drawings for No-Mow Native Seed Mix Schedule, including Permanent Grasses, Forbs, Cover Crops and Seeding Rates.
3. **Design Basis Supplier:** Cardno Native Plant Nursery. Phone: 1-574-586-2412; or approved equivalent.

C. Sod Fertilizer: Triple superphosphate fertilizer to encourage root growth, applied and worked into the soil at the rate of 2-1/2 pounds per 1,000 square feet, or per soil test.

E. Maintenance Materials:

1. **Weed Killer:** A broad-leaf, broad-spectrum herbicide, not a pre-emergent, appropriate to the treatment of the specific pest, applied by licensed personnel per manufacturer's recommendations.
2. **Fungicide:** A fungicide appropriate to the treatment of the specific fungus identified as a pest, applied by licensed personnel per manufacturer's recommendations.
3. **Insecticide:** An insecticide appropriate to the treatment of the specific insect identified as a pest, applied by licensed personnel per manufacturer's recommendations.
4. **Commercial Fertilizers:** Complete fertilizer, uniform in composition, free flowing with elements partially derived from organic sources, and suitable for application with approved equipment.
 - a. **For General Maintenance:** For up to two years, type and application rate shall be determined by testing agency's soil test but may contain the following percentages by weight: 10% nitrogen, 10% phosphorous, and 10% potash.
 - b. Applications made after two years following installation shall contain no phosphorus unless a soil test shows the soil to be deficient in phosphorous.

PART-3 - EXECUTION

3.1 PREPARATION

- A. **General:** Prior to installation, clear surfaces of all stones larger than 1-1/2" in diameter, and all trash, debris, roots, brush, wire, grade stakes and other objects that would interfere with planting or maintenance operations. Keep prepared soil in friable condition by cultivation until

work in this section is installed.

1. Replacement Sod or Seed: Replacements shall be same as specified sod where existing sod is damaged, or specified prairie seed where existing seed is damaged.
- B. Verification of Grades: Verify grades established during final soil preparation as being true to finish contours shown and maintain such areas until the effective date to begin installation. Level any undulations or irregularities in the surface resulting from fertilizing, liming, tilling, or other causes. Reconstruct flooded, washed out areas or areas damaged otherwise and reestablished grades in accordance with the Contract Documents.
- C. Treated Soil: Do not place sod or seed on soil which has been treated with soil sterilizers until sufficient time has elapsed to permit dissipation of toxic materials. The Contractor shall assume full responsibility for any loss or damage to sod or seed arising from improper use of sterilizers or due to his failure to allow sufficient time to permit dissipation of toxic materials, whether or not such sterilizers are herein specified.
- D. Sod Season: The spring season for sodding lawns shall be from workable ground conditions and sod can be cut, from approximately April 1 through June 30; and from August 15 to November 15. Sod shall be placed when the ground is in a workable condition and temperatures are less than 95 degrees Fahrenheit. "Workable" ground condition is defined as ground conditions which are neither frozen nor muddy. Sod shall not be placed when the sod or ground surface is frozen or during extended drought. Special conditions exist which may warrant a variance in the sodding dates. Submit a written request for such variance to Architect.
- E. Hydroseed:
1. Season: The seasons for hydroseeding native turf shall be from workable ground conditions, from approximately April 15 through May 15; and from September 1 through October 1. Seed shall be placed when the ground is in a workable condition and temperatures are less than 95 degrees Fahrenheit. "Workable" ground condition is defined as ground conditions which are neither frozen nor muddy. Seed shall not be placed when the ground surface is frozen or during extended drought. Special conditions exist which may warrant a variance in the seeding dates. Submit a written request for such variance to Architect.
 2. Ground Preparation: Ground preparations shall start with complete removal of all existing vegetation in areas to be seeded by using a broad spectrum herbicide by licensed applicator. Wait until herbicide residue is inactive, per manufacturer's recommendations.
 3. Tilling: Till the soil repeatedly at regular intervals 2-3 weeks apart for a minimum period of two months prior to hydroseeding. If ground is wet, allow surface to dry before proceeding.
 4. Repair and stabilize any eroded areas as work progresses and de-compact any areas of concern.
 5. For persistent vegetation, selectively apply targeted herbicide and wait until herbicide residue is gone, per manufacturer's recommendations.
 6. Top surface of seedbed shall be pulverized to present a smooth, uniform, loose, well-broken and fine-grained soil, finish graded, with all large clods, boulders, earth balls, stumps, large roots, or other materials which would interfere with the work removed.
 7. Calibration: Calibrate hydroseeders and adjust to sow seeds at specified rate.
 8. Slopes: All slopes steeper than 4:1 shall receive a light application of wood fiber mulch.

- F. **Moistening the Soil:** During periods of high temperatures and after all unevenness in the soil surface has been corrected, the soil shall be lightly irrigated immediately prior to laying the sod or hydroseeding.

3.2 INSTALLATION

A. Sod:

1. **Laying the Sod:** Lay sod so that no voids occur, tamp and roll, and then thoroughly water. The completed sodded surface shall be true to finished grade, even and firm at all points. Lay the first row of sod in a straight line with subsequent rows placed parallel to and tightly against each other. Stagger lateral joints to promote more uniform growth and strength. Do not overlap or stretch sod. Butt tight all joints in order to prevent voids which would cause air drying of the roots.
 - a. **Slopes:** Place sod in ditches with the longer dimension perpendicular to the flow of water in the ditch. Place sod on slopes, starting at the bottom of the slope, with the longer dimension parallel to the contours of the ground. Bury the exposed edge flush with the adjacent sod.
 - b. **Staking:** On slopes where the sod may be displaced during sodding operations, work from ladders or treaded planks. Stake sod on all slopes of steeper than 3:1, with not less than four stakes per square yard, and with at least one stake for each piece of sod. Drive stakes, with the flat side against the slope, 6" into the ground, leaving approximately ½" of the top above the ground.
2. **Watering and Rolling:** Water sod immediately after installation to prevent excessive drying during the progress of the work. As sodding is completed in any one section the entire area shall be rolled. Thoroughly irrigate to a depth sufficient that the underside of the new sod pad and the soil immediately below the sod are thoroughly wet.
3. **Edges:** Where sod abuts hard edging, such as sidewalks, curbs, steel or wood edges, butt sod tightly to edge, leaving no gaps. Where sod abuts soft edge, such as at plant beds or tree pits, trim sod to form a neat line, accurately placed according to the Drawings. Where sod edge is shown as parallel or perpendicular, construct edge straight and true to line to within one inch tolerance. Where sod edge is shown as curvilinear, blend edge to create a smooth line with no bumps.

B. Hydroseeding: Hydroseeding is required. Increase seed count and application rate for hydroseeder as recommended by supplier.

1. **Protect adjacent fences and other surfaces from spray.**
2. **Equipment:** Use hydraulic equipment equivalent to that of Hydro-Turf Model 900.
3. **Operations:** Spray a uniform coat of homogenous slurry with green tint over area to be hydroseeded, including all areas of natural vegetation which have been disturbed by the construction process. Apply in multiple operations if required and operate equipment so as to accomplish complete coverage. Do not over-spray.
4. **Watering:** Watering period shall begin immediately following seeding operations and shall continue for a period of at least three weeks, or until a successful stand has established. A fine mist shall be used for initial watering that will not disturb the seed. It shall be the Contractor's responsibility, until acceptance, to provide all watering required for full germination and growth. Keep turf damp at all times until seed is well germinated. Carefully water as frequently as soil and site climate conditions require for maximum growth and coverage.

3.3 POST-INSTALLATION OPERATIONS

- A. Control of Weeds: Hand weed, if necessary, all turf areas to promote growth of desired species. Protect new turf from trampling. Selectively apply selective herbicide to pervasive weeds in native areas.
- B. Native and bio swale areas shall be mown three times, approximately 4-6 weeks apart after full germination by the installer.
- C. Re-Seeding: Immediately re-seed all areas not fully germinated, (areas larger than 60 square inches which fail to show 70% germination) prior to Architect's review.

3.4 REPAIR AND CLEANING

- A. Disposal of Surplus Material: Surplus and waste materials resulting from sodding and hydroseeding operations shall be disposed of by the Contractor daily as the work progresses.
- B. Protection: Protect turf against damage, including erosion and trespass, and provide proper safeguards as needed. Replant damaged areas. Repair or replace all such defective work, and all other work damaged thereby, which becomes defective during the term of the specified warranty.
- C. Replacements: Replace, without cost to the Architect, as soon as weather conditions permit and within a specified sodding or seeding period, all areas not in a vigorous, thriving condition, during and at the end of the warranty period. "Vigorous and thriving condition" is defined as turf which bears foliage of a normal density, size and color. Replacements shall closely match adjacent specimens of turf. They shall be furnished, planted, maintained and warranted as specified, and shall be subject to all requirements stated in this Specification. Make all necessary repairs due to replacements at no extra cost to the Architect.
- D. Patching: In the circumstance whereby the Owner requests repair of an area which has been accepted and then damaged by others, the Contractor shall repair said areas designated by the Architect, upon issuance of a written change order which specifies the cost to the Architect. Turf repair shall be accomplished in a manner which shall cause a minimum of disturbance to the existing stand of grass. This work shall be installed, maintained and warranted according to the same conditions as specified herein.

3.5 MAINTENANCE

- A. Maintenance Period: Perform landscape maintenance of turf areas, as specified hereunder, for the following periods:
 - 1. Initial Maintenance: Maintain each area until Substantial Completion and the warranty period is formally started. Maintenance shall begin immediately upon delivery to the site and as each portion is installed and shall continue for the specified period. Initial maintenance for seeded areas shall take place until the third mowing is complete.
 - 2. First Year Maintenance: Perform landscape maintenance of work covered by this section for a period of approximately one year commencing with Substantial Completion and coinciding and terminating exactly with the First Year Maintenance of the plant materials. First year maintenance for seeded areas shall start from the third mowing and end at the termination of the First Year maintenance for plantings.

- B. Work Subject to Maintenance: Perform work for the following portions of the site or the work:
1. Initial Maintenance: The work installed under this contract.
 2. First Year Maintenance: The work installed under this contract,
- C. Landscape Maintenance Season: The landscape maintenance season is defined as the months during which landscape maintenance operations are required and extends from April 1 to November 30 of any given year. When substantial completion occurs after April 1, the season extends from substantial completion through November 30.
- D. Turf Maintenance: Maintain all turf areas by inspecting, watering, weeding, replanting, mowing, trimming, edging, and other operations necessary to keep lawn areas green and uniform in appearance. All maintenance which is termed "annual" means those operations which take place yearly by the maintaining Contractor as specified under "Maintenance Period" herein. Monthly inspections of seeded areas is required; submit recommendations to Owner.
1. Annual Soil Tests: Turf soil shall be tested once a year at the beginning of the season in several locations for pH and essential nutrients. Submit test results and lab recommendations to the Owner.
 2. Watering: The Contractor shall provide all necessary watering to insure the success of all lawn areas. During the first week, keep sod pads and seeded areas moist at all times. In the absence of adequate rainfall, perform watering daily or as often as necessary during the first week, and thereafter for another week in sufficient quantities to maintain moist soil to a depth of at least 4". In subsequent weeks, water sod and seed areas as required to maintain adequate moisture in the upper inches of the soil necessary for the promotion of deep root growth. Water prior to the heat of the day to prevent wilting. Watering is required prior to acceptance of the work. Water at the rate necessary to keep installed sod and seed in thriving condition, as defined hereinabove.
 - a. Monitor Moisture: Monitor the application of water to prevent any too-dry or too-wet condition from occurring. Report immediately any excessive moisture condition to the Architect. If an automatic watering system is used, monitor and correct timing, frequency, and usage. Provide watering in those areas not covered by the irrigation system. The Contractor shall be so familiar with the state of sod and seed area moisture that he shall notify Architect immediately if sod or seed is endangered.
 3. Weed Control: Inspect turf areas for weed infestations at least monthly. Keep sod and seed areas free from weeds. If weeds or other undesirable vegetation threaten to smother the planted sod or seed, spray or drench said vegetation with weed killer, or in the case of rank growth, uproot manually, rake and remove from the site. If weed killer is used, apply per manufacturer's recommendations. Sprinkling shall not resume for a 24 hour period following application, or as manufacturer recommends. Contractor shall notify Owner and Architect of his intent to use weed killer.
 4. Sod Mowing: The first mowing shall not be attempted until the sod is firmly rooted and secure in place. Perform all mowing in a neat and orderly manner. Remove no more than 1/3 of the grass leaf. Grass height shall be maintained between 1-1/2" - 2-1/2" unless otherwise specified, with frequency of cuttings to be determined by growth rate of sod. Keep mowers sharp and in good adjustment. Cut sod cleanly and sharply, mow evenly so that no ridges are evident. All clippings shall be caught and removed from the site.
 5. Initial Mowing of Seeded Areas: Mowing can begin after establishment of the stand and

continue until close of the season the year it is seeded. If sown in the Spring, maintenance shall include 3 mowings by rotary mower for control of weeds, at specified heights. The approximate schedule shall be as follows but may be modified to earlier dates if conditions exist where weed are setting seed:

- a. August 15 - September 1: 6" minimum
 - b. September 15 - October 1: 6" minimum
 - c. October 15 - November 1: 12" minimum
6. Edging and Trimming: All turf areas adjacent to paving or cultivated areas shall be kept neat and attractive by edging and trimming. Under no circumstances shall the Contractor trim at the base of trees with a "weed eater" type of trimmer.
 7. Pest Control: Control of pests such as insects or fungus diseases shall be done as required to keep sod and seed areas in a thriving condition with appropriate spray applied by licensed personnel per manufacturer's recommendations. Notify Owner of intent to spray prior to performing this work.
 8. Annual Fertilization: Apply to all sod areas per soil test recommendations, in mid-spring after early flush of growth and again during late summer or early fall. Turf fertilizer application shall be limited to the outside of tree root zones.
 - a. Two years after installation, fertilizer applications of phosphorus are only permitted when soil tests indicate a deficiency of phosphorous in the soil.
 9. Annual Clean-ups: Annual clean-ups in sodded and seeded areas are included in maintenance.
 10. Clean-up: Cleaning operations shall be performed at least daily during and after all maintenance operations, so that the project site is kept in a neat and tidy condition at all times.

END OF SECTION 32 91 01

SECTION 32 93 11 -- LANDSCAPE PLANTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Landscaping work as shown and specified.

1. All Plantings of every description shown on the Drawings.
 - a. Work includes removal and replacement of any trees which are in the way of the installation of transformers or are damaged by construction. Although the trees which are likely to be in the way are identified on the Drawings, all existing trees are subject to this requirement. See Drawings.
2. Soil work, including agronomic soil testing, supplemental topsoil, amendments and soil mixes.
3. Water Supply: Provide all temporary water supply from source(s) on or off site. See Drawings.
4. Warranty: Warranty plants for one year.
5. Initial Maintenance: Maintain plantings through Substantial Completion of the landscape work.
6. First Year Maintenance: Provide landscape maintenance for the Project for one year, starting with substantial completion and exactly coinciding with the landscape guarantee period.

B. Related Sections include the following:

1. Applicable provisions of Division 01 – General Requirements shall govern work under this specification section.
2. Applicable provisions of “Owner” General and Detailed Technical Specifications utilized for this project.
3. Section 01 81 13 - Sustainable Design Requirements
4. Section 01 81 13.13 -- Sustainable Design Requirements.
5. Section 31 13 00 - Landscape Removal, Pruning & Protection.
6. Section 32 92 01 – Sod and Seed.
7. Environmental Soil Testing: Division 31 Section "Acceptance of Backfill, Topsoil and CU Structural Soil."

1.2 SUBMITTALS

- A. LEED Submittals: Product Data as required to show compliance with LEED MR Credit Sourcing of Raw Materials, meeting all documentation requirements, including back-up documentation.
- B. General: Submit samples and descriptions of materials to the Architect. For samples of plant materials see "Review" hereinafter. Delivery of materials may begin only after descriptions or samples have been approved.

- C. Plant Sources: Submit list of sources for plant material to be provided, with any deviations to size or variety noted, and coordinate directly with landscape Architect a tagging schedule with appointments arranged in geographic sequence, by:
1. Time and date of appointment.
 2. Nursery name, contact, location and phone number. Include name and location of nursery of origin for all imported, pre-dug material.
 3. Plant name, variety, size, and quantity to be tagged at proposed nursery.
 4. All varieties and sizes confirmed as specified.
 5. Or if not as specified, evidence that plant cannot be found and proposed substitution alternatives.
- D. Submit photographs of proposed plant material taken in the nursery where they are grown prior to requesting inspection and tagging.
- E. Comply with State of Illinois and federal laws with respect to inspection of all plants for plant diseases and insect infestation. Submit an inspection certificate, required by law to this effect, with each shipment.
- F. Samples:
1. Submit samples and certified analyses by recognized laboratory for humus, fertilizer, organic matter, commercial fertilizer, soil conditioner, amendments and each source of supply prior to the beginning of work under this Section. The manufacturer's analysis for standard products will be acceptable.
 2. For all topsoil materials, submit one representative soil samples of each topsoil proposed for use, whether imported and/or existing in stockpile on site to an agronomy laboratory certified by the Illinois Environmental Protection Agency and provide well-labeled analysis results with agronomist's name and signature, lab address and phone number, to the Architect for approval. Each sample shall be taken from three different locations of each proposed topsoil. Retest imported topsoil until acceptable topsoil is achieved.
 - a. Supplemental topsoil is required.
 - b. Coarse sand to be used as soil mix component.
 3. Review shall not be construed as final acceptance. The Architect may take samples of materials delivered to site and analyze them for compliance with specifications.
 4. Do not deliver topsoil to site, or spread existing topsoil, until amendments are determined, and soil is approved.
- G. LEED Soil Restoration Requirement: Submit source for topsoil. No topsoil shall be imported from greenfield or farm sites.
- H. Topsoil:
1. Data: Submit to Architect the location of all properties from which supplemental topsoil is to be obtained, approximate quantity available from each, names and addresses of owners of the said properties, and depth to which soil shall be taken.
 2. Soil Mix Materials: Submit one quart size plastic container with specified soil mix ingredients, such as sand, organic matter, etc.
 3. Fill Material: Submit product data consisting of certification that each material proposed for use complies with specified requirements.

- I. Soil Test Analysis:
1. Submit copies of test analyses for imported topsoil and existing topsoil from site.
 2. Soil testing required in this Section shall be performed by an agronomy lab and is not the same as other environmental testing which may be required in other Sections for imported soils.
 3. Submit soil test results at least two months prior to planting. If imported topsoil does not meet required analysis, submit for an alternate source of topsoil.
 4. Provide a mechanical analysis and a complete chemical analysis as described below of the following:
 - a. Any existing soil proposed for use left in place. Label the report "Existing Topsoil."
 - b. Any supplemental topsoil proposed to be imported to the site. Label the report "Supplemental Topsoil."
 5. The date of the topsoil analysis shall be within 60 days of importing soil to the site.
 6. The mechanical analysis shall include the percent of sand, silt and clay.
 7. The chemical analysis shall include:
 - a. Base: pH, conductivity (measure of soil salinity) and percent organic matter.
 - b. Anions: Sulfur, phosphorous and nitrate-N,
 - c. Cations: Potassium, calcium, magnesium and sodium.
 - d. Minor Elements: Iron, zinc, manganese, copper, boron and aluminum.
 - e. CEC (cation exchange capacity)
 8. Include in the analysis the agronomist's recommended amounts of the following needed to bring the topsoil into compliance with the requirements of this Section. Agronomist's recommendations shall include:
 - a. Amendments for pH to achieve a range of 6.8 to 7.2.
 - b. Amendments for soil composition and texture to achieve sandy loam to loam classification.
 - c. Amendments for organic matter to achieve 3-5% after amending for soil texture.
 - d. Fertilizer required for healthy growth of plants.
 - e. Other soil conditioners, such as gypsum, that may be helpful for plant growth.
 9. The Architect reserves the right to interview the agronomist regarding recommendations and to modify recommendations if not deemed responsive to the specifications.
 10. Furnish 5 copies of test analysis reports.
- J. Infiltration/Percolation Test Results: Perform infiltration/percolation tests in tree pits, by filling pits with water. Achieve an infiltration rate of at least 75 mm within 4 hours, or a percolation rate of 100% within 24 hours. Submit 5 copies of test results to Architect.
- K. Compaction Test: Perform a bulk density test on existing soil in area of the site where trees will be planted, measured as grams per cubic centimeter. Achieve bulk density between 1.40 to 1.65 g/cm, or if Proctor tested, 75-85%. Submit 5 copies of test results to Architect.
- L. Submit two copies of written landscape maintenance instructions for care of installed plants to be turned over to Owner after Substantial Completion.

1.3 QUALITY ASSURANCE

A. Ability to Deliver:

1. Investigate sources of supply and confirm they can supply plants specified on plant list in sizes, variety, growth characteristics, and quality noted and specified before submitting bid. Failure to take this precaution will not relieve responsibility for furnishing and installing plant material in accordance with Contract requirements.
2. Substitutions may be permitted only upon submission of written proof that specified plant is not obtainable locally. Such substitutions may be made upon written authorization by Architect.
3. Furnish and install plants shown on drawings in quantity, size, growth characteristics and quality designated.

B. Inspection:

1. Pre-Tagging Material and Selected Specimen: All trees, and plants identified as "selected specimen," shall be approved and pre-tagged at their place of growth from a source in Northern Illinois or Southern Wisconsin. See Drawings.
2. Submit photos of plant material as grown in the nursery for preliminary review by Architect. Select and pre-tag plant material before requesting inspection by Architect.
3. In addition to review of plant material photographs, Architect may inspect plant material at nursery. Such inspection shall be in addition to inspection at job site.
 - a. If plants and materials required to be inspected are located outside radius of 100 miles from Project site, Architect's direct and indirect cost including normal profit shall be borne and paid by Contractor.
4. Written Requests: Written requests for inspection of plant material at their place of growth shall be submitted to Landscape Architect 2 months prior to digging. Written requests shall state the place of growth, quantity of plants to be inspected, and confirmation of available quantity in specified variety, size and growth characteristics. The Landscape Architect may refuse inspection at this time if, in his/her judgment, a sufficient quantity of specified plants is not available for inspection.
 - a. Arrange initial tagging of all trees to be tagged within one or two days, from a minimum number of sources.
 - b. Arrange for back up sources of supply in the event that reviewed plants do not conform.
5. Upon delivery and before planting request inspection of plants by Architect.
6. Inspection and approval is for quality, size, and variety only, and in no way impairs right of rejection for failure to meet other requirements during progress of Work. All materials furnished for the work shall conform in every respect to reviewed samples.
7. Plants which do not conform shall be removed from the site and immediately replaced with conforming material at Contractor's expense.
8. The Contractor shall be present during required inspection or as may be required by Architect.
9. Furnish Certificates of Inspection as may be required by law to accompany shipments prior to acceptance of material.

- C. Qualifications of Installer: A single installer, performed by a Landscape Contracting firm which has a minimum of 5 years of experience successfully completing projects of a similar size and value, and supervised by an on-site full time IGIA Certified Landscape Technician, for soil preparation, sod and landscape plantings installations.
- D. Perform planting by personnel familiar with accepted landscape planting procedures. A qualified foreman, with a minimum of 5 years of experience installing plant material is to be on-site during planting procedures.
- E. Reference Standards:
 - 1. Provide specified analyses and tests of topsoil, fertilizer and humus in accordance with requirements of Association of Official Agricultural Chemists.
 - 2. Plant names used in plant list are in accordance with "Standardized Plant Names," published by American Joint Committee on Horticulture Nomenclature (current edition).
 - 3. Size grading standards of plant materials shall be in accordance with American Association of Nurseryman, Inc., (AAN) Code of Standards ANSI Z60.1.
- F. Agronomic Soil Testing: As soon as possible upon award of contract, employ at no additional expense a soil testing agency acceptable to the Architect. Using methods approved by the Association of Agricultural Chemists, conduct all tests, interpret results and prepare reports specified herein for topsoil to be provided.
 - 1. Each report shall state whether or not the test specimens conform to all requirements of the Contract Documents and shall specifically note any deviations there from.
 - 2. Contractor shall secure this test in a timely fashion.
 - 3. The date of the topsoil analysis report shall be within 60 days of the importing of such materials to the site.
 - 4. On the basis of the above tests, soil amendments other than those specified herein may be authorized.
 - 5. If samples of supplemental topsoil fail to meet requirements, find alternate sources and submit new test results.

G. Other Tests:

1.4 PRODUCT DELIVERY, STORAGE, AND HANDLING

- A. Delivery Handling and Storage of Soil Mix Materials: Do not deliver, amend, place, spread, or grade topsoil while in a frozen or muddy condition. Coordinate staging areas for soil mix materials with Architect.
- B. Pre-Tagged Plant Materials: The Contractor shall arrange and be responsible for the successful movement of all plant materials which are pre-tagged. Arrange for plant materials to be picked up and shipped from the nursery to the site, or an alternative off-site location if the site is not ready. Take up all questions regarding plant material shipping with the nursery prior to shipment taking place. Document all conversations with the nurseryman and submit them to the Architect prior to shipment. Plants shall be dug, handled, shipped, held, and maintained at a location acceptable to the Architect as specified herein.
 - 1. Shipped Material: Carefully protect all plant material which is shipped from heat, freezing, desiccation and injury during transport.

2. Out of State Tagging: If out of state material sources are accepted, the entire cost of travel for the Landscape Architect will be borne by the Architect. Arrangements for travel will be made by the Landscape Architect at the Landscape Architect's convenience.
- C. Preparation for Delivery:
1. Balled and Burlapped (B&B) Plants: Low profile package trees are required.
 - a. Dig and prepare for shipment in a manner that will not damage roots, branches, shape, and future development of plant.
 - b. Originate from soil which will hold a firm ball when wrapped with burlap or similar material, bound with twine or cord so as to hold balls firm and intact. Treated burlap or nylon ropes around balls are not acceptable.
 - c. Ball Sizes: Not less than the standard established by AAN.
 - d. Drumlace plants 2 in. in caliper and over.
 - e. Plants moved with a ball will not be accepted if the ball is dry, cracked, or broken before or during planting operations.
 2. Potted or Container Plants: Provide container to hold ball shape protecting root mass during delivery and handling.
 3. Freshly Dug: All plants shall be freshly dug. Heeled-in plants or plants from cold storage will not be accepted. All nursery grown plants shall have been transplanted or root pruned at least once in the last 3 years.
- D. Delivery:
1. Plant Material: Take precautions in accordance with best trade practices to ensure the arrival of plant material at job site in good condition and without injury. Cover plants to prevent drying, transit disease or injury. Do not ship diseased or infested plant material.
 2. During shipment, all plants shall be properly protected by a shade tarpaulin of approximately 90 percent shade material. No plant shall be so bound with rope or wire at any time as to damage the bark, break branches or destroy its natural shape.
 3. Broken branches, bruised bark, broken balls or other damage shall constitute grounds for rejection. Handle plants from bottom of root ball only. Protect all plants from drying out. Do not transport plant materials in sub-zero weather. No plant with a frozen ball shall be accepted.
 4. Pruning: Do not prune before delivery or prior to planting or transplanting. New plants which show evidence of having been pruned or new trees which have fresh cuts of limbs over 1-1/4" not completely calloused shall be rejected.
 5. Fertilizer: Deliver fertilizer to site in original, unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law.
 6. Maintenance Materials: Deliver anti-desiccant spray in containers of the manufacturer; mix and use according to manufacturer's direction. Deliver insecticide spray in the manufacturer's containers; mix and spray according to manufacturer's directions. Deliver fungicide in manufacturer's containers; mix and apply according to manufacturer's directions only with the acceptance of the Architect. Deliver herbicide in the manufacturer's containers; apply per manufacturer's directions, only with the acceptance of the Architect.
 7. Other Materials: Store all other materials so as to keep them clean and protected from damage, in accordance with manufacturer's recommendations.

Notify Architect, a minimum of 24 hrs before delivery of plant material. Failure to notify Architect in advance, in order to arrange proper scheduling may result in loss of time or removal of plant or plants not installed as specified or directed.

8. Each shipment shall be accompanied by an invoice showing sizes and varieties of plants included in each shipment. Provide copy of invoice to Architect upon delivery of plant material.

E. Storage:

1. Plant Material:

- a. Set plants which are not to be planted within 4 hours on ground and heal in with peat, soil, mulch or other media, out of construction traffic.
- b. Protect roots of plant material from drying or other possible injury.
- c. Water plants as necessary until planted.
- d. Plants shall not remain unplanted for longer than 3 days.

2. Store fertilizer, humus, and spray materials in weatherproof storage areas in such a manner that their effectiveness will not be impaired.

1.5 JOB CONDITIONS

- A. Pre-installation Conference: Conduct preconstruction conference at the project site in compliance with requirements of Division 1 Section "Project Management and Coordination."

1. Review maintenance procedures for surrounding streets, walks, paving and site amenities.
2. Review procedures for work on public property.
3. Review plant locations and procedures for adjustment.
4. Coordinate timely soil installation for hydroseeding which will require operations over several months.

- B. Topography: Refer to existing grades, new grades for adjacent pavements, and new landscape grades shown on the Drawings. Data on existing elevations, grades, structures or other topographic features of the site were determined by a topographic survey. The data are not intended as representations or warranties of exact conditions that may be encountered at the time of construction. It is expressly understood that the Owner and Architect will not be responsible for interpretations or conclusions drawn there from by the Contractor. The Contractor shall examine the construction site, coordinate his work with the General Contractor and determine, to his own satisfaction, the existing conditions under which construction shall proceed.

- C. Construction Survey Staking: Provide field surveys for landscape finish grading at appropriate intervals to meet required grades.

- D. Review of Subgrade: Subgrade acceptance is subject to depths described herein, and the following conditions.

1. Confirm Subgrade Elevations: Confirm required subgrade elevations to within 1/10 foot tolerance. Refer to Drawings Soil Plans and Details for required depths.

2. Confirm Compaction: Inspect subgrade and all embankments to depth of 12", checking composition and stability. Fill material encountered within planting areas shall be "Suitable Subgrade Fill Material". Confirm compaction at subgrade, as follows, and notify Architect of any discrepancies before proceeding with work.
 - a. Under plant beds: 85%
 - b. Under pedestrian paved areas: 90 - 95%.

- E. Coordination: Coordinate with all other installers working in the area.
 1. Coordinate with installers and installation of transformers to minimize removal and replacement of existing trees. When transformers are installed, have the Contractor mark the path of any conduit traversing the existing landscape area. Schedule a meeting with the Architect to determine any additional damaged trees to be replaced.
 2. Coordinate with installers to minimize destruction or compaction of areas to receive new landscape areas, including areas to receive new planting or seeding.

- F. Protection of the Drainage Courses: Prevent damage to drainage courses including soil separator fabric during topsoil placement and grading operations.

- G. Protection of Adjacent Property and Dust Control: Prevent any substances from blowing, spilling, dropping, or depositing on adjacent property. Keep soil materials off of constructed retaining walls. Keep the construction area sufficiently dampened to control dust caused by operations.

- H. Excavation Around Existing Utilities: Data on the location and nature of existing and proposed utilities, as shown on the Drawings, are made available solely for the convenience of the Contractor. Neither the Owner nor the Architect guarantees the accuracy or completeness of the data. The Contractor shall investigate the location, size, depth and nature of all utilities which may interfere with his work. Stake locations with Utility Owner, report discrepancies and consult with Utility Owner and Architect immediately prior to proceeding with work.
 1. Utilities to Remain: If utilities are to remain in place, protect them from damage, and repair them if damaged to a condition satisfactory to the Utility Owner and Architect, at no additional cost to the Owner.
 2. Utilities to be Removed: If utilities are to be removed, they shall be demolished and completely removed from the site. Consult with the Architect and Utility Owner before any utility services are shut off or disconnected.
 3. Excavation in Gas Easements: Notify Architect immediately if plants are designated for locations on or near gas easements. All excavation located on or near gas easements shall be hand-dug only after utility is staked and depth known. Exercise all caution according to utility owner recommendations and industry standards necessary to insure safe operations.

- I. Planting Seasons:
 1. Spring Planting: From time soil becomes workable to June 15. Fall Planting: September 1 to November 15. Plant evergreen shrub plantings no later than November 1. Plant evergreen tree plantings no later than October 15. Plant perennial and groundcover plants no later than October 1.
 2. Summer Season: June 2 through August 31. Planting shall be considered unseasonable and shall require approval by the Architect. Approval to plant under

- such conditions shall in no way relieve the Contractor from the guarantee provisions of these specifications.
3. Container Plants: Planting season designated above may be extended for container grown plants when approved by the Architect.
 4. Digging Season: Dig plants labeled "Spring only" during the Spring season only; or, only with acceptance of Architect, may be pre-dug or stage dug.
- J. Plant only when weather and soil conditions are suitable in accordance with the best practices of industry.
- K. Protection:
1. Protect planted areas against damage by other work.
 2. Any barricades or temporary fencing and signs shall be maintained until acceptance. Upon final acceptance of the work, remove said barricades or temporary fences, or leave them if so desired by the Owner.
 3. Replace, repair, re-stake or replant sod or plantings which are damaged. Damage to existing structures, utilities, trees, lawns, shrubs, pavements or other property caused by the Contractor shall be restored to original conditions at the Contractor's expense.
 4. Protect lawn areas, and repair damage resulting from planting operations.
- L. Permits: Obtain, fill out and submit Highway Permit Forms and Highway Permit Bonds for Illinois Department of Transportation (IDOT); Chicago Bureau of Forestry, and other local governing agency, and obtain approval to plant or perform other operations in the right-of-way.
- M. Utilities: Have Utility Owners stake locations prior to excavation of plant pits or beds. The Contractor shall be responsible for locating all underground utilities and shall take all necessary precautions not to disturb or damage these utilities.
- N. Wherever landscape work is executed in conjunction with other work, arrange the schedule that will permit execution of landscape work as specified.
- O. Due to LEED performance requirements, the soil and plantings will need to be delegated design to achieve the performance criteria for soil pH, bulk density, infiltration, etc.

PART 2 - PRODUCTS

2.1 PLANTS

- A. Refer to the Plant List, or Drawings, for specific types and quantities of plants to be furnished. Quantities are included for convenience only. In the event that discrepancies occur, the actual plant designations as drawn on the Drawings shall govern.
1. Replacement Trees: Replace existing trees removed for transformer installation and all trees otherwise damaged by construction with new trees of same species, variety and size as existing trees prior to being removed or damaged. Record damage as it occurs and submit photographic evidence to Architect. All replacement trees are subject to the same requirements for trees as specified in this Section.
- B. General:

1. Provide plant material nursery grown in northern Illinois or within same hardiness zone as project site or have been acclimated to conditions of same hardiness zone for minimum of two years or growing seasons. Hardiness zones shall conform to "Zones of Plant Hardiness" as provided by U.S. Department of Agriculture.
2. Unless specifically noted otherwise, provide plants of selected specimen quality, have normal habit of growth and be sound, healthy, vigorous plants with well-developed root systems, free of disease, insect pests, their eggs or larvae, and injuries. They shall be of specimen quality, exceptionally heavy, symmetrical, tightly knit and so trained or favored in development and appearance as to be unquestionably and outstandingly superior in form, number of branches, compactness and symmetry. Under-grown, overgrown or root bound plants are not acceptable quality. All plants shall show evidence of satisfactory growth prior to Final Acceptance.
3. Do not prune before delivery. Prune only at time of planting.
4. Trees shall have a single leader. Trees which have damaged, crooked or multiple leaders, are not acceptable unless specifically specified. Trees with abrasion of bark, sun scalds, disfiguring knots, or fresh cuts of limbs over 1-1/4 in., which have not completely calloused, are not acceptable.
5. Shrubs shall be full plants with many branches after planting, as described above. Bare root plants shall have many fine hair-like roots. Container plants shall be thoroughly rooted within the container, but not root-bound.
6. Plants shall be freshly dug, balled and burlapped or container grown. No bare root, heeled-in plants or plants for cold storage will be accepted, except as otherwise specified, unless Contractor makes such request in writing and plants are inspected and approved.

C. Plant Name and Size:

1. Measure plants when branches are in their normal position. Height and spread refer to plant's main body and not from branch tip to branch tip.
2. Take caliper measurement at point on trunk 6 inches above natural ground line for trees up to 4 inches in caliper and at point 12 inches above natural ground line for trees 4 inches and over in caliper.
3. If range of size is given, no plant shall be less than minimum size and not less than 50% of plants shall be as large as upper half of range specified.
4. Measurements specified are minimum size acceptable and are measurements after pruning, where pruning is required. Plants meeting measurements specified, but not producing normal balance between height and spread, are not acceptable.
5. Shrubs shall be matched specimens from single block source.
6. Plants shall be true to species and variety and shall conform to measurement specified in Plant List, except that plants larger than specified may be used if approved by Architect. Use of such plants shall not result in increase in Contract price. If larger plants are approved, increase ball of earth in proportion to size of plant.
7. Where plants larger than specified have been submitted in writing for approval and approved in writing by Architect, Contractor shall assume responsibility of guarantee for plant in size as planted.
8. Labels: All plants shall be labeled with the correct plant name and size. Labels shall be securely attached to all plants, bundles, and containers of plant materials delivered.
9. Parkway and Parking Lot Trees: Trees for these areas are required by the Landscape Ordinance, shall be the minimum size specified, and the genus and species and variety specified.

- D. Substitutions: Substitution of plant materials is not permitted unless authorized in writing. If proof is submitted, substantiated in writing, that any plant specified is not obtainable, a proposal will be considered for the use of the nearest available size or similar variety with a corresponding adjustment of the Contract price.
- E. Balled and Burlapped Plants (Designated B&B):
1. Dig plants with firm natural balls of earth of diameter indicated below and of sufficient depth to encompass fibrous and feeding root system necessary for full recovery of plant.
 2. Plants having balls broken or cracked during delivery or at the time of planting will be rejected.
 3. For Evergreen trees, trunk diameter shall be used to determine minimum required ball dimensions. Minimum ball dimensions shall be those as specified for single stem trees.
 4. The diameter at top of each ball shall be diameter specified above and diameter at bottom of each ball shall not be less than 70% of specified top diameter. Top and bottom sources shall be parallel.
 5. Ball shall be of specified depth at points perpendicular to bottom of ball.
 6. Balls greater than 30" diameter shall be drum-laced.
 7. Architect may reject any plant specified as balled and burlapped which, in his opinion, fails to conform to balling requirements set forth.
- F. Container Plants and Pot Grown Plants:
1. Container grown plants shall have heavy fibrous root system, or well developed taproot, that has been developed by proper horticultural practice including transplanting and root pruning.
 2. The root system shall have developed sufficiently long for new fibrous roots to develop so root mass will retain its shape and hold together when removed from container.
 3. In no case should container strangle or girdle natural growth of plant.
 4. The diameter of spread shall determine the inside diameter of pot in which they shall be grown for at least 3 months prior to delivery.
 5. Plant container sizes shall conform to American Association of Nurseryman, Inc., ANSI Z60, 1.
- G. Deciduous (Shade and Ornamental) Trees:
1. Trees shall be limbed up six feet, prior to pruning, but no more than nine feet, and shall be matched in crown height and development.
 2. Trees shall also have crowns equivalent to 1/2 of tree height or so that crown of tree is in proportion to trunk as tree grows.
 3. Provide trees of specimen quality.
 4. All material shall be Balled and Burlapped.
- H. Perennial Forbs and Grasses:
1. Perennials and grasses specified as "container" or "pot" shall be provided as container grown plants or shall be provided with firm natural balls of earth with diameter and depth in accordance with American Standard for Nursery Stock for size specified on Plant List.
 2. See "Preparation for Delivery" in this Section.

2.2 PLANTING MATERIALS

- A. Water: Existing water supply from hose bibs at the project building may be used for all planting operations. Provide hose and equipment necessary for proper watering of plant material. Provide water at no extra cost if it is not available at the Project site.
1. See Drawings for sources of supply.
- B. Subgrade Fill Material: Suitable subgrade fill material shall be used only if required to fill in voids left by the Architect.
1. Suitable Subgrade Fill Material: Supplemental Topsoil as defined below.
 2. Existing Topsoil In Place: The area to be seeded has been topsoiled previously and that soil may be re-used specified requirements, procedures and amendments.
- C. General Requirements for LEED Soil Restoration:
1. Topsoil: No topsoil shall be imported from greenfield or farm sites.
 2. Organic Matter: Amend soils with mature stable specified compost materials such that top 12" of soil contains 3% minimum Organic Matter.
 3. Compaction: Meet required bulk densities within 100% of root zones, 30" minimum depth for tree pits and 12" minimum for seeded areas.
 4. Infiltration Rate: Achieve required infiltration rates (inches per hour) or saturated hydraulic conductivity (millimeters per second) comparable to loam.
 5. Chemistry/Biological Function: Meet required PH, cation exchange capacity indicating loam or sandy loam, and nutrient profiles with low salinity.
- D. Soils:
1. No-Mow Native Seeded Areas: Existing topsoil in place with supplemental topsoil as needed to meet existing grades if disturbed; worked and amended as specified to meet General Requirements for LEED Soil Restoration.
 3. Plant Beds for Perennials and Grasses: Supplemental Topsoil as specified to meet General Requirements for LEED Soil Restoration.
- D. Supplemental Topsoil: Topsoil shall be loamy soil from the A horizon of soil profiles of local soils or a naturally occurring natural topsoil classified as a sandy loam, typical of the site locality without a mixture of subsoil, having a pH of 6.8 to 7.3. Clay soils or topsoil contaminated with clay is not acceptable. Supplemental topsoil shall be stripped at source from A margins only. The top 3-6" of topsoil shall be shredded and screened. At least 90 percent must pass the 2.00 mm (No. 10) sieve prior to placement. It shall be relatively free from large roots, sticks, weeds, brush, or stones larger than 25 mm (1 inch) in diameter, or other litter and waste products.
1. All topsoil required to meet depths and grades shown shall be imported "Supplemental Topsoil." Test and amend supplemental topsoil to meet required composition, acidity, and organic matter content.
 2. "Supplemental topsoil" means all topsoil imported to the site which is required to meet finish grades shown.
 3. Composition: Sandy loam or loam classification.
 4. Acidity: 6.8 to 7.2 pH.
 5. Organic Content: 3-5% after amending for texture. Add if deficient.
 6. Import topsoil conforming to above requirements from off-site sources as required to complete the work. Do not obtain from greenfields, farmland, bogs or marshes.

7. Perform test analysis on each source of topsoil to demonstrate compliance with the above and submit reports as specified.
 - a. Existing in place topsoil.
 - b. Imported supplemental topsoil.
 8. Regardless of source of supply, the top three inches minimum of topsoil shall be finely pulverized prior to placement in all locations so that surfaces are not lumpy.
- E. Soil Conditioner for Tree Planting Soil Mix: Biochar, a fine grained charcoal made from a biomass blend of 50% corncob and 50% wood chips; high in carbon and largely resistant to decomposition, produced as a result of pyrolysis by heating biomass in a low or no oxygen environment; and finely ground with no pieces larger than the size of pea gravel.
- F. Biological Components For Soil Mix:
1. Mycorrhizae for Trees, commercially available, mycorrhizae fungi inoculants, consisting of a blend of at least 17 ectomycorrhizas and endomycorrhizas, and bio-stimulant complex containing time release 20-10-5 fertilizer, humic acids derived from leonardite and various vitamins and other macro and micronutrients; such as ROOT Myco Tabs, or approved equivalent.
 2. Mycorrhizae for Plant Beds: Mycorrhizae for Plant Beds: Commercially available, mycorrhizae fungi inoculants, consisting of a blend of at least 17 ectomycorrhizas and endomycorrhizas, and bio-stimulant complex containing a low dose of 0-2-8 fertilizer plus iron, such as IronROOTS with Mycorrhizae Soluble Rooting Stimulant, or approved equivalent.
- G. Planting Soil Mix: All tree pits and shrub beds shall be backfilled with the planting soil mix specified herein. All the specified soil mixes shall be adjusted with soil amendments to adjust pH and thoroughly mixed by hand or by mechanical means prior to placement.
1. Soil Mix: For all tree pits, expanded tree pit root zones and shrub beds which are not underdrained, use a soil mix of approved supplemental topsoil. Amend with sand to achieve loam or sandy loam texture, which meets all testing criteria.
 2. Add and thoroughly blend in 5% by volume approved bio-char.
 3. Add 1 tablet Mycorrhizae for Trees at time of planting trees for each ½ caliper tree trunk (i.e., 8 tablets for 4" caliper tree; 20 tablets for a 10" tree) after backfilling soil mix to within 6-12" of the top of the tree pit. Place tablets 1 inch adjacent to rootball, evenly distributed around circumference of rootball. Continue backfilling and water in.
 4. After placement and settlement of soil and planting of trees, add 1 inch pine bark fines organic matter to entire surface of planting soil mix throughout the expanded tree pit, and rake into top layer of soil.
- H. pH Adjustment: Adjustments to soil pH shall be pursuant to soil test recommendations to achieve a neutral to slightly acid soil.
1. Sulphur: Sulphur shall be wettable granular sulfur, mixed and applied according to the soil test recommendations and to the types of plantings in the area requiring amendments. Apply sulfur if pH is 7.2 or above. If soil pH is above 7.2, multiple applications may be required prior to end of guarantee period.
 2. Limestone: Do not apply limestone to soil unless pH of soil is less than 6.3. Ground limestone (calcium carbonate) if required, shall have the following analysis: At least 50% shall pass a No. 200 USS mesh sieve. At least 90% shall pass a No. 100 USS mesh sieve. 100% shall pass a No. 10 USS mesh sieve. Total carbonates shall not be less than 80% or 44.8% calcium oxide equivalent; for purposes of calculation total carbonates shall be considered as calcium carbonates.

- I. Sand: Clean, sharp, well-graded, coarse sand passing 1/4" mesh screen, free of foreign and organic matter, with a pH of 5.5 to 6.5.
- J. Organic Matter Compost: Organic content shall be three to five percent after amending with sand. Adjust soil in top 6-12" of planting soil mix to add organic matter if less than 5% by soil test. The following types of organic matter may be used.
 - 1. Pine Bark Fines: Finely shredded and composted pine bark, passing a 3/8 inch sieve, suitable for horticultural purposes, and free of harmful residues, lumps, roots, stones and other foreign matter, shall be worked into the top 12" of soil.
 - 2. One Step Conditioner: A soil conditioner consisting of mycorrhizae, ground southern yellow pine bark fines, composted rice hulls and organic compost with nutrients and supplements to improve soil condition. Apply soil conditioner at the rate of 3" deep across surface of all plant beds and tree pits and work into soil. This soil conditioner may be used in place of pine bark fines and mycorrhizae applied per manufacturer's recommendations for backfilling top layers of soil mix in tree pits and shrub plantings.
 - 3. Compost: Mature compost that enhances the soil's ability to support vegetation with a carbon ratio below 25:1; low pollutants concentrations that do not exceed limits established by USEPA in the 40 CFR Part 503 Biosolids Rule, Section 503.13, Pollutant Concentrations; and no weed seeds or invasive plant propagules.
 - 4. Other Organic Matter: Submit proposed alternative, approved by soil laboratory, for approval by Landscape Architect. Other organic materials may be acceptable only if they do not adversely affect pH of soil mix.
 - 5. No sphagnum peat moss shall be used.
- K. Gypsum: If magnesium is high, consult with lab agronomist and amend soil with gypsum per soil lab recommendations to balance calcium.
- L. Premium Shredded Hardwood Bark Mulch:
 - 1. Finely shredded, premium, triple milled, from mixed hardwood species and free of sticks, leaves, and wood chips, 60% shall range between 1 and 3 in. in length; remaining 40% shall not exceed 1-1/2 in.
 - 2. Maximum of 5% content by weight of shredded wood particles.
- M. Fertilizer:
 - 1. Commercial type, uniform in composition, free flowing, conforming to state and federal laws, and suitable for application with equipment designed for that purpose.
 - 2. Fertilizer to contain minimum basis percentage by weight of following:
 - a. Nitrogen: 6%, 1/4 of nitrogen shall be in form of nitrates, 1/4 in form of ammonia salts, and 1/2 in form of organic nitrogen.
 - b. Phosphorus: 24%, available phosphoric acid shall be derived from super phosphate having minimum analysis of 20% available phosphate.
 - c. Potash: 24%, potash shall be in form of sulphate of potash.
 - d. Balance of fertilizer shall be materials usually present in such products, free from dust, sticks, sand, stone, and other debris.
 - 3. Coordinate N-P-K requirements with those recommended by soils lab agronomist.

2.3 LANDSCAPE ACCESSORIES

A. Plant Maintenance Materials:

1. Anti-desiccant Spray: An emulsion which provides a protective film over plant surfaces, permeable enough to permit transpiration, such as:
 - a. "Wiltpruf", NCF Nursery Specialty Products, Inc., Groton Falls, N.Y.,
 - b. Volck Dormant Oil Spray, by The Scotts Company.
 - c. Approved equivalent.
2. Insecticides, Herbicides, and Fungicides: Materials used for the control of pests shall be appropriate to the pest or pests which pose a problem to the materials and shall be used by licensed personnel in strict accordance with the manufacturer's recommendations. No phytotoxic materials shall be used.
3. Do not use herbicides or glysohate on site without written approval by Owner and only propose it where hand weeding will not control a problem. Follow manufacturer's recommendations, using licensed personnel, and notify all parties of intent to spray, prior to use. Protect nearby plants from overspray.

B. Support Appurtenances: No initial guying is required.

1. Ground Anchors: 30" stamped steel all-purpose tree stake. Use three anchors per tree. Bury a minimum of 30" in compact soil.
2. Guy Cable: 1/4" galvanized twisted seven strand rope.
3. Guying Wire: 10 gauge annealed galvanized steel double strand.
4. Hose: 8" to 10" lengths of 2-ply, reinforced black rubber hose, at least 3/4" diameter.
5. Turnbuckles: Galvanized or dip-painted, with 3" minimum lengthwise opening, fitted with screw eyes.
6. Ties: Constructed of No. 10 gauge galvanized wire, single strand through an 8" to 12" length of plastic hose.
7. Flag: Flag guys with 18 inch sections of 1-inch diameter white PVC pipe.

C. Wrapping Materials: New, clean, plain burlap, manufactured for the purpose of wrapping trees, free of breaks and tears, seamed along one edge, at least 8 oz. in weight, and a minimum of 4 - 6" wide for tree trunks. All purpose burlap, crepe paper or other materials are not acceptable quality. Use twine to tie burlap at 12" intervals, running twine vertically on trunk as well as horizontally.

1. Source: Great Western Bag Company. 708-231-4205.
2. Source: Sea-Rich Co. 800-332-2247.
3. Approved equivalent.
4. If seamed wrap is not available, use 6" burlap and fold over exposed edge and tie every 6 inches.

D. Tree Irrigation Bag: Reinforced, UV treated, 10 mil polyethylene bags with heavy-duty nylon zippers with poly pro straps and heat sealed edges. Provide one for each tree over 2 inches in caliper. Each bag shall hold 20 gallons of water.

1. Design Basis: Treegators are available through Forestry Supply, Inc. P.O. Box 8397, Jackson, MS 39284-8397 (800.647.5368).
2. Tree Diapers will also be acceptable when installed and used per manufacturer recommendations.

3. Alternate manufacturers will be considered. Submit sample with manufacturer's technical information and instructions.
4. Approved equivalent systems for supply of a slow drip of water over an extended period of time will also be considered. Submit shop drawing and sample.

PART 3 – EXECUTION

3.1 INSPECTION

- A. Do not install plantings where depth of soil over underground construction, obstructions or rock is insufficient to accommodate roots or where pockets in rock or impervious soil will require drainage. Where such conditions are encountered in excavation planting areas and where stone, boulders or other obstruction cannot be broken or removed by hand methods and where trees to be planted found under overhead wires, bring to the attention of the Architect. Alternate locations for planting may be designated by Architect.
- B. Remove rock or other underground construction and drain planting areas only when approved by Architect. Payment of extra shall be based on in-place volume required to provide normal requirements for plantings.
- C. Verify location of underground utilities with appropriate sources prior to construction. Contact J.U.L.I.E. at least 48 hours before commencing with construction operations. Repair damaged utilities.
- D. Conflicts with utilities shall be called to the Architect's attention before proceeding with work. Alternate locations may be designated by the Architect.

3.2 INSTALLATION

- C. Topsoil/Finish Grading:
 1. Do not place or work topsoil in frozen or muddy condition.
 2. Establish final grade as shown on drawings. Grades not otherwise indicated are uniform levels or slopes between points where elevations are given or between such points and existing finished grades.
 3. Where drawings show existing grades of landscaped areas not to be changed remove enough material to allow placement of 18in. of new topsoil and 6 inches of drainage material beneath shrub plantings and 24 inches of topsoil minimum beneath tree plantings, unless existing topsoil to required depth is undisturbed and of equal or better quality than specified herein. In latter case, existing topsoil may be left in place and use only enough new topsoil to bring these areas up to grade.
- D. Prepare Existing Landscape Beds: Strip existing sod where it occurs. Scarify the top 6" of soil if supplemental soil is added to existing soil. Establish existing grades to blend with existing grades and eliminate uneven areas resulting from rough-grading operations.
- E. Soil Loosening: To reduce soil compaction, loosen grades of existing soil to an average depth of 12 inches. IN areas where there are trees, avoid tree roots.
- F. Soil Amendments and Fertilizer: Apply 3" of specified organic matter and incorporate it into soil to a depth of 6 inches. Apply fertilizer to perennial plant beds at rates according to manufacturer Do not fertilize no-mow areas unless recommended by testing laboratory.
- G. Tree Replacement Identification:

1. Conduct an inspection with the Architect, identify existing trees to be replaced, and stake new locations for planting.
- H. Preparation:
1. Planting Season: Conform to planting seasons defined in Part 1, 1.5 Job Conditions.
 2. Preparation of Planting Areas: Cover surrounding turf (if existing) in a manner to protect turf areas that are to be trucked or hauled over and upon which soil is to be temporarily stocked. Restore if damaged.
 3. Maintain at least one stockpile of planting soil mix for backfilling plants during planting operations. Do not backfill plant beds with un-amended topsoil.
 4. Stake or paint locations of plants and bed lines. Architect must approve locations before excavation is started. Provide 48 hours' notice for approval. Contractor to be present during approval. Make adjustments in locations and outlines as required. In the event that pits or areas for planting are prepared and backfilled with topsoil to grade prior to commencement of lawn operations, mark so they can be readily located when work of planting proceeds.
 5. Remove weed growth prior to planting installation.
- I. Excavation for Planting: See Drawings.
1. Comply with the requirements of Division 31 Sections. Excavate circular pits with sloped sides to limits as shown on the Drawings.
 - a. Dig oversize tree pits as shown on the Drawings.
 - b. Where limestone is encountered in tree pit areas, over-dig tree pit to five times the diameter of the tree rootball and backfill with planting soil mix.
 - c. Excavate entire shrub bed as one to depth shown on the Drawings.
 2. Depth of pits for trees shall be as indicated. Excavate to greater depth as suitable to accommodate ball, container or bare roots when plant is set to finish grade allowing for 6 in. of compacted, prepared soil in bottom of pit.
 3. Install aeration/drainage pipe system in tree planting pits as indicated.
- J. Testing of Plant Pits and Trenches:
1. Perform percolation tests for all plant pits. In many cases, underdrainage can daylight down the slope. Correct underdrainage for all pits which fail to drain, until they drain freely.
 2. Where obstructions below or above ground are encountered, alternate locations may be selected as approved by Architect.
 3. Where locations cannot be changed as determined by Architect, submit cost required to remove obstructions to depth of not less than 6 in. below required pit depth. Proceed with work after approval of Architect.
 4. Dispose of excavated material not suitable for backfilling offsite in legal manner.
- K. Prepare Supplemental Topsoil for Turf:
1. Provide, place and prepare pulverized topsoil for turf areas after placement.
 2. Evenly distribute, and thoroughly and uniformly mix pH adjusters and fertilizer into the top layer of dry topsoil. Apply pH adjustment per soil test recommendations.
 3. Lightly roll surface to firm the bed, and then re-level to the appropriate grade. Finished surface of no-mow areas shall show no evidence of clods or clumped soil.

4. Form grade so that turf is just below flush with paved areas, or as required for seeded areas.
- L. Prepare Planting Soil Mixes for Plant Beds, Tree Pits, and Planters:
1. Prepare planting soil mix prior to placement in plant beds and prior to backfilling tree pits.
 2. Topsoil shall be dry and pulverized prior to amending. Clean topsoil of lumps, stones, debris and noxious weeds before mixing. Mix specified soil amendments at rates according to soil test recommendations. Mix pH adjusters with dry soil prior to adding any fertilizers. Fertilize according to soil test recommendation.
 3. Provide supplemental topsoil to achieve required planting soil mix depths, volumes and ratios to meet required finish grades.
- M. Preparation of Planting Pits:
1. Confirm dimensions of required tree and plant beds. See Drawings. Loosen soil at bottom of pit to minimum depth of 4 inches by spading or other effective methods.
 2. Scarify walls of tree pits.
 3. Backfill bottom of pit with 6 inch layer of compacted topsoil to provide firm bedding.
 4. If drainage problems are encountered, correct or install underdrainage.
- N. Amend Existing Topsoil for No-Mow Areas: See Drawings.
1. Turf Areas: 6 inches minimum, with top 3" pulverized.
- O. Install Prepared Planting Soil Mix in Plant Beds Areas: See Job Conditions for division of responsibility. Install prepared, amended and adjusted planting soil mix to the following depths:
1. Tree Pits: 4 inches below bottom of root ball.
 2. Perennial Grass Beds: 24 inches minimum.
- P. Placing Planting Soil: Provide, place, spread and rough grade specified planting soil mixes to depths specified in all areas to be planted. Place no planting soil above the foundation line of any adjacent structure. Notify Architect immediately if such conditions exist, including conditions that would not allow enough space for required drainage courses and planting soils to be installed below the top of foundation. Place enough soil mix to meet finish grades within specified tolerances, including any berms or rolls to grades as described on the Drawings.
1. Finished surface of plant bed areas shall show no clods or clumped soil.
 2. Promptly plant and mulch all areas which have had topsoil amended to alleviate clay conditions to avoid cement or adobe crust formation.
- Q. Setting and Backfilling Plants: Set trees and container plants in center of pits on layer of soil mix, plumb and straight and at such level that, after settlement, the crown of the tree root balls shall be 2" above the adjacent finished grade, the root flare shall be at 2" above finish grade, and shrub root balls shall be at finish grade. Do not backfill beds with planting soil until they have been reviewed by the Architect. Brace plants rigidly in position until the planting soil has been tamped solidly around the ball and roots. Backfill plants with planting soil mix to one-half full, water thoroughly, eliminating all air pockets. Tamp thoroughly before installing the remainder of the planting soil to the top of pit, eliminating all air pockets. At the end of one year, the plant shall be at the same depth. Never plant groundcover or other plants over top of root ball of tree or other plant.

1. Balled and Burlapped (B&B) Plants:
 - a. Remove excess soil from crown of rootball so that root flare is exposed.
 - b. Adjust compacted soil so that top of root ball at its flare is 2" above finish grade. Place trees centrally in pits so that all tree trunks are straight and plumb. When shown in-line, plant trees so that they are in alignment when viewed from end of row.
 - c. Remove twine tied around tree trunk. Remove burlap around ball to expose top half of ball. Remove wire and all other non-decomposable materials from top half of the rootball. Leave no plastic or foreign materials in the pit.
 - d. Backfill planting pits with topsoil in 12-in. layers and lightly irrigate and tamp each layer to fill voids until the planting mixture is at final grade.
 - e. Remove nursery plant identification tags.
 - f. Remove Wrappings: See Drawings. Cut and remove ropes, strings and wrapping from the top half of the ball after plant has been set. Leave balance of wrapping intact around the ball. All waterproof, water repellent or rot resistant wrappings shall be removed from the ball. Wire baskets shall be removed if the ball will hold together once it is removed. If the ball will not hold together, remove the top half of the wire basket once the plant is in the planting hole.

2. Container Grown Plants:
 - a. Open and remove potted plants from containers.
 - b. If the growing medium is comprised of 75% or more of peat, perlite, sand or like material other than soil, pull visible roots away from container medium so as to leave roots partially exposed.
 - c. Place plants in plant pit or trench and carefully backfill with topsoil among exposed roots. Continue backfilling and tamping in 6-in. layers until topsoil is at final grade.
 - d. Remove nursery plant identification tags.

- R. Saucer Formation:
 1. Smooth planting areas to conform to specified grades after full settlement has occurred and mulch has been applied.
 2. Form a shallow saucer, 6" deep capable of holding water, about each plant around edge of pit by depressing soil slightly below finished grade.
 3. Raise basin rims above general finished grade on low side of sloped areas by placing a mound of topsoil around the edge of each pit.
 4. Water plants immediately after planting. Avoid puddled soil conditions.
 - a. Trees: Perform initial watering on all trees which are designated for root pruning. Water trees immediately by thoroughly saturating root balls.
 - b. Install tree irrigation bags immediately after planting by zipping together around base of tree trunk. Fill bags with water immediately upon installation. Keep root balls thoroughly saturated during first three weeks following planting. Thereafter refill bags as required, according to weather conditions, to keep root balls in a moist condition during growing seasons, through Initial Maintenance. Test root balls for optimal moisture once a week using a soil auger. Remove bags by November 1st.
 - c. Perennial Grasses: Soak plant by fully saturating plant pit with water to full depth of plant pit.

5. Incorporate required topdressing of organic matter and fertilizer into prepared planting mixture at rate specified.
- S. Finish Grading: Rake smooth and finish grade all planted areas. Any undulations or irregularities on the surface shall be raked to smooth planes prior to planting. All areas shall slope to drain as indicated on drawings. Elevations in landscape areas after planting shall be +/- .10 foot of the finished grades shown on the drawings.
- T. Final Grades: Final finish grades of all planting areas, including beds and pits, after settling, shall be as shown on the Drawings. Required final grades and elevations shall be as shown by figured elevations or dimensioned depths; or where none are indicated, final grades and elevations shall be even lines or planes between such figured elevations, or between figured elevations and tops of paving or curbs. Verify grades established during final grading as being true to finish contours shown and maintain such areas until the effective date to begin any operations.
- U. Mulching:
 1. Mulch all plantings immediately after planting, as planting progresses.
 2. Maintain mulch for shade trees with minimum 3-in. depth of shredded hardwood bark to cover a concentric circular mulch ring as shown on the Drawings. Do not bring mulch closer than 6" to the root flare of the tree. Volcano mulching is prohibited.
 3. Maintain mulch in all planting beds in their entirety with 2" of mulch being careful not to mulch over stems.

3.3 PROTECTION AND MAINTENANCE

- A. Fertilizer:
 1. First Application (Ratio 1-4-4): Prior to installation of mulch to plant beds and saucers, apply commercial fertilizer to plant bed or saucer area at rate of 1/2 lb of active ingredient per 100 sq. ft.
 2. Second Application (Ratio 5-3-2): Apply fertilizer 60 days after planting at rate of 1/2 lb of active ingredient per 100 sq. ft.
- B. Anti-Desiccant Spray: If deciduous trees or shrubs are accepted by Architect to be moved full leaf, spray with anti-desiccant at nursery before moving and again 2 weeks after planting. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage, immediately after planting.
- C. Wrapping: Wrap trunks of deciduous trees immediately after they are planted. Wrap trunks of trees spirally from bottom to top with specified burlap, with 2" overlap, snug and neat, and securely tie with suitable twine at the top and bottom and at 12" intervals along the trunk. Entirely cover the trunk with wrap from the ground to the height of the second branches.
- D. Guying: No guying is required unless the tree fails to maintain a plumb position. Guys shall be completed immediately after planting. Guying of trees is not required unless plant fails to maintain an upright and plumb position. Drive anchors into the ground outside of the planting pit to a depth that will securely hold the tree. Attach cables with hose around the trunk. Leave cables with just enough slack that they will go tight in a wind. Plants shall stand plumb after and guying.

1. Guying: Guy all specimen trees which fail to maintain a plumb position, as determined by the Architect. Guy wires shall run out from tree in 3 opposed directions and each guy wire shall have a white "flag" as a warning of existing obstruction. Tighten guy wires to firm tensions by approved methods. Flag guys with 18 inch sections of 1-inch diameter white PVC pipe if guys extend outside planting area or pose a tripping hazard.

E. Watering:

1. Thoroughly water all trees and plants immediately after installation.
2. Fill irrigation bags weekly and water perennial grasses as needed during period of initial maintenance.

F. Mulching:

1. Mulch shade trees, evergreen trees, ornamental trees, singularly planted shrubs, hedge plantings, and massed plantings. Cover entire tree pit with minimum 3-in. depth of shredded hardwood bark. Cover perennial grass beds in their entirety with 2" specified mulch.
2. Mulch within 3 days after installation.
3. "Volcano Mulching" is not allowed. Keep mulch away from tree trunk as shown on the Drawings.

3.4 CLEAN UP

- A. Furnish all labor and materials to perform daily cleaning operations as the work progresses and at the conclusion of work. Remove soil or similar material brought onto paved areas, keeping these areas clean. Keep sidewalks and other paved areas clean of debris.
- B. Upon completion of planting, remove excess soil, stones, and debris and dispose of off-site in legal manner. Remove all equipment and unused materials provided for work and put the premises in a neat and clean condition.
- C. Tree Seal Removal: Remove trees seals just prior to end of warranty period.
- D. Protection: Protect plants against damage, including erosion and trespass, and provide proper safeguards as needed. Replant damaged areas. Repair or replace all such defective work, and all other work damaged thereby, which becomes defective until substantial completion. Advise Architect at that time as to whether continuing protections are required, and leave in place, if acceptable.
- E. Repair of Grade Relationship: Plants that do not bear the correct relationship to finished grade after settlement shall be raised or lowered, regardless of size, at no additional cost to Owner, throughout the specified warranty period.

3.5 MAINTENANCE

- A. Maintenance: Maintain plant material until landscape operations have received substantial completion of the project. This includes not only plant material but also installation completion (preliminary acceptance) of seeded areas. The landscape maintenance season is defined as the months during which landscape maintenance operations are required and extends from April 1 to November 30 of any given year.

- B. First Year Maintenance: Continue to maintain, including watering for all plant material through November 30 of year of Substantial Completion and throughout the One Year warranty period.
- C. Maintenance begins immediately after each plant is installed and shall include watering, necessary cultivation, weeding, pruning, disease and insect pest control, protective spraying, resetting of plants to proper grades or upright position, restoration of damaged planting saucers, and any other procedure consistent with good horticultural practice necessary to ensure normal, vigorous, and healthy growth of work.
1. Watering: Provide all necessary watering to insure the success of all plantings by supplying a sufficient quantity of water to penetrate the root systems of the plants on a frequent enough basis so as to avoid any moisture related stress. Monitor the application of water to prevent any too-dry or too-wet condition from occurring. Immediately bring any excessive moisture condition to the attention of the Architect. Regardless of watering method, it is the responsibility of the Contractor to monitor the application of water and to correct and adjust its application to insure success of the plantings.
 - a. Confirm Water Source: See Job Conditions Section of this specification.
 - b. Trees: Refill bags at least weekly, according to weather conditions, to keep root balls in a moist condition during growing seasons. Test root balls for optimal moisture once a week using a soil auger. Remove bags the week of November 15. Do not keep bags on trees over winter.
 - c. Shrubs: Auger test root balls of plants on a weekly basis to assure consistent and adequate moisture content for their survival. Shrubs may be routinely watered with soakers, provided that the Contractor thoroughly saturates the root zones. Hand sprinkling of the shrubs is not acceptable.
 - d. Other Plantings: Planting beds may be watered with a hose that has a water dispersing attachment, provided that the beds are adequately and frequently watered to assure the success of those plantings.
 2. Tree Pit and Plant Bed Maintenance: Maintain a circular outline at the base of all trees where practical and possible until the trees have become established. Cultivate all shrubs beds, and other planting beds as required to keep areas free of weeds and grass. Keep tree pits free of weeds. On a weekly basis, clean all planted areas including tree pits, of litter including cigarette butts and paper items.
 3. Pruning: Architect will review all plantings with Contractor at the maintenance review to determine the need for pruning. Special reviews shall be made by the Contractor after severe storms to determine damage. Remove all rubbing, dead, broken or down limbs immediately. Prune to preserve growth lines of shrubs, evergreens and trees to conform to the objectives of the landscape design. Do not shear or tip-prune any plants without first consulting with the Architect. Use clean implements, disinfecting between each cut, if necessary. Remove all debris resulting from pruning operations and legally dispose of off the site as the work progresses, at least daily.
 - a. Trees: Prune trees to retain required height and spread. Do not cut tree leaders. Remove all dead wood, suckers and broken or badly bruised branches, remove only injured or dead branches from flowering trees, if any. Do not paint cuts. After pruning is completed, and before wrapping, inspect tree trunks for injury, improper pruning and insect infestation and take corrective measures required. If needed, apply IPM insecticide according to

manufacturer's instructions, and in accordance with local and state laws.

- b. Perennial Grasses: Cut back grasses to 6" height at start of annual maintenance season to retain natural character and accomplish their use in the landscape design.
4. Pest Control and Control of Damage: Perform all pest control operations to maintain all trees, shrubs, and plant beds in a flourishing condition, including control of insects, fungus and other diseases. Do not use phytotoxic materials on plants. Spray for pests using licensed personnel only. Keep all drain inlets in plant beds clean and draining freely and make frequent inspections to assure proper drainage.
 5. Weed Control: Perform weed control in all planted, mulched or gravel areas by pulling or cultivation. Spraying or drenching may be allowed only if accepted by Architect so that susceptible vegetation is protected.
 6. Fertilization: Fertilize all trees and shrubs at the start of the first year's Spring season.
 7. Other Maintenance Operations: Clean, rake and maintain all mulch areas at specified depths throughout the maintenance period. Monitor growth and adjust supports for trees, shrubs and perennials. Sweep or rake up and re-deposit gravel mulches, such as at tree grates or drip strips, which has spilled off of gravel areas.

3.6 ACCEPTANCE

- A. Planting Acceptance: Upon substantial completion of the project, the Architect will inspect landscape work for acceptance. Acceptance requires:
 1. Plant material shall conform to drawings with respect to quantity, quality, size, species, and location, except those items accepted or revised in field by Architect
 2. Plant material shall be in healthy condition as defined under guarantee requirements below.
 3. Items shall appear to be in general conformance with specifications.

3.7 GUARANTEE

- A. Contractor shall guarantee for period of one year from the date of Substantial Completion or Preliminary Acceptance, replacement of plant which had died, or is in dying condition, or which has failed to flourish in such manner that its usefulness or appearance has been impaired. Replace any tree with dead main leader or crown which is 25% or more dead.
 1. Exclusions: Contractor shall not be liable for replacement cost of plants damaged by deicing compounds, fertilizers, pesticides or other materials not specified in Contract Documents or not applied by the landscaper, by relocating or removal by others, by acts of God, or by vandalism, and losses due to curtailment of water by local authorities.
 2. Inspection of Maintenance: During guarantee period, Contractor shall, from time to time, inspect watering, cultivation, and other maintenance operations carried on by Owner with respect to such work, and promptly report to Owner any methods, practices or operations considered unsatisfactory and not in accord with interests of good horticultural practices.
 - a. Failure of Contractor to inspect or report shall be construed as an acceptance of Owner's maintenance operations, and Contractor shall not thereafter claim or assert that any defects which may later develop are result of such methods or practices or operations.

3.8 REPLACEMENTS

- A. Plants which die or require replacement for other reasons during the guarantee period shall be replaced as soon as possible during following acceptable planting seasons:
 - 1. Spring Replacement Season, All plants: From workable ground to June 15.
 - 2. Fall Replacement Season:
 - a. Deciduous plants - September 1 to November 15.
 - b. Evergreen plants, groundcovers and perennials - September 1 to October 15.
- B. Topsoil that does not conform to the environmental standards set by these Specifications shall be excavated and replaced with topsoil that does at Contractor's expense.
- C. Procedure:
 - 1. Dispose of all excess materials including excess plants off-site in legal manner.
 - 2. Replacements shall be of same size and species as original plant unless otherwise approved by Architect.
 - 3. Replacements shall be supplied and installed in accordance with specifications.
 - a. Additional one-year guarantee for replacement plants shall begin on date of final acceptance of plant material by Architect as documented in field report.
 - 4. Replacement and Damages:
 - a. Decisions of Architect for required replacements shall be conclusive and binding upon Contractor.
 - b. Contractor shall be responsible for repairing damage to property also caused by defective workmanship and materials.
 - c. In the circumstance whereby the Owner requests repair of planting areas which have been damaged by others, repair said areas designated by the Architect upon issuance of a written change order which specifies the cost to the Owner. Protect finished work where replacements are made. Replanting shall cause a minimum of disturbance to the existing plantings. This work shall be installed, maintained and warranted according to the same conditions as specified herein.

END OF SECTION 32 93 11

SECTION 33 10 13 – WATER SERVICE

PART 1 - GENERAL

1.1 SUMMARY

- A. This item shall include furnishing all labor, materials, tools, and equipment required to install the water service as established by Contractor in continuity to the plans and specifications for the complete systems. The work shall include excavation for water pipes, water service installation, backfilling trenches, and testing and disinfecting of the complete water systems as required.
- B. Ductile or other slip-joint connected pipe is to be made electrically continuous with exothermically welded bonds across joints. Dielectrics are to be installed at street connection.
- C. Related Sections: Requirements that relate to this section are included but not limited to the sections below.
 - 1. Section 01 31 00 "Submittal Requirements".
 - 2. Section 01 74 19 "LEED Construction Waste Management and Disposal" for Construction Waste management Plan.
 - 3. Section 31 23 16 "Excavation".
 - 4. Section 31 23 23.01 "Fill"
 - 5. Section 31 23 17 "Excavating, Backfilling, and Compacting for Utilities"

1.2 SUBMITTALS

- A. Manufacturers literature, installation instructions, dimensions, materials, standards, certifications and guarantees.

1.3 QUALITY ASSURANCE

- A. In accordance with Division 01 Sections.
- B. The work performed on joining all pipe and fittings, must be performed by a plumber licensed in the State of Illinois or the City. This work must include, but not be limited to, joining all pipe and fittings, installing joint gaskets, assembling all joints, installing continuity wedges, and tightening all gland nuts and bolts, as applicable for the installation.

PART 2 - PRODUCTS

2.1 MATERIAL

- A. Water service piping and fittings shall be as specified herein and in Section 22 11 16.
- B. The pipe 3-inch and larger shall be ductile iron conforming to standard ANSI/AWWA C151/A21.51, with mechanical joints. 3-inch pipe shall be class 54, 4-inch pipe and 6-inch pipe shall be class 55, and 8-inch through 12-inch pipe shall be class 56. The pipe and fittings shall

be cement lined to conform with standard ANSI/AWWA C104/A21.4. The size and pipe class shall be stenciled on all material delivered to the job site. Fittings to be furnished and installed as specified or shown on the Contract Plans shall be mechanical type with retainer glands, ductile iron in accordance with ANSI/AWWA C110/A21.10 standard and have a 250 psi pressure rating. All pipe and fittings shall be encased in 4 mil cross laminated high density polyethylene tubing.

- C. The pipe smaller than 3" shall be Type "K" soft copper to comply with ASTM B 88 latest edition and installed with wrought copper (95-5 Tin Antimony solder joint) fittings in accordance with ASME B16.22.
- D. Connection to city water main by City of Chicago. The contractor shall reimburse the City for their costs at the rate per service connection.
- E. Stops and fittings shall be fabricated of brass and provided with outlets suitable for copper connections.
- F. Bedding material shall be gradation CA-16/CA-11 per plans. Backfill material shall be satisfactory excavated material/CA-16/CLSM per plans.

2.2 VALVES

- A. 2 -inch water service and smaller:
 - 1. Roundway (curb stop) valves: Roundway valves are to be of the ball valve type, of bronze construction, with flared end connections, and Minneapolis style curb box threads. Roundway valves are to conform to ASTM B62 and ASTM C800 standards.
 - 2. Shut-off Boxes: Shut-off boxes must be Chicago Shut-off Water Boxes, Type B, as manufactured by C. P. Test Services – Valvco, Inc. Boxes are to be made of rigid ABS plastic, of a two piece, sliding friction type design. The bottom tube is to be fitted with a bonded metal female threaded end fitting for fasten the shut-off box to the roundway valve assembly. A cast iron lid and rim top casting is to be bonded to the top of the two piece assembly. The two piece assembly must be capable of providing adjustable lengths from 37 to 72-inches.
 - 3. Corporation Cocks and Tapping Connection: Corporation cocks must be of the plug type, and of brass construction. Corporation cocks must conform to ASTM B62 and AWWA C800 standards. Water mains must be tapped at a 45 degree angle from the vertical axis of the main. The corporation cock must be turned so that the T-handle is on top of the fitting. Service are to extend horizontally at a right angle from the water main to the existing or proposed curb stop.
- B. 3-inch water service and larger: The Contractor shall furnish and install Chicago Standard Gate Valves in the sizes required wherever shown on the plans or specified. All valves must give an unobstructed waterway of full size when open. Gates or stems must not extend into the waterway:
 - 1. Gate Valves: Gate valves are to be Chicago Standard Gate Valves, Series N, as manufactured by East Jordan Iron Works Inc., and comply with AWWA C500 standards. Gate valves must be used on all water mains up to and including 16-inches in diameter, and on building services 3-inches in diameter and larger. Valves are to be installed in precast concrete valve basins.

2. Resilient Wedge Valves: The use of resilient wedge valves is restricted and must be of type and installed per City of Chicago Water Design Section standards.
3. Butterfly Valves: Butterfly valves are to be used on all water mains larger than 16-inches in diameter and must be of type and installed per City of Chicago Water Design Section standards.

2.3 DUCTILE IRON PIPE RESTRAINT

- A. Mechanical joint thrust restraint glands must be used. Where such glands cannot be used to provide sufficient thrust restraint, concrete thrust blocks must be used.
- B. CONCRETE THRUST BLOCK RESTRAINT
 1. All concrete used in the construction of thrust blocks must be Class SI of the SSRBC.
 2. All reinforcing steel used in the construction of thrust blocks must conform to the requirements of ASTM A615.

PART 3 - EXECUTION

3.1 HORIZONTAL SEPARATION - WATER MAINS AND SEWERS

- A. The work under this section will be performed in accordance with applicable sections of the City of Chicago Building and Plumbing Code, latest edition.
- B. Water mains shall be located at least ten feet horizontally from any existing or proposed drain, storm sewer, sanitary sewer, combined sewer or sewer service connection.
- C. Water mains may be located closer than ten feet to a sewer line when:
 1. Local conditions prevent a lateral separation of ten feet; and
 2. The water main invert is at least 18 inches above the crown of the sewer; and
 3. The water main is either in a separate trench or in the same trench on an undisturbed earth shelf located to one side of the sewer.
- D. When it is impossible to meet (1) or (2) above, both the water main and drain or sewer shall be constructed of slip-on mechanical joint cast or ductile iron pipe. The drain or sewer shall be pressure tested to the maximum expected surcharge head before backfilling.

3.2 VERTICAL SEPARATION - WATER MAINS AND SEWERS

- A. A water main shall be separated from a sewer so that its invert is a minimum of 18 inches above the crown of the drain or sewer whenever water mains cross storm sewers, vertical separation shall be maintained for that portion of the water main located within ten feet horizontally of any sewer or drain crossed. A length of water main pipe shall be centered over the sewer to be crossed with joints equidistant from the sewer or drain.
- B. Both the water main and sewer shall be constructed of slip-on or mechanical joint cast or ductile iron pipe, prestressed concrete pipe, when:
 1. It is impossible to obtain the proper vertical separation as described in (A) above; or

2. The water main passes under a sewer or drain.

- C. A vertical separation of 18 inches between the invert of the sewer or drain and the crown of the water main shall be maintained where a water main crosses under a sewer. Support the sewer or drain lines to prevent settling and creaking the water main, as shown on the plans or as approved by the Engineer.
- D. Construction shall extend on each side of the crossing until the perpendicular distance from the water main to the sewer or drain line is at least ten feet.

3.3 WATER SERVICE LINES

- A. The horizontal and vertical separation between water service lines and all storm sewers, sanitary sewers, combined sewers or any drain or sewer service connection shall be the same as water main separation described above.
- B. Water pipe above shall be used for sewer service lines when minimum horizontal and vertical separation cannot be maintained.

3.4 CONSTRUCTION PROCEDURES

- A. Excavation: The Contractor shall do all excavation of whatever unclassified material is encountered to the depths established by Contractor. Trench depths, not established, shall be figured to allow a minimum of 5'-6" cover over the top of the pipe.
1. In open cut excavation, the Contractor shall keep the trench width at the top of the pipe not wider than established, unless the angle or repose of the soil is unsuitable.
- B. Pumping: The contractor shall remove, by pumping or other means, any water accumulated in the excavation and keep the trench dry during the pipe laying period. The contractor shall provide adequate pumps, well points, or other dewatering method at no extra cost to the Owner.
- C. Bedding: All water mains shall be laid on a six-inch (6") layer of CA-16/CA-11 limestone per plans.
1. As established by Contractor, or where necessary because of soil conditions, concrete cradles or concrete encasement shall be built. The pad section of a cradle or encasement shall be built at least twelve (12) hours before pipe laying. A sufficient number of No. 9 annealed iron pipes shall be embedded in the pad and subsequently tied around the pipe to prevent the pipe from moving off line and/or grade.
- D. Installation Of Pipe: Before lowering the pipe into the trench and while suspended, each pipe shall be inspected by the Contractor for defects. Defective, damaged or unsound pipe shall be immediately removed from the site. The interior of each pipe shall be inspected for cleanness and cleared of all dirt and foreign matter before being lowered into the trench.
1. Unless otherwise directed, pipe shall be laid with bell ends facing in the direction of laying. After a length of pipe is placed in the trench, the spigot shall be centered in the bell of the preceding pipe, the pipe shoved into position and brought to true alignment and there secured with sand tamped under and on each side of the pipe, excepting at bell holes. No earth or other foreign matter shall be allowed to enter into the joint space.
2. The bells, spigots and rubber gaskets shall then be thoroughly washed in soapy water so that no particles of sand or grit can damage the gasket. Slip-on joints shall be constructed in strict accordance with the manufacturer's recommendations.

3. CA-16/CA-11 crushed limestone shall be tamped into place to the spring line of the pipe.
- E. Cutting of Pipe: Where necessary to cut pipe, cutting shall be done with proper tools and cut end of pipe shall be square and regular. Cutting shall be done in strict conformance with manufacturer's instructions.
 - F. At locations where pipe thrust is anticipated to occur, pipe and fittings must be anchored or restrained. Polyethylene encasement is to be installed on all new water main pipe and fittings before pipe is installed and braced against movement. Care must be taken so as not to damage the polyethylene encasement during the installation or blocking of the pipe and fittings. If damage occurs, the Contractor must repair or replace the polyethylene encasement at his expense.
 - G. Installation of Valves and Fittings: Before connecting valves or fittings to the pipe, such valves shall be cleaned and inspected by the Contractor for defects. Defective, damaged or unsound valves shall have a mechanical joint and be placed as established by contractor. All bolts, valves or fittings shall have thrust blocks as required set to undisturbed earth. All bolts shall be sufficiently tightened to manufacturer's recommendation.
 - H. Backfilling:
 1. Support pipes, and conduits as required during placement and compaction of backfill/bedding fill.
 2. Backfill of auxiliary valves and line valves, shall be carefully tamped to insure proper alignment. Contractor shall properly align and set to grade all valve boxes after completion of curb and gutter construction.
 3. Pipe Zone: Crushed limestone granular backfill shall be carefully placed and thoroughly tamped and compacted around the pipe with hand tools up to the spring line of the pipe.
 4. Granular Trench Backfill: All trenches and the excavation around fire hydrants, valves and other appurtenances which occur within the limits of existing or proposed pavements, sidewalks and curb and gutters, or where the edge of the trench shall be within two feet (2') of said improvements shall be backfilled with compacted granular backfill.
 5. Guarantee: The contractor shall guarantee all work for a period of one year after acceptance by the Owner. Any trenches improperly backfilled or where settlement occurs shall be reopened and properly compacted. The cost of any corrections and/or repair of any damages to other facilities shall be the responsibility of the Contractor.

3.5 TESTING

- A. Hydrostatic testing of water mains must be performed in accordance with AWWA C600 and the City of Chicago Department of Water Management's (DWM) requirements. The disinfection of water mains must be performed in accordance with IEPA Regulations, AWWA C651, and DWM.
- B. After completion of the disinfection/chlorination process, the chlorination water must be thoroughly flushed from all pipelines per DWM. The water main must be flushed until the water flows clear.

3.6 REMOVAL AND DISPOSAL

- A. Connection to the water main shall be made by the City of Chicago Water Department. Contractor shall coordinate final connection with the city.

END OF SECTION 33 10 13

SECTION 33 41 00 – SEWERAGE AND DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

- A. Section includes all labor, materials, tools, and equipment required to install the exterior storm, sanitary, and combined sewer systems as established by the Contractor in accordance with the plans and specification for a complete system. The work shall include but is not limited to excavation for sewer pipes and structures, sewer pipe and structure installation, backfilling trenches, and testing of the complete systems as required, five feet from exterior of building footprint.

1.2 REFERENCE STANDARDS

- A. AASHTO LRFD - Bridge Design Specifications; 2017.
- B. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2014 (Errata 2017).
- C. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary; 2006.
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2017.
- E. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2016).
- F. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2016.
- G. ASTM C150/C150M - Standard Specification for Portland Cement; 2017.
- H. ASTM C33/C33M - Standard Specification for Concrete Aggregates; 2016, with Editorial Revision (2016).
- I. ASTM C425 - Standard Specification for Compression Joints for Vitrified Clay Pipe and Fittings; 2004 (Reapproved 2013).
- J. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012 (Reapproved 2017).
- K. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015a.
- L. ASTM C891 - Standard Practice for Installation of Underground Precast Concrete Utility Structures; 2011.
- M. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008, with Editorial Revision (2016).
- N. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings; 2012.

- O. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.
- P. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017.
- Q. AWWA C153/A21.53 - Ductile-Iron Compact Fittings; 2011.

1.3 DEFINITIONS

- A. Drainage Piping: System of sewer pipe, fittings, and appurtenances for gravity flow of storm drainage.

1.4 ADMINISTRATIVE REQUIREMENTS

- A. Coordinate with other utility work.

1.5 SUBMITTALS

- A. Shop drawings for precast concrete manholes and other structures. Include frames, covers, and grates.
- B. Inspection and test reports specified in the "Field Quality Control" Article.

1.6 QUALITY ASSURANCE

- A. Environmental Agency Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems.
- B. Utility Compliance: Comply with regulations pertaining to sanitary sewerage and storm drainage systems. Include standards of water and other utilities where appropriate.
- C. Product Options: Drawings indicate sizes, profiles, connections, and dimensional requirements of system components and are based on specific manufacturer types indicated.

1.7 PERFORMANCE REQUIREMENTS

- A. Gravity-Flow, Nonpressure-Piping Pressure Ratings: At least equal to system test pressure.

1.8 DELIVERY, STORAGE, AND HANDLING

- A. Protect pipe, pipe fittings, and seals from dirt and damage.
- B. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.9 SITE CONDITIONS

- A. Site Information: Perform site survey, research public utility records, and verify existing utility locations.
- B. Existing Utilities: Do not interrupt existing utilities serving facilities occupied by the Owner or others except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. Notify Architect not less than 48 hours in advance of proposed utility interruptions.

2. Do not proceed with utility interruptions without receiving Architect's written permission.

PART 2 - PRODUCTS

2.1 PIPES AND FITTINGS

- A. Ductile-Iron Sewer Pipe class 52 or equivalent:
 1. Ductile-Iron Fittings: AWWA C110, ductile or gray iron, for push-on joints.
 2. Pipe joints must be push-on type joints with rubber gaskets unless otherwise shown on the Drawings, specified. Push-on type joints must conform to AWWA C111.
 3. Exterior of pipe and fittings must be coated with a petroleum asphaltic material in conformance with AWWA C110.
 4. Pipe encased in 4 mil cross laminated high-density polyethylene tubing. The tubing must comply with AWWA C105.
- B. Reinforced-Concrete Sewer Pipe and Fittings: ASTM C 76 (ASTM C 76M), Class III, Wall B, with O-ring type joints.
 1. Gaskets: ASTM C 443 (ASTM C 443M), rubber.
- C. Extra Strength Vitrified Clay (ESVCP) Pipe:
 1. Pipe: ASTM C 700.
 2. Joints: ASTM C 425.
 3. Gaskets: ASTM C 425; high grade vulcanized elastomeric compound consisting of basic natural or synthetic rubber. Provide gaskets manufactured in compliance with Rubber Manufacturer's Association tolerances for gaskets.
- D. Perforated pipe: ASTM D3034; PVC-SDR-26. Provide four rows of perforations meeting AASHTO M278 specifications. Joints ASTM D2855 or ASTM D 3212.

2.2 MANHOLES

- A. Precast Concrete Manholes: ASTM C478/ASTM C478M, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints.
 1. Ballast: Increase thickness of precast concrete sections or add concrete to base section, as required to prevent floatation.
 2. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
 3. Riser Sections: 4-inch minimum thickness, 48-inch diameter, and lengths to provide depth indicated.

4. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 5. Gaskets: ASTM C443/ASTM C443M, rubber.
 6. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match a 24-inch- diameter frame and cover.
 7. Steps: ASTM C478/ASTM C478M individual steps or ladder. Omit steps for manholes less than 60 inches deep.
 8. Pipe Connectors: ASTM C923/ASTM C923M, resilient, of size required, for each pipe connecting to base section.
 9. Precast subsurface structures shall be rated to accommodate AASHTO LRFD HS-20 loading.
- B. Manhole Frames and Covers: Heavyweight manhole frame and heavy duty manhole lid ASTM A48, Class 35B, cast gray iron and per current City Of Chicago code - Department Of Water Management Regulations For Sewer Construction And Stormwater Management. Equip on-site manhole covers with lock-bolt or approved locking mechanism device if indicated on plans. Include indented top design with lettering cast into cover:
1. Drainage Piping Systems: Raised flush letters per current city code.
 2. Pipe Connectors: ASTM C923/ASTM C923M, resilient, of size required, for each pipe connecting to base section.
 3. Precast subsurface structures shall be rated to accommodate AASHTO LRFD HS-20 loading.

2.3 CATCH BASINS

- A. Precast Concrete Catch Basins: ASTM C478/ASTM C478M, precast, reinforced concrete, of depth indicated, with provision for rubber gasket joints.
1. Base Section: 6-inch minimum thickness for floor slab and 4-inch minimum thickness for walls and base riser section, and having a separate base slab or base section with integral floor.
 2. Riser Sections: 4-inch minimum thickness; 48-inch diameter, and lengths to provide depth indicated.
 3. Top Section: Eccentric cone type, unless concentric cone or flat-slab-top type is indicated. Top of cone of size that matches grade rings.
 4. Gaskets: ASTM C443/ASTM C443M, rubber.
 5. Grade Rings: Include 2 or 3 reinforced-concrete rings, of 6- to 9-inch total thickness, that match a 24-inch- diameter frame and grate.
 6. Steps: ASTM C478/ASTM C478M individual steps or ladder. Omit steps for catch basins less than 60 inches deep.

7. Pipe Connectors: ASTM C923/ASTM C923M, resilient, of size required, for each pipe connecting to base section.

B. Frames and Grates:

Manhole Frames and Grates: Heavyweight manhole frame and heavy duty Catch Basin lid ASTM A48, Class 35B, cast gray iron and per current City Of Chicago code - Department Of Water Management Regulations For Sewer Construction And Stormwater Management. Equip on-site manhole covers with lock-bolt or approved locking mechanism device if indicated on plans. Include indented top design with lettering cast into cover:

a. Drainage Piping Systems: Raised flush letters per city code

b. Install ADA [American Disabilities Act] approved grates for catch basins located within pedestrian path of travel (within property limits only).

2.4 CLEANOUTS

- A. Push-on-Joint, Ductile-Iron Fittings: AWWA C110/A21.10, ductile- or gray-iron standard pattern or AWWA C153/A21.53, ductile-iron compact pattern.
- B. Gaskets: AWWA C111/A21.11, rubber.

2.5 CONCRETE

- A. General: Cast-in-place concrete according to ACI 318, ACI 350, and the following:
 1. Cement: ASTM C150/C150M, Type II.
 2. Fine Aggregate: ASTM C33/C33M, sand.
 3. Coarse Aggregate: ASTM C33/C33M, crushed gravel.
 4. Water: Potable.
- B. Structures: Portland-cement design mix, 4000 psi minimum, with 0.45 maximum water-cement ratio.
 1. Reinforcement Fabric: ASTM A1064/A1064M, steel, welded wire fabric, plain.
 2. Reinforcement Bars: ASTM A615/A615M, Grade 60, deformed steel.

2.6 TRANSITION AND PIPE COUPLINGS

- A. Pipe transitions and Pipe couplings shall be water tight couplings with stainless steel band clamps or approved equal.

2.7 PROTECTIVE COATINGS

- A. General: Include factory- or field-applied protective coatings to structures and appurtenances according to the following:

- B. Coating: 1- or 2-coat, coal-tar epoxy, 15-mil minimum thickness, except where otherwise indicated.
 - 1. Manholes: On exterior and interior surfaces.
 - 2. Manhole Frames and Covers: On interior surfaces.
 - 3. Catch Basins: On exterior and interior surfaces.
 - 4. Catch Basin Frames and Grates: On interior surfaces.

PART 3 - EXECUTION

3.1 EARTHWORK

- A. Excavating, trenching, and backfilling is specified in Division 31.

3.2 IDENTIFICATION

- A. Install green warning tapes directly over piping and at outside edges of underground structures.
 - 1. Use warning tapes or detectable warning tape over ferrous piping.
 - 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.3 INSTALLATION, GENERAL

- A. General Locations and Arrangements: Drawings indicate the general location and arrangement of underground sewerage and drainage systems piping. Location and arrangement of piping layout take into account many design considerations. Install piping as indicated, to extent practical.
- B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.
- C. Install gravity-flow-systems piping at constant slope between points and elevations indicated. Install straight piping runs at constant slope, not less than that specified, where slope is not indicated.
- D. Install piping pitched down in direction of flow, at minimum slope of 1 percent (1:100) and 36-inch minimum cover, except where otherwise indicated.

3.4 PIPE JOINT CONSTRUCTION AND INSTALLATION

- A. General: Join and install pipe and fittings according to the following.
 - 1. Hub-and-Spigot, Vitrified Clay Pipe and Fittings: With rubber compression gaskets according to ASTM C425. Use gaskets that match class of pipe and fittings.

3.5 MANHOLE INSTALLATION

- A. General: Install manholes, complete with accessories, as indicated.
- B. Set tops of frames and covers flush with finished surface where manholes occur in pavements. Set tops 3 inches above finished surface elsewhere, except where otherwise indicated.
- C. Place precast concrete manhole sections as indicated, and install according to ASTM C891.
 - 1. Provide rubber joint gasket complying with ASTM C443/ASTM C443M, at joints of sections.
 - 2. Apply bituminous mastic coating at joints of sections.

3.6 TAP CONNECTIONS

- A. Make connections to existing piping and underground structures so finished work conforms as nearly as practical to requirements specified for new work.
- B. Use commercially manufactured wye fittings for piping branch connections. Remove section of existing pipe, install wye fitting into existing piping, and encase entire wye fitting plus 6-inch overlap, with not less than 6 inches of 3000-psi, 28-day, compressive-strength concrete.
- C. Make branch connections from side into existing piping, sizes 4 to 20 inches by removing a section of existing pipe and installing a wye fitting into existing piping. Encase entire wye with not less than 6 inches of 3000-psi, 28-day, compressive-strength concrete.
 - 1. Use concrete that shall attain a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - 2. Use epoxy bonding compound as an interface between new and existing concrete and piping materials.
- D. Protect existing piping and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.

3.7 FIELD QUALITY CONTROL

- A. Clear interior of piping and structures of dirt and superfluous material as the work progresses. Maintain swab or drag in piping and pull past each joint as it is completed.
 - 1. In large, accessible piping, brushes and brooms may be used for cleaning.
 - 2. Place plug in end of incomplete piping at end of day and whenever work stops.
 - 3. Flush piping between manholes and other structures, if required by authorities having jurisdiction, to remove collected debris.
- B. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of the Project.
 - 1. Defects requiring correction include the following:
 - a. Alignment: Less than full diameter of inside of pipe is visual between structures.

- b. Deflection: Flexible piping with deflection that prevents passage of a ball or cylinder of a size not less than 92.5 percent of piping diameter.
 - c. Crushed, broken, cracked, or otherwise damaged piping.
 - d. Improper infiltration: Water leakage into piping.
 - e. Improper exfiltration: Water leakage from or around piping.
- 2. Replace defective piping using new materials and repeat inspections until defects are within allowances specified.
 - 3. Reinspect and repeat procedure until results are satisfactory.

END OF SECTION 33 41 00

ABBREVIATIONS

Table of abbreviations for architectural elements including floor types, materials, and structural components.

ABBREVIATIONS

Table of abbreviations for hardware, finishes, and construction details.

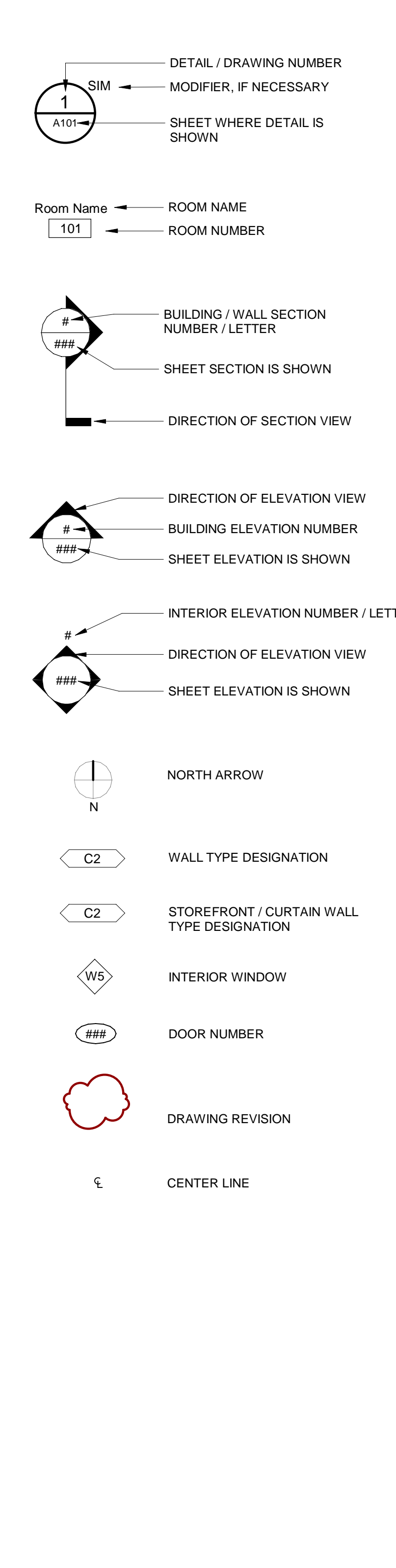
ABBREVIATIONS

Table of abbreviations for structural and mechanical elements.

GENERAL NOTES - PROJECT

- A. THE CONSTRUCTION DRAWINGS ILLUSTRATE THE DESIGN INTENT OF THE WORK... B. ALL WORK SHALL CONFORM TO THE REQUIREMENTS OF ALL APPLICABLE STATE AND/OR LOCAL CODES... C. DO NOT SCALE DRAWINGS... D. FIELD VERIFY ALL DIMENSIONS PRIOR TO START OF WORK...

SYMBOLS



SHEET INDEX

Table listing sheet numbers and names for various project components including general notes, life safety, civil, landscape, structural, architectural, and electrical sheets.

SHEET INDEX

Table listing sheet numbers and names for fire protection, plumbing, mechanical, and fire alarm sheets.



PROJECT Emergency Medical Services (EMS) Addition 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION 303 E. Wacker Dr. #1400 Chicago, IL 60601 312-375-7700

ARCHITRAVE LIMITED ARCHITECTURE 211 W. Wacker Dr. #1650 Chicago, IL 60606

ABERCROMBIE PLANNING+DESIGN PUBLIC SAFETY DESIGN CONSULTANT 3508 Overton Park Dr W Fort Worth, TX 76109 817-920-9138

INFRASTRUCTURE ENGINEERING CIVIL ENGINEERING One South Wacker #2650 Chicago, IL 60606 312-425-9560

MILHOUSE ENGINEERING ELECTRICAL ENGINEERING 333 S. Wabash Ave #2901 Chicago, IL 60604 312-618-7185

JACOBS / RYAN ASSOCIATES LANDSCAPE ARCHITECTURE 1527 N. Sandburg Terrace Chicago, IL 60610 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS TECHNOLOGY CONSULTANT 233 S. Wacker Dr. #4400 Chicago, IL 60606 312-202-3300

REGISTRATION E001 SYMBOLS AND ABBREVIATIONS E002 CAMPUS SITE PLAN E101 SECOND FLOOR POWER PLAN E102 THIRD FLOOR POWER PLAN E103 FOURTH FLOOR POWER PLAN E104 ROOF POWER PLAN E201 SECOND FLOOR LIGHTING PLAN E202 THIRD FLOOR LIGHTING PLAN E203 FOURTH FLOOR LIGHTING PLAN E500 ELECTRICAL RISER DIAGRAM E600 DETAILS E601 SCHEDULES E602 PANEL SCHEDULES E603 PANEL SCHEDULES E604 PANEL SCHEDULES E605 COMCHECK E606 LIGHTING CONTROL SCHEDULE

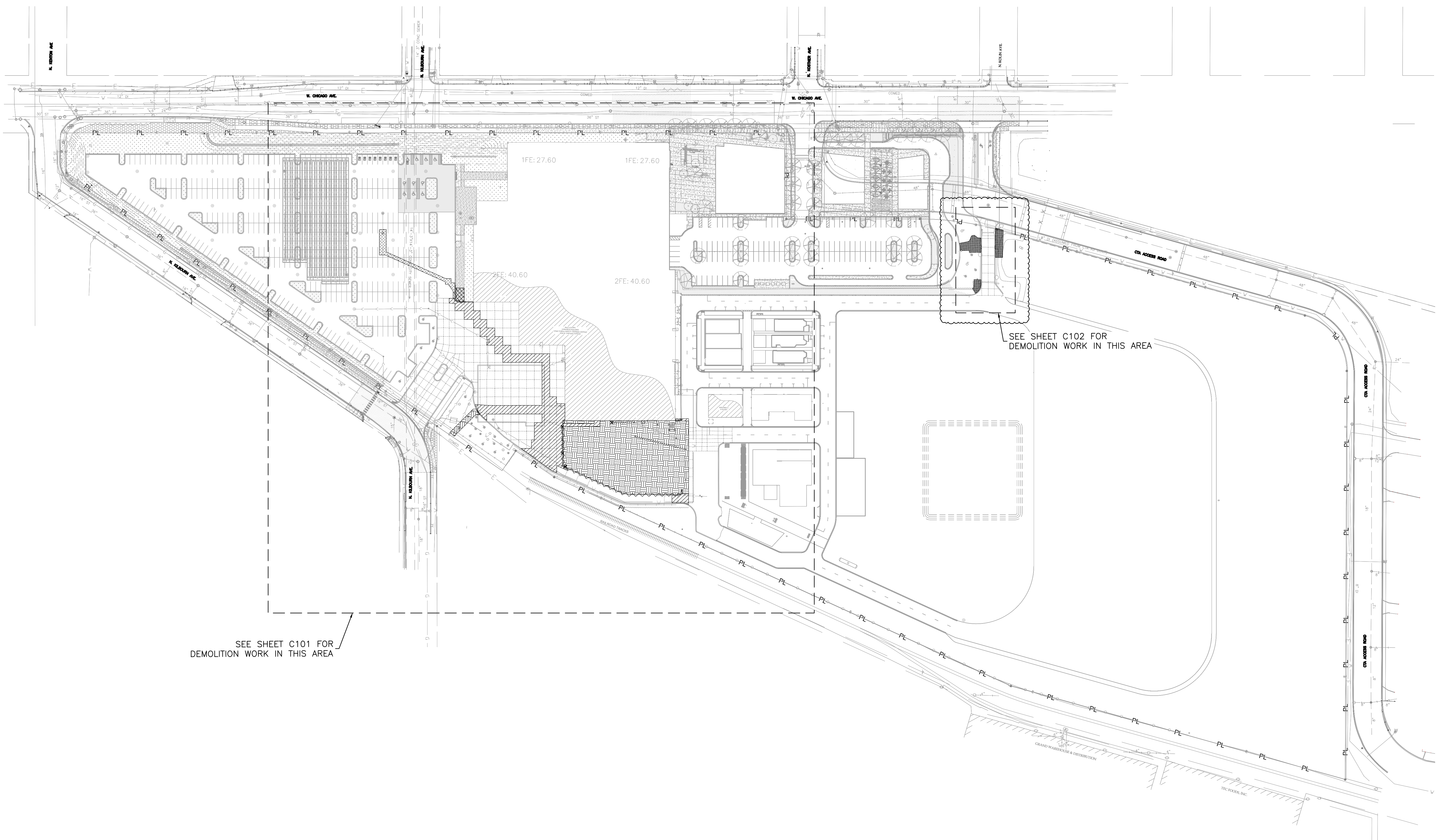
IT & SECURITY T001 TECHNOLOGY LEGEND T002 TECHNOLOGY NOTES T5101 TECHNOLOGY SITE PLAN T100 OVERALL SECOND FLOOR PLAN AND EXISTING BUILDING - TECHNOLOGY T110 SECOND FLOOR TECHNOLOGY PLAN T111 SECOND FLOOR TECHNOLOGY PATHWAY PLAN T120 THIRD FLOOR TECHNOLOGY PLAN T121 THIRD FLOOR TECHNOLOGY PATHWAY PLAN T130 FOURTH FLOOR TECHNOLOGY PLAN T131 FOURTH FLOOR TECHNOLOGY PATHWAY PLAN T301 TECHNOLOGY ELEVATION PLANS T401 ENLARGED FLOOR PLAN AND DETAILS ROOM TR-277 T402 ENLARGED FLOOR PLAN AND DETAILS ROOM TR-377 T403 ENLARGED FLOOR PLAN AND DETAILS ROOM TR-477 T404 ENLARGED FLOOR PLANS AND DETAILS ROOM TR-264 & EXISTING MER219 T501 TECHNOLOGY DETAILS T502 TECHNOLOGY DETAILS T503 TECHNOLOGY DETAILS T601 TECHNOLOGY DIAGRAMS T641 SIMULATION AUDIO SYSTEM T642 SIMULATION AV CONTROL T643 SIMULATION VIDEO SYSTEM T644 AUDIO VISUAL EQUIPMENT SCHEDULES T671 ACCESS CONTROL DIAGRAMS T701 CONDUIT AND PATHWAY DETAILS T702 CONDUIT AND PATHWAY DETAILS T771 SECURITY CONDUIT AND PATHWAY DETAILS

ISSUE/REVISION 3 07/12/2024 ADD 01 2 07/05/2024 ISSUED FOR PERMIT 1 06/26/2024 ISSUED FOR BID

PROJECT NUMBER PBC: 007215 AECOM: 60710711

SHEET TITLE ABBREVIATIONS, LEGENDS, & SHEET INDEX

SHEET NUMBER G001



DEMOLITION LEGEND

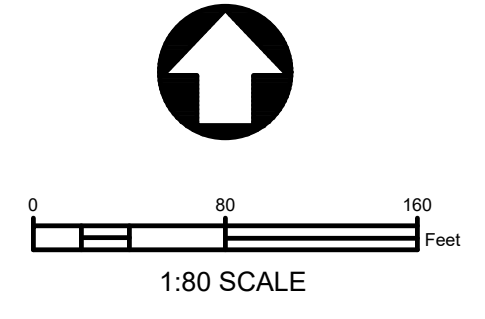
— PL —	JPSTC PROPERTY LINE
- - - - -	PARCEL 3 PROPERTY LINE
[Hatched Pattern]	HMA PAVEMENT & BASE REMOVAL
[Diagonal Hatched Pattern]	CONCRETE PAVEMENT & BASE REMOVAL
[Cross-hatched Pattern]	CONCRETE SIDEWALK & BASE REMOVAL
[Stippled Pattern]	CLEAR & GRUB, EXCAVATION & FILL PER PLANS
~ ~ ~ ~ ~	CURB & GUTTER REMOVAL
— S —	SEWER REMOVAL
X	REMOVAL

SEE SHEET C101 FOR DEMOLITION WORK IN THIS AREA

SEE SHEET C102 FOR DEMOLITION WORK IN THIS AREA

NOTES:

1. THE CONTRACTOR SHALL VERIFY AND COMPARE TO ALL EXISTING SURVEY POINTS BEFORE BEGINNING ANY CONSTRUCTION AND REPORT ANY DISCREPANCIES TO THE ARCHITECT IMMEDIATELY.
2. CONDUCT SITE DEMOLITION OPERATIONS ENSURING MINIMUM INTERFERENCE WITH STREETS, WALKS, AND OTHER ADJACENT FACILITIES.
3. REMOVAL WORK INCLUDES BUT IS NOT LIMITED TO PAVING, CURBS, GUTTERS, GRAVEL, CONCRETE BLOCKS, CONCRETE BARRIER WALLS, WOOD, FENCES, POSTS, UTILITY POLES, UTILITY STRUCTURES AND PIPES, GUARD RAIL, RAILROAD TIES, TIRES, METAL ETC. OR OTHER STRUCTURES. REMOVAL OF ALL THE EXISTING SITE ITEMS WITHIN PROJECT SITE INCLUDING BUT NOT LIMITED TO GRAVEL, CONCRETE BLOCKS, CONCRETE BARRIER WALLS, TIRES, RAILROAD TIES, WOOD, METAL ETC. ARE NOT SHOWN ON THE PLANS AND THE CONTRACTOR SHALL VISIT THE SITE BEFORE BIDDING AND ASCERTAIN THE EXTENT OF REMOVALS AND PROPOSED WORK. BURNING ON OWNER'S PROPERTY IS NOT PERMITTED.
4. REMOVE ALL DEMOLISHED MATERIALS (UNLESS NOTED OTHERWISE) FROM PROJECT SITE REGULARLY AND DISPOSE OF LEGALLY. THE CONTRACTOR SHALL COMPLY WITH CONTRACT DOCUMENTS, FEDERAL, STATE, AND LOCAL ORDINANCES WITH REGARDS TO REMOVAL AND DISPOSAL OF MATERIALS FOR ITEMS TO BE DEMOLISHED/REMOVED.
5. THE CONTRACTOR SHALL HAND DIG WITHIN 2' OF KNOWN UTILITIES BEFORE USING POWER EQUIPMENT. THE CONTRACTOR SHALL USE EXTREME CAUTION WHILE EXCAVATING NEAR THE SUBSURFACE FACILITIES/UTILITIES. ALL EXISTING FACILITIES/UTILITIES OR COMPLETED NEW CONSTRUCTIONS AND INSTALLATIONS NOT INDICATED FOR DEMOLITION, IF DAMAGED AS A RESULT OF ON GOING CONSTRUCTION WORK ON THIS PROJECT SHALL BE REPLACED OR REPAIRED BY THE CONTRACTOR AT NO COST TO THE OWNER.
6. THE CONTRACTOR SHALL COORDINATE ALL DEMOLITION/EXCAVATION WITH THE PROJECT PLANS AND CORRESPONDING DETAILS. WITHIN THE PROJECT SITE, EXISTING ABANDONED CONCRETE FOUNDATIONS AND UTILITIES, IF IN CONFLICT WITH PROPOSED FACILITIES/UTILITIES SHALL BE REMOVED.
7. SAWCUT, REMOVE, AND REPLACE PART OF CONCRETE PAVEMENT PANEL AND BASE. PROVIDE NEW CONCRETE PAVEMENT JOINT PER JOINTING PLAN.
8. NOT ALL THE POSTS FOR THE STAIRCASE AND PORCH STRUCTURE ATTACHED TO THE STAIRCASE ARE SHOWN. PROTECT EXISTING STAIRS, CONCRETE STAIR LANDING, AND STAIRCASE/PORCH FOUNDATIONS AND POSTS TO REMAIN.
9. SAWCUT ALL EXISTING CONCRETE PAVEMENT UP TO THE NEAREST JOINT, EXCEPT WHERE OTHERWISE NOTED.
10. THE CONTRACTOR TO CONTACT AND COORDINATE WITH STORMTRAP AT 815-941-4549 BEFORE PERFORMING ANY EXCAVATION OR CONSTRUCTION OVER AND AROUND THE EXISTING UNDERGROUND STORMTRAP DETENTION SYSTEM. THE CONTRACTOR SHALL USE EQUIPMENT/METHODS WHICH WILL NOT RESULT IN THE MAXIMUM WEIGHT AND GROUND PRESSURE BEING EXCEEDED PER STORMTRAP STANDARDS.
11. REMOVE AND LEGALLY DISPOSE OF ALL TREES AND SCRUB VEGETATION WITHIN JPSTC PROPERTY.
12. THE CONTRACTOR SHALL PROTECT ALL EXISTING TREES NOT CALLED OUT FOR REMOVAL THROUGHOUT THE PROJECT SITE. IF DAMAGED, THE CONTRACTOR SHALL REPLACE THE DAMAGED TREE WITH THE SAME SIZE AND SPECIES WITHOUT ANY COST TO THE OWNER.
13. EXISTING UTILITIES TO BE ABANDONED, SHALL BE REMOVED AT LOCATIONS IF IN CONFLICT WITH PROPOSED FACILITIES OR UTILITIES. SEE DETAIL 1 SHEET C908 FOR SEWER STRUCTURES AND PIPES TO BE ABANDONED.
14. THE HOLES CREATED DUE TO REMOVAL WORK SHALL BE FILLED WITH CA-6 BACKFILL AND COMPACTED TO 95% MODIFIED PROCTOR DENSITY.
15. EXCAVATION SHOULD START ONLY AFTER THE IRRIGATION LINES HAVE BEEN DRAINED, THE VALVES ARE SHUT OFF, AND THE SYSTEM IS CAPPED PER MEP/LANDSCAPE PLANS. EXISTING ABANDONED IRRIGATION LINES SHOULD BE REMOVED IF FOUND WITHIN THE LIMITS OF THE PROPOSED UTILITY TRENCHING OR WITHIN EXCAVATION FOR PROPOSED WORK.
16. REMOVE AND SALVAGE EXISTING ARM GATE WITH CONCRETE FOUNDATION AND ASSOCIATED CABLES/EQUIPMENT FOR REINSTALLATION PER SITE PLAN AND TECHNOLOGY SITE PLAN. ABANDON EXISTING SIGNAL DETECTOR LOOP.



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT

CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #185
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-630-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
IR	DATE	DESCRIPTION

PROJECT NUMBER
 PBC-#07215 AECOM: 60710711

SHEET TITLE

OVERALL DEMOLITION PLAN

SHEET NUMBER

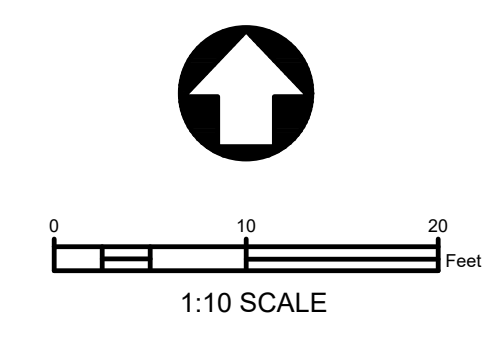
C100



DEMOLITION LEGEND

- PL — JPSTC PROPERTY LINE
- - - - - PARCEL 3 PROPERTY LINE
- [Hatched Box] HMA PAVEMENT & BASE REMOVAL
- [Diagonal Hatched Box] CONCRETE PAVEMENT & BASE REMOVAL
- [Cross-hatched Box] CONCRETE SIDEWALK & BASE REMOVAL
- [Stippled Box] CLEAR & GRUB, EXCAVATION & FILL PER PLANS
- [Wavy Line] CURB & GUTTER REMOVAL
- [Dashed Line] SEWER REMOVAL
- [X] REMOVAL

SEE SHEET C100 FOR NOTES.



PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT

CONSULTANTS
AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #185
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-620-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

IR	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

PROJECT NUMBER

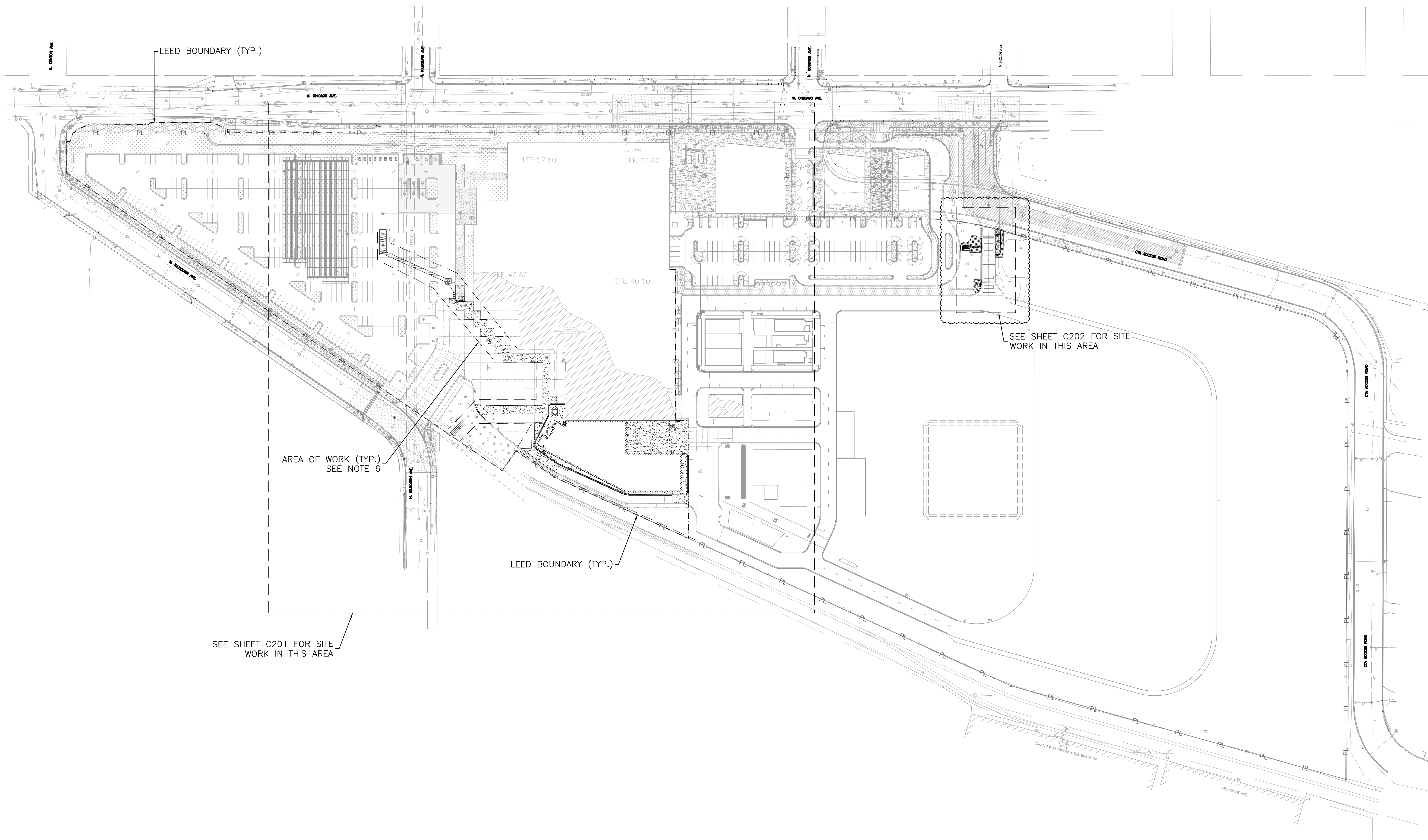
PBC-#07215 AECOM: 60710711

SHEET TITLE

DEMOLITION PLAN

SHEET NUMBER

C102

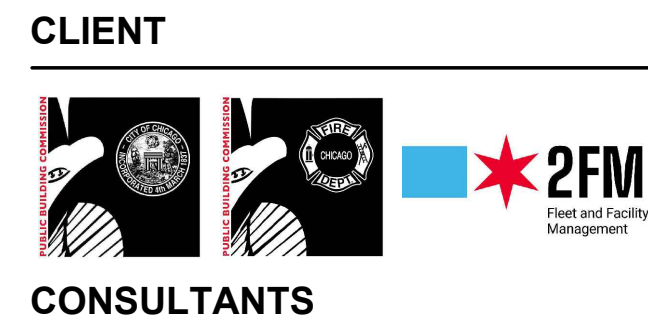


SITE LEGEND	
— PL —	JPSTC PROPERTY LINE
—	PARCEL 3 PROPERTY LINE
- - - -	LEED BOUNDARY
[Hatched Box]	BUILDING (SEE ARCHITECTURAL PLANS)
[Dotted Box]	CONCRETE PAVEMENT & BASE (SEE DETAIL 7 SHEET C901)
[Dotted Box]	CONCRETE SIDEWALK & BASE (SEE DETAILS 1 SHEET C901)
[Dotted Box]	ASPHALT PAVEMENT & BASE (SEE DETAIL 6 SHEET C901)
[Double Line]	CONCRETE CURB & GUTTER BV.12 (SEE DETAIL 2 SHEET C901)
[Hatched Box]	CONCRETE DEPRESSED CURB & GUTTER
[Double Line]	6" CONCRETE BARRIER CURB (SEE DETAIL 5 SHEET C901)
[Box with X]	2' CURB CUT FOR ROLLING GATES
[Box with Dots]	DETECTABLE WARNING TILE
[Dotted Box]	LAWN, PLANTINGS AND TREES (SEE LANDSCAPE PLANS)

- NOTES:
- FOR PROPOSED LAWN/PLANTINGS AND TREE DETAILS, SEE LANDSCAPE PLANS.
 - FOR FENCING SEE LANDSCAPE PLANS.
 - DIMENSIONS AND RADII SHOWN AT CURBS ARE TO THE FACE OF CURB.
 - ARCHITECT CAN PROVIDE ELECTRONIC CAD FILES OF SITE PAVING PLANS FOR CONSTRUCTION STAKING AND LAYOUT ON SITE, IF REQUIRED BY THE CONTRACTOR.
 - AREA OF WORK LIMITS ARE APPROXIMATE.
 - FOR CONCRETE AT DOORWAYS SEE STRUCTURAL PLANS.
 - ANY PARKING STALL STRIPING THAT IS REMOVED OR DAMAGED PARTIALLY DUE TO SEWER TRENCHING SHALL BE REMOVED IN FULL LENGTH AND RESTRIPE TO MATCH EXISTING STRIPING. ANY NEARBY PARKING STALL STRIPINGS THAT HAVE FADED/DAMAGED DUE TO CONSTRUCTION WORK SHALL BE REMOVED IN FULL LENGTH AND RESTRIPE.
 - FOR CONCRETE PAD FOR TRANSFORMER SEE DETAIL 3 SHEET C905. PROVIDE YELLOW-PAINTED 4" DIA. BOLLARDS AROUND CONCRETE PAD. SEE DETAIL 9 SHEET C907.



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CLIENT
AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #185
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-520-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

IR	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

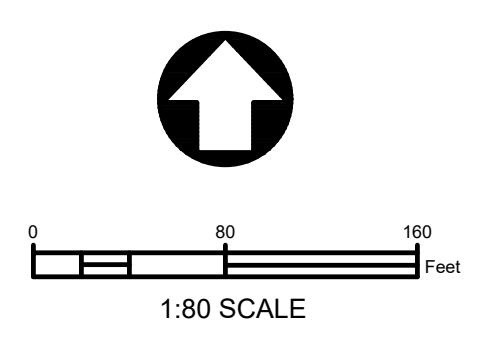
PROJECT NUMBER
 PBC-#07215 AECOM: 60710711

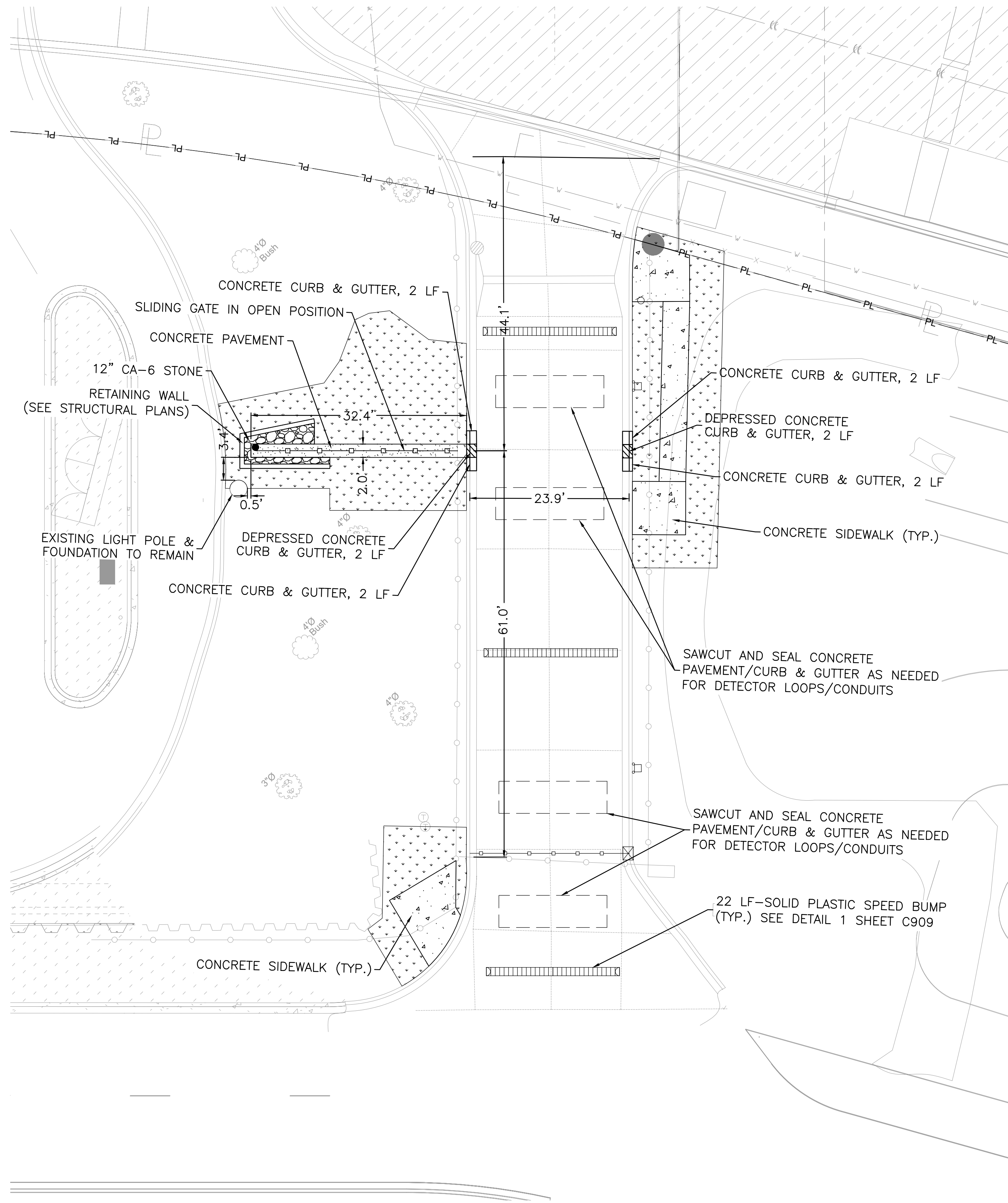
SHEET TITLE

OVERALL SITE PLAN

SHEET NUMBER

C200





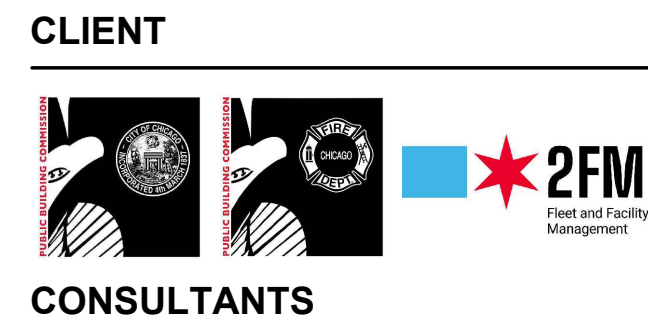
SITE LEGEND

- PL — JPSTC PROPERTY LINE
- PARCEL 3 PROPERTY LINE
- - - LEED BOUNDARY
- BUILDING (SEE ARCHITECTURAL PLANS)
- CONCRETE PAVEMENT & BASE (SEE DETAIL 7 SHEET C901)
- CONCRETE SIDEWALK & BASE (SEE DETAILS 1 SHEET C901)
- ASPHALT PAVEMENT & BASE (SEE DETAIL 6 SHEET C901)
- CONCRETE CURB & GUTTER BV.12 (SEE DETAIL 2 SHEET C901)
- CONCRETE DEPRESSED CURB & GUTTER
- 6" CONCRETE BARRIER CURB (SEE DETAIL 5 SHEET C901)
- 2' CURB CUT FOR ROLLING GATES
- DETECTABLE WARNING TILE
- LAWN, PLANTINGS AND TREES (SEE LANDSCAPE PLANS)

SEE SHEET C200 FOR NOTES.



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #185
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-520-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

IR	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

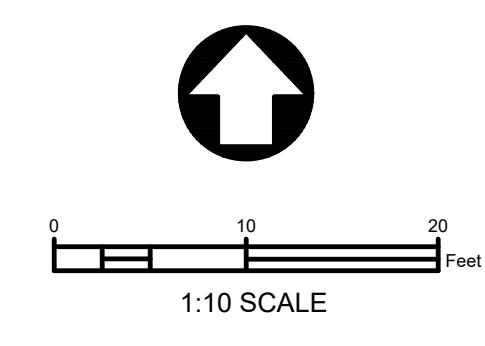
PROJECT NUMBER
 PBC-#07215 AECOM: 60710711

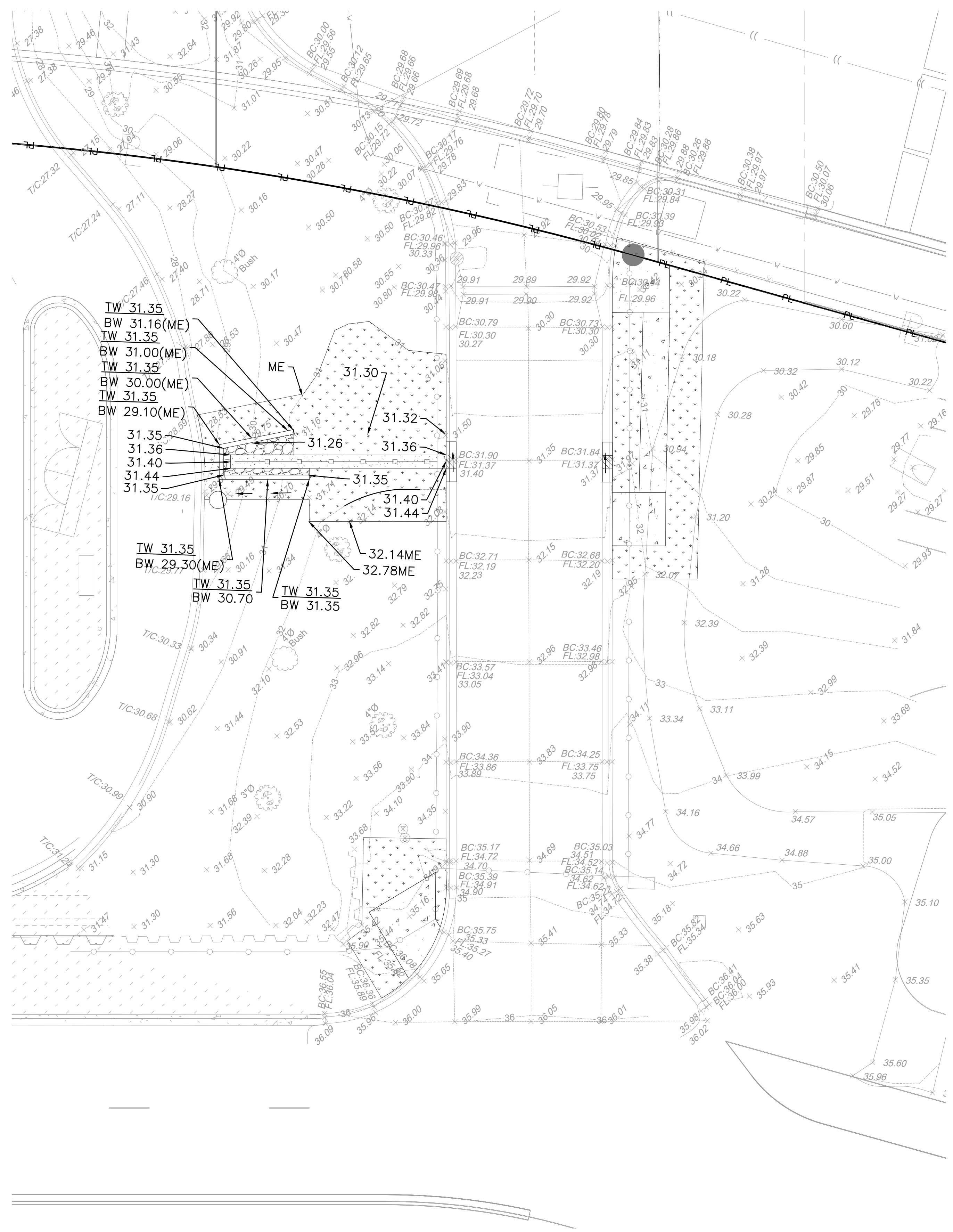
SHEET TITLE

SITE PLAN

SHEET NUMBER

C202





GRADING LEGEND

- PL — JPSTC PROPERTY LINE
- - - - - PARCEL 3 PROPERTY LINE
- XX.XX TOP OF CURB EL.
- XX.XX GUTTER/BOTTOM OF CURB EL.
- TWXX.XX TOP OF WALL EL.
- BWXX.XX BOTTOM OF WALL EL.
- RXX.XX RIM EL.
- SXX.XX SWALE BED EL.
- 1.50% PAVEMENT SLOPE ARROW
- ME MATCH EXISTING EL.
- HWL HIGH WATER LEVEL
- FFE FINISHED FLOOR EL.
- ADJ RXX.XX ADJUST RIM EL. TO XX.XX
- ⊙ MANHOLE
- ⊙ CATCH BASIN
- ⊙ CLEAN OUT
- ➔ SLOPE/FLOW DIRECTION

SEE SHEET C300 FOR NOTES.



PROJECT

Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT



CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL,
 MECHANICAL, PLUMBING, FIRE PROTECTION
 333 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED

ARCHITECTURE
 211 W. Wacker Dr. #165
 Chicago, IL 60605
 312-442-3500

ABERCROMBIE PLANNING+DESIGN

PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-9198

INFRASTRUCTURE ENGINEERING

CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING

ELECTRICAL ENGINEERING
 333 S. Wabash Ave #501
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES

LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-464-3217

LEVEL-1 GLOBAL SOLUTIONS

TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
IR	DATE	DESCRIPTION

PROJECT NUMBER

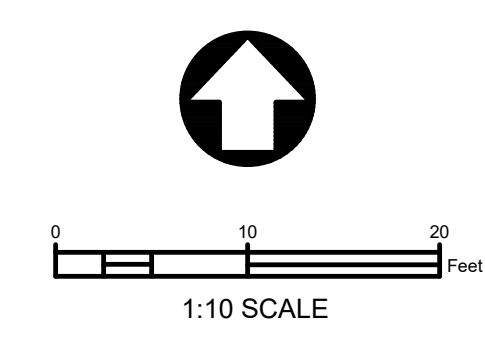
PBC: #07215 AECOM: 60710711

SHEET TITLE

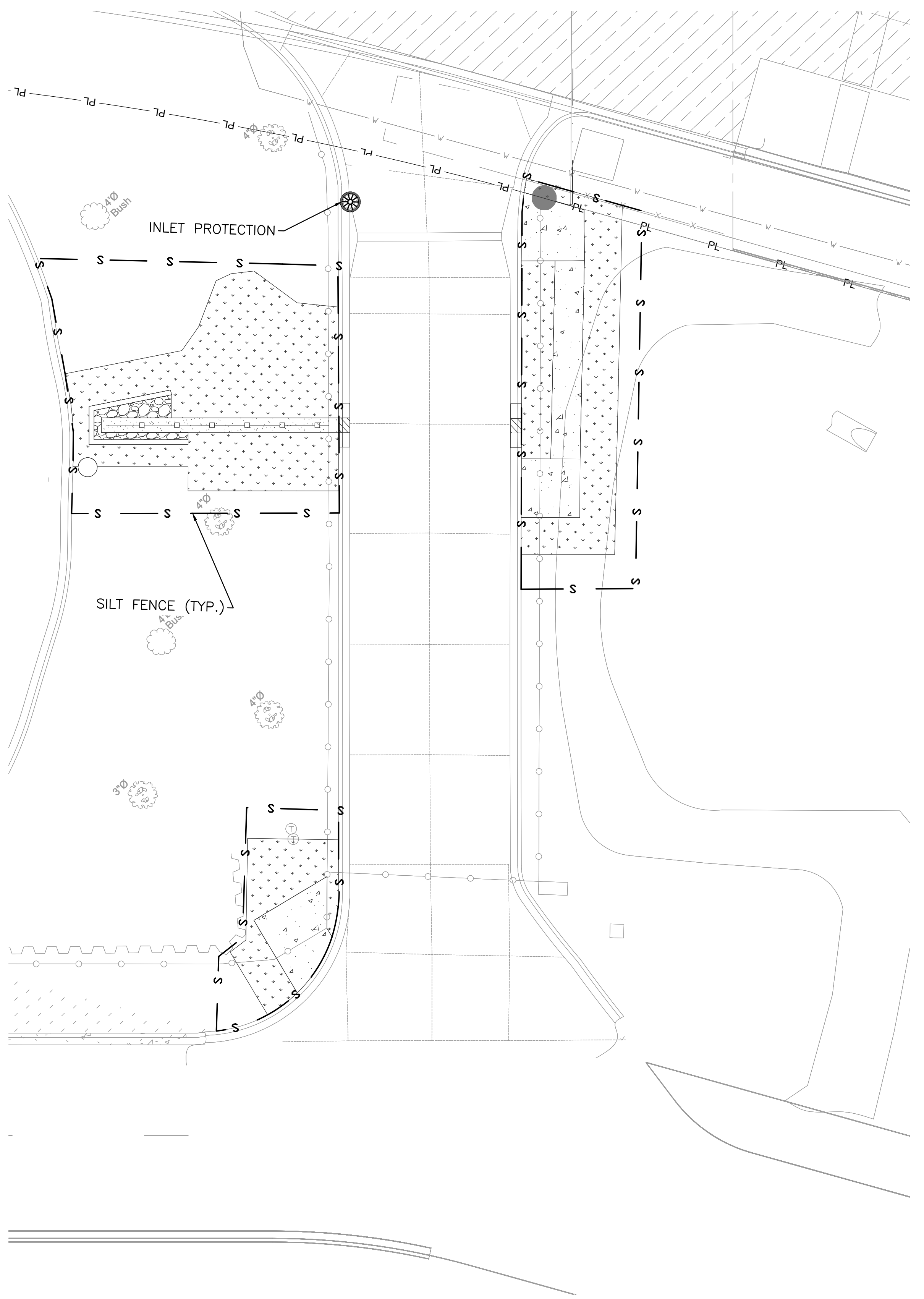
GRADING PLAN

SHEET NUMBER

C302



Designer: CS
 Checker: HG
 Approver: HG
 Date: 10/19/2023



SOIL EROSION & SEDIMENT CONTROL LEGEND

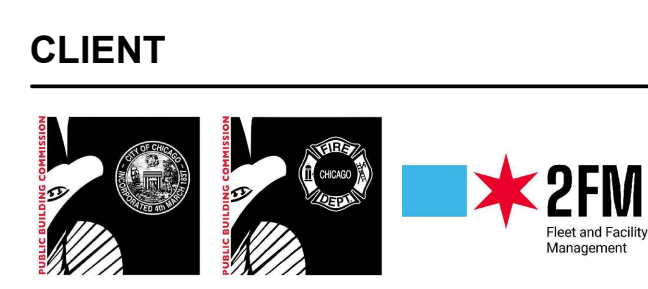
- S — SILT FENCE
- ⊗ INLET PROTECTION

SOIL EROSION & SEDIMENT CONTROL NOTES

1. SEE SHEET C502 FOR NOTES AND DETAILS.



PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #165
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 Fort Worth, TX 76109
 817-920-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2850
 Chicago, IL 60606
 312-425-9500

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-252-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

IR	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

PROJECT NUMBER

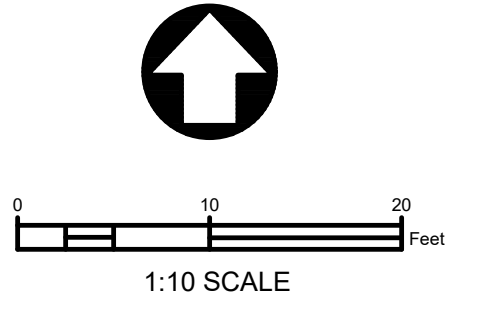
PBC-#07215 AECOM: 60710711

SHEET TITLE

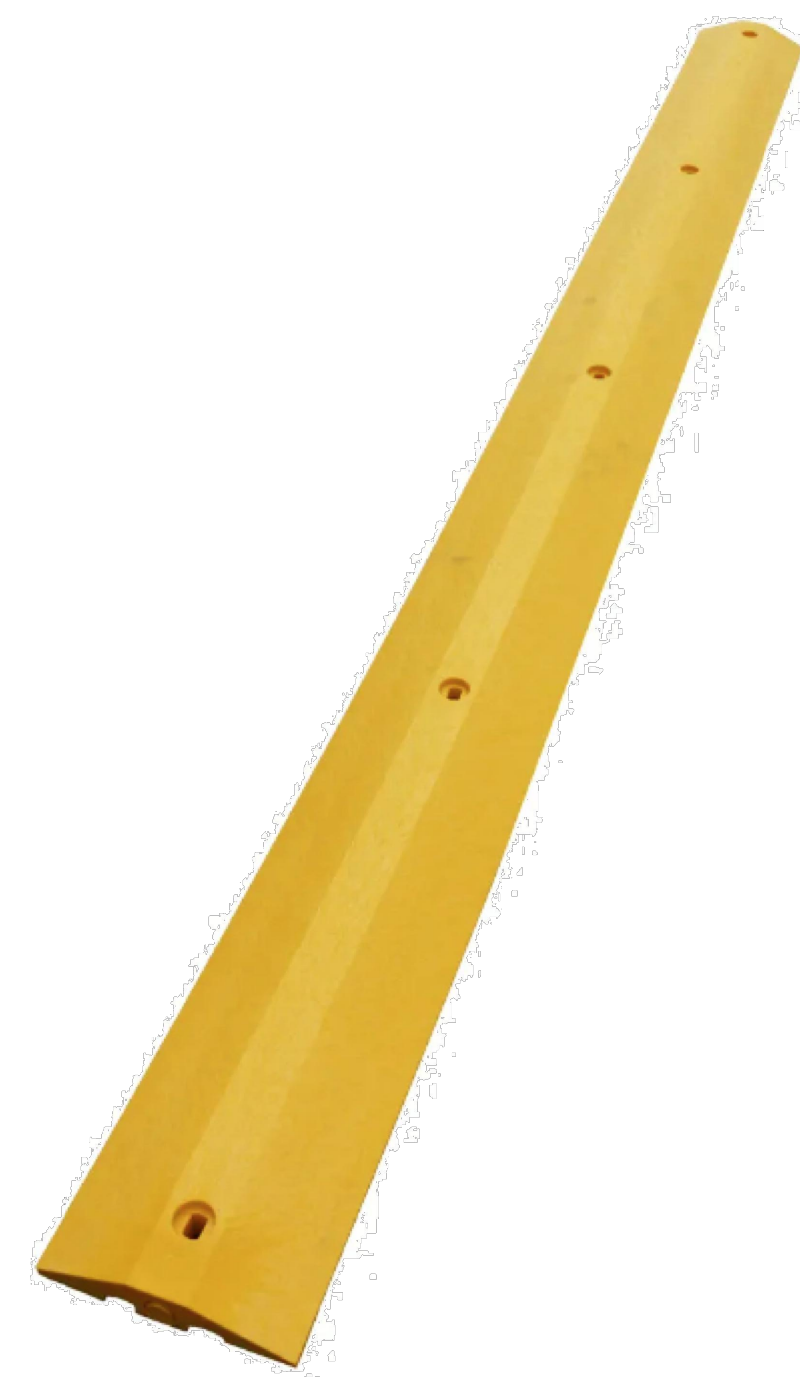
SOIL EROSION AND SEDIMENT CONTROL PLAN

SHEET NUMBER

C503



User Name: 10/20/2023 8:58:49 AM
 File Name: A:\Projects\2023\10711\ESTC-EMS-Addition\AECOM\ESTC_ADD_A.rvt



10' RECYCLED SOLID PLASTIC SPEED BUMP WITH 5" LAGS & ANCHORS
(BY TRAFFIC SAFETY STORE 800-429-9030 OR APPROVED EQUAL)

- 10' LONG X 10" WIDE X 2" TALL
- APPROXIMATELY 43 LBS EACH
- INCLUDES FIVE (5) FASTENERS PER BUMP

12" RECYCLED PLASTIC SPEED BUMP END CAPS WITH FOUR (4) 5" LAG BOLTS & ANCHORS
(BY TRAFFIC SAFETY STORE 800-429-9030 OR APPROVED EQUAL)

- 12" LONG X 10" WIDE X 2" TALL
- 4 LBS EACH
- INCLUDES TWO (2) FASTENERS
- 2 END CAPS

THE SPEED BUMP HAS YELLOW COLOR MOLDED IN THROUGHOUT. THE SPEED BUMP IS MOLDED OF 100 PERCENT POST-CONSUMER PLASTIC, LEED QUALIFIED, FADE-PROOF, AND LIGHTWEIGHT WITH A LIFETIME ANTI-BREAKAGE GUARANTEE. SPEED BUMP INCLUDES RECESSED BOLT HOLES.

1 SPEED BUMP DETAILS
C900 SCALE: N.T.S.

Designer: CS
 Checked: HG
 Approved: HG
 CHE130742

Last Pooled: 10/26/2024 8:58:49 AM
 Filename: Autodesk Docs\BIM\AEC\USA\2024\10\11\PS1C_EMS_Addendum\02_P2C_ADD_Avt



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #165
 Chicago, IL 60605
 312-462-2500

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-9198

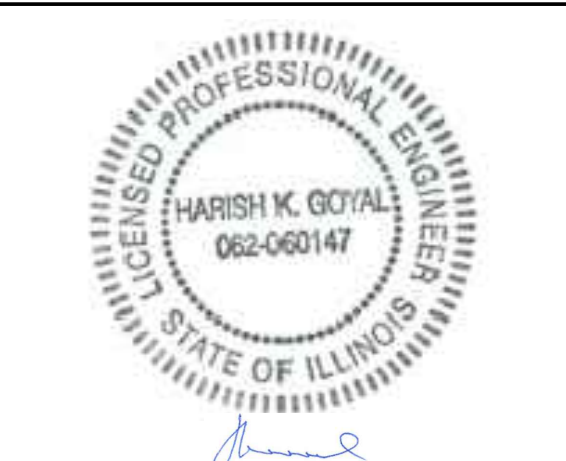
INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #501
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



KEY PLAN

ISSUE/REVISION

IR	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

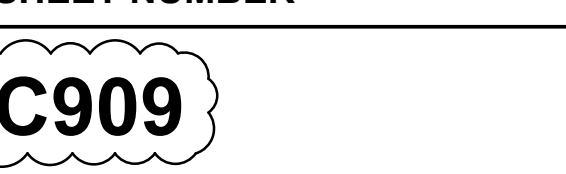
PROJECT NUMBER

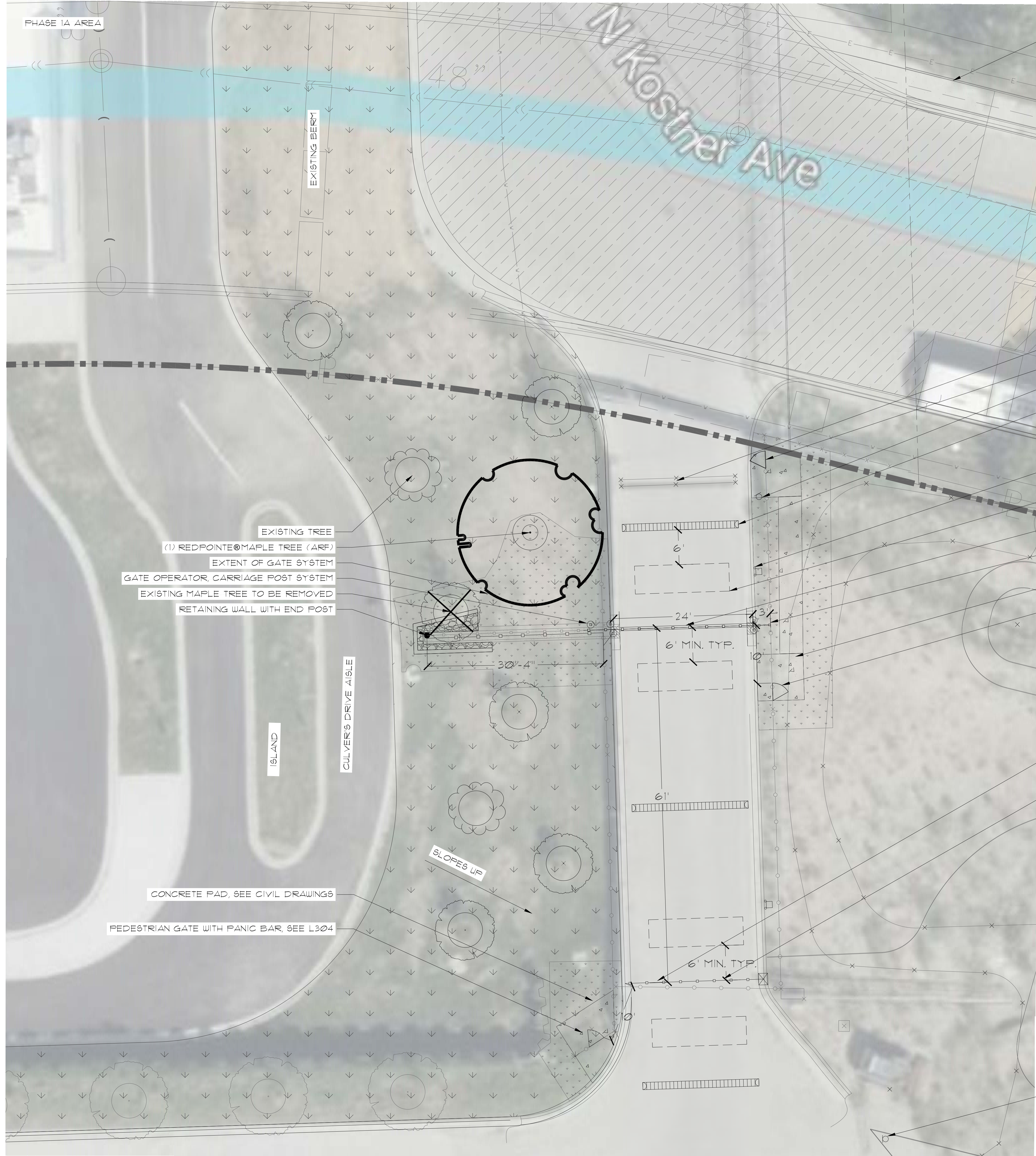
PBC: #07215 AECOM: 60710711

SHEET TITLE

DETAILS

SHEET NUMBER





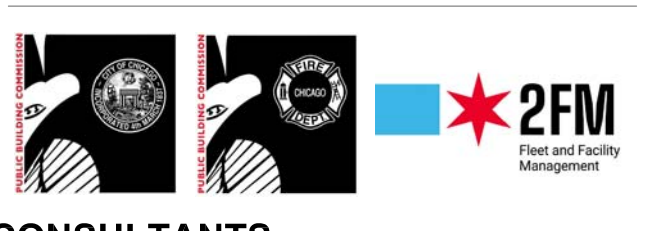
- LEGEND:**
- PROJECT LIMIT LINE
 - TREE PROTECTION FENCE
 - EXISTING 6' CHAIN LINK FENCE
 - x-x- EXISTING GUARDRAIL
 - ▨ GRAVEL
 - SEED
 - ▨ PROTECTION AREA
 - SINGLE PANEL LED LIGHT
 - ⊙ CARD READER
 - ⊙ GATE POSTS
- NOTES:**

1. THIS IS A CONCEPT PLAN - NOT FOR CONSTRUCTION.
2. SEE NOTES ON SHEET L302.
3. RENOVATE EXISTING GATE TO MEET UL325/ASTM F2200 STANDARDS

- NOTES:**
1. SLIDING GATES SHALL CONFORM TO THE CURRENT UL 325 AND ASTM F2200 STANDARDS.
 2. FOR CLASS IV - RESTRICTED ACCESS VEHICULAR GATE OPERATOR, WARNING SIGNS SHALL BE ATTACHED TO BOTH SIDES OF THE GATE AREA IN HIGHLY VISIBLE LOCATIONS.
 3. ENTRAPMENT AREAS SHALL BE COVERED WITH AT LEAST 2 SAFETY DEVICES IN EACH DIRECTION OF TRAVEL.
 4. GATES SHALL HAVE TWO BOTTOM EDGES.
 5. ALL OPERATORS AND ACCESS CONTROLS SHALL BE INSTALLED AT 6'-0" MINIMUM AWAY FROM THE GATE. ALSO SEE NOTES 15 AND 16.
 6. A SEPARATE PEDESTRIAN GATE, OUT OF REACH OF THE MOVING GATE, BUT WITHIN 10 FEET SHALL BE PROVIDED.
 7. PROVIDE ROLLER COVERS ON CANTILEVER WHEELS.
 8. PROVIDE VINYL COATED WIRE MESH SCREEN WITH OPENINGS LESS THAN 2-1/2 INCHES AFFIXED TO GATE AND FENCE TO 6 FOOT HEIGHT ABOVE GRADE.
 9. THE GATE SHALL NOT MOVE ON ITS OWN WHEN POWER IS TURNED OFF.
 10. THE GAP BETWEEN THE GATE AND THE STATIONARY FENCE POSTS SHALL BE LESS THAN 2-1/2 INCHES.
 11. PROVIDE POSITIVE STOPS AT BOTH THE FULLY OPEN AND CLOSED POSITIONS.
 12. RECEIVER GUIDES SHALL BE RECESSED BEHIND THE RECEIVER POST.
 13. PROVIDE A CATCH POST TO PREVENT GATE FROM FALLING IF DISCONNECTED FROM SUPPORTING HARDWARE.
 14. PROVIDE TWO SETS OF PHOTO SENSORS FOR EACH DIRECTION OF TRAVEL.
 15. PROVIDE DOUBLE HEIGHT CARD READER A MINIMUM OF 6 FEET AWAY FROM GATE.
 16. PROVIDE DETECTOR LOOPS A MINIMUM OF 6 FEET AWAY FROM GATE.
 17. PROVIDE EDGE SENSORS ON BOTH THE LEADING AND TRAILING EDGES OF THE GATES.
 18. CLASS IV GATES SHALL HAVE A GUARDHOUSE OR CCTV GATE MONITORING TO VERIFY CREDENTIALS OF VEHICLES ENTERING OR EXISTING THE FACILITY, AND TO ENSURE SAFE GATE OPERATION WHEN PEDESTRIANS ARE PRESENT.
 19. PROVIDE AN AUDIO ALARM ON GATE OPERATOR, COMPLYING WITH ASTM F2200.
 20. GATE SHALL HAVE SMOOTH BOTTOM EDGE.
 21. REFER TO ALL OTHER SAFETY MEASURES, PRECAUTIONS DEVICES AND STANDARDS REQUIRED IN UL 325 STANDARD TO WHICH GATE OPERATORS ARE MANUFACTURED AND TESTED, AND ASTM F2200 STANDARD SPECIFICATIONS FOR AUTOMATED VEHICULAR GATE CONSTRUCTION.
 22. SEE CIVIL DRAWINGS FOR RETAINING WALL, WALKWAYS, AND MODIFICATIONS TO EXISTING PAVEMENTS AND CURBS.
 23. ANY OMISSIONS OR DEVIATIONS FROM UL325 AND ASTM F2200 STANDARDS SHALL NOT BE THE RESPONSIBILITY OF JACOBS/RYAN ASSOCIATES.



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-9198

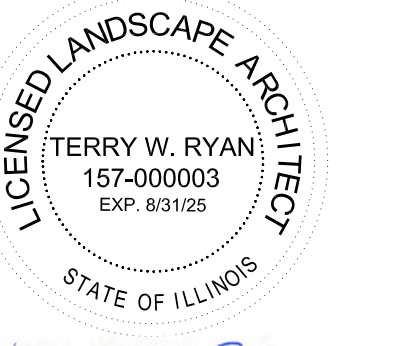
INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

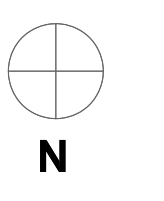
JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 7527 N. Sandburg Terrace
 Chicago, IL 60630
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



NORTH ARROW



ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/28/2024	ISSUED FOR BID
(R)		DATE DESCRIPTION

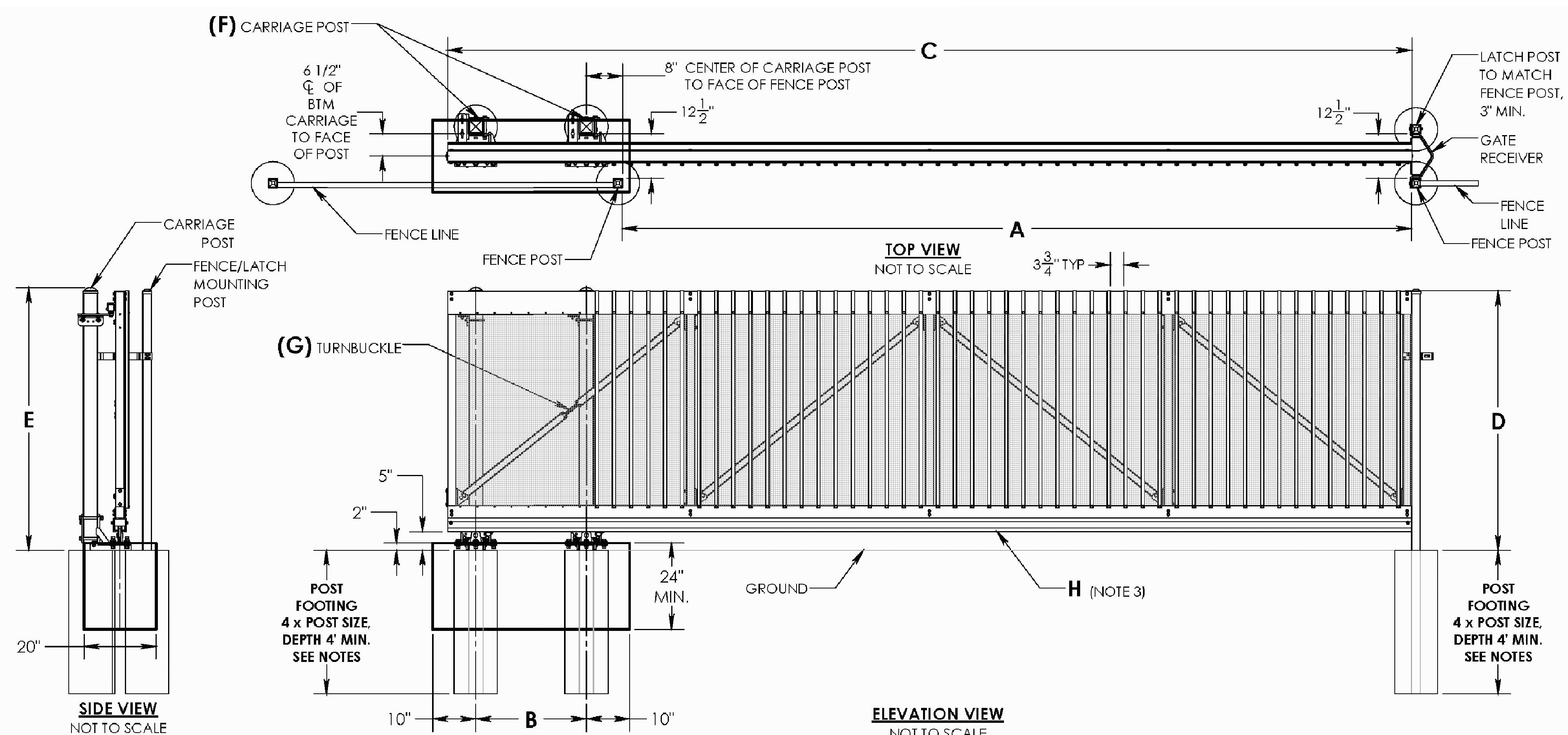
PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
SLIDING GATE PLAN ALLOWANCE

SHEET NUMBER

L301

IN PROGRESS - NOT FOR CONSTRUCTION

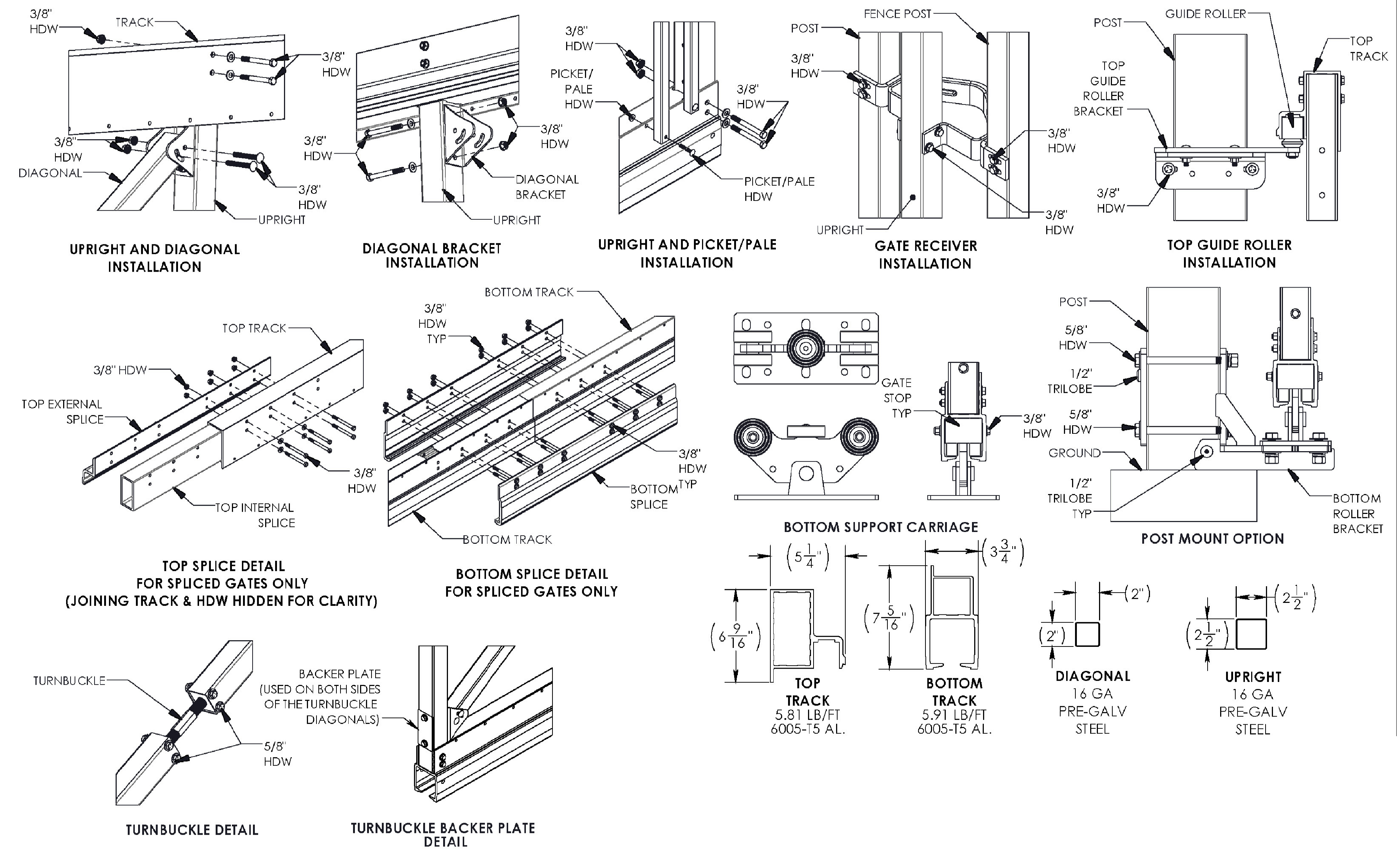


NOMINAL GATE SIZE
6'H X 22'-24'W

GATE INFORMATION CHART

Letter	Description	Value
A	CLEAR OPENING	22'-24'
B	CARRIAGE/POST SPACING C/C	49" +0.00' / -1.00"
C	OVERALL GATE LENGTH	358-3/4"
D	HEIGHT TO TOP OF PICKETS	72"
E	POST HEIGHT	74"
F	CARRIAGE POST SIZE	4"
G	NO. OF TURNBUCKLES	1
H	NO. OF SPLICES	1

- NOTES:**
- BOTH SLAB AND POST MOUNT OPTION SHOWN.
 - TOP OF SLAB WILL BE 2" ABOVE GROUND.
 - SPLICE REQUIRED ON LARGE GATES.
 - SEE INSTALLATION INSTRUCTIONS FOR ANCHOR DETAIL.
 - FOOTING DEPTHS ARE MINIMUM OR BASED ON LOCAL CONDITIONS.
 - GATE SHALL BE MOUNTED TO RETAINING WALL.



6' HT. ORNAMENTAL METAL SLIDING GATE DETAILS
SCALE: NTS

NOTES:
1. SEE NOTES ON SHEET L301.



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT



CONSULTANTS

AECOM
ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-372-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-520-9199

INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-616-7185

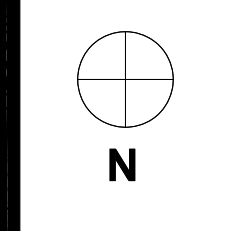
JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION



NORTH ARROW



ISSUE/REVISION

IR	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

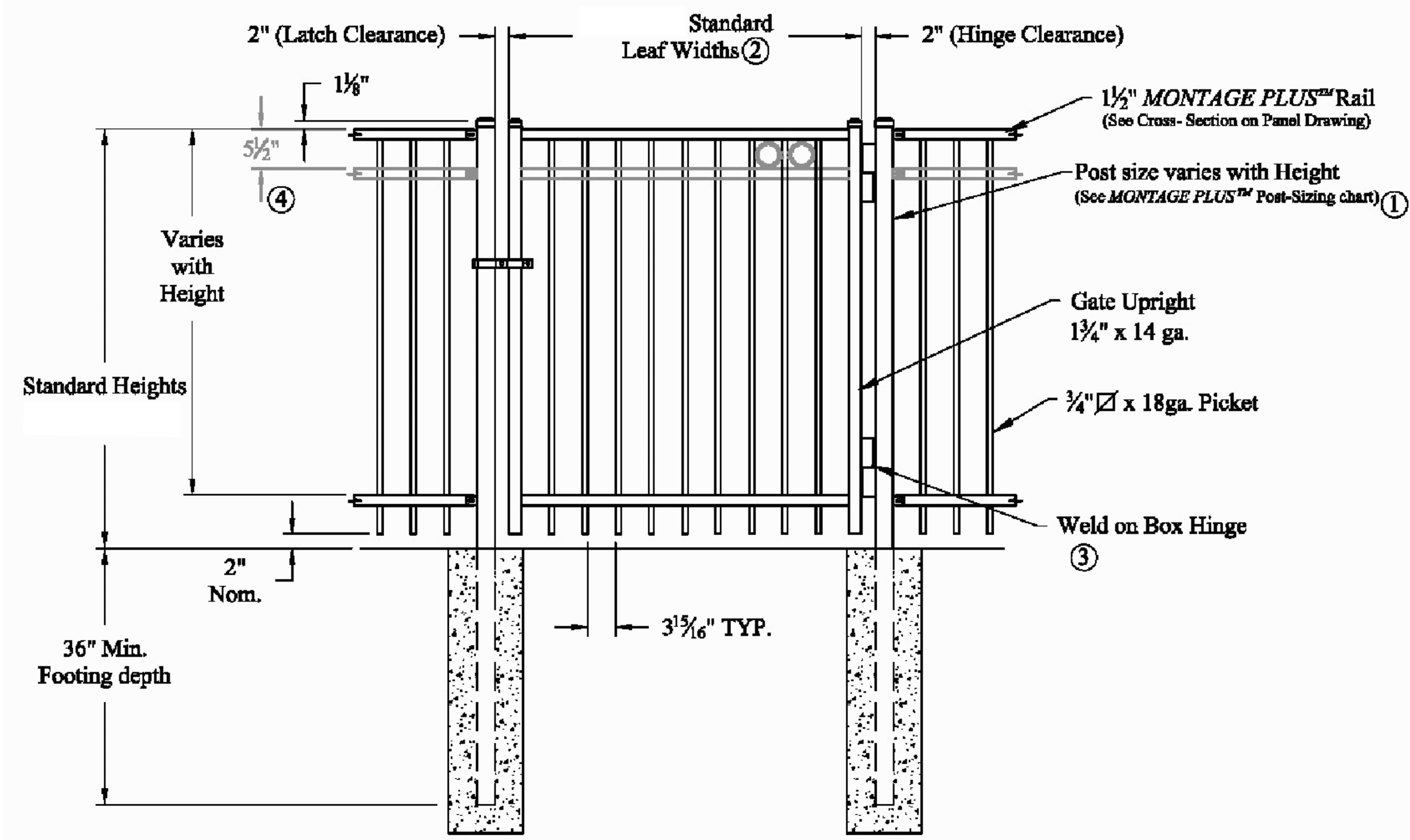
PROJECT NUMBER
PBC: #07215 AECOM: 60710711

SHEET TITLE
SLIDING GATE DETAILS

SHEET NUMBER

L303 3

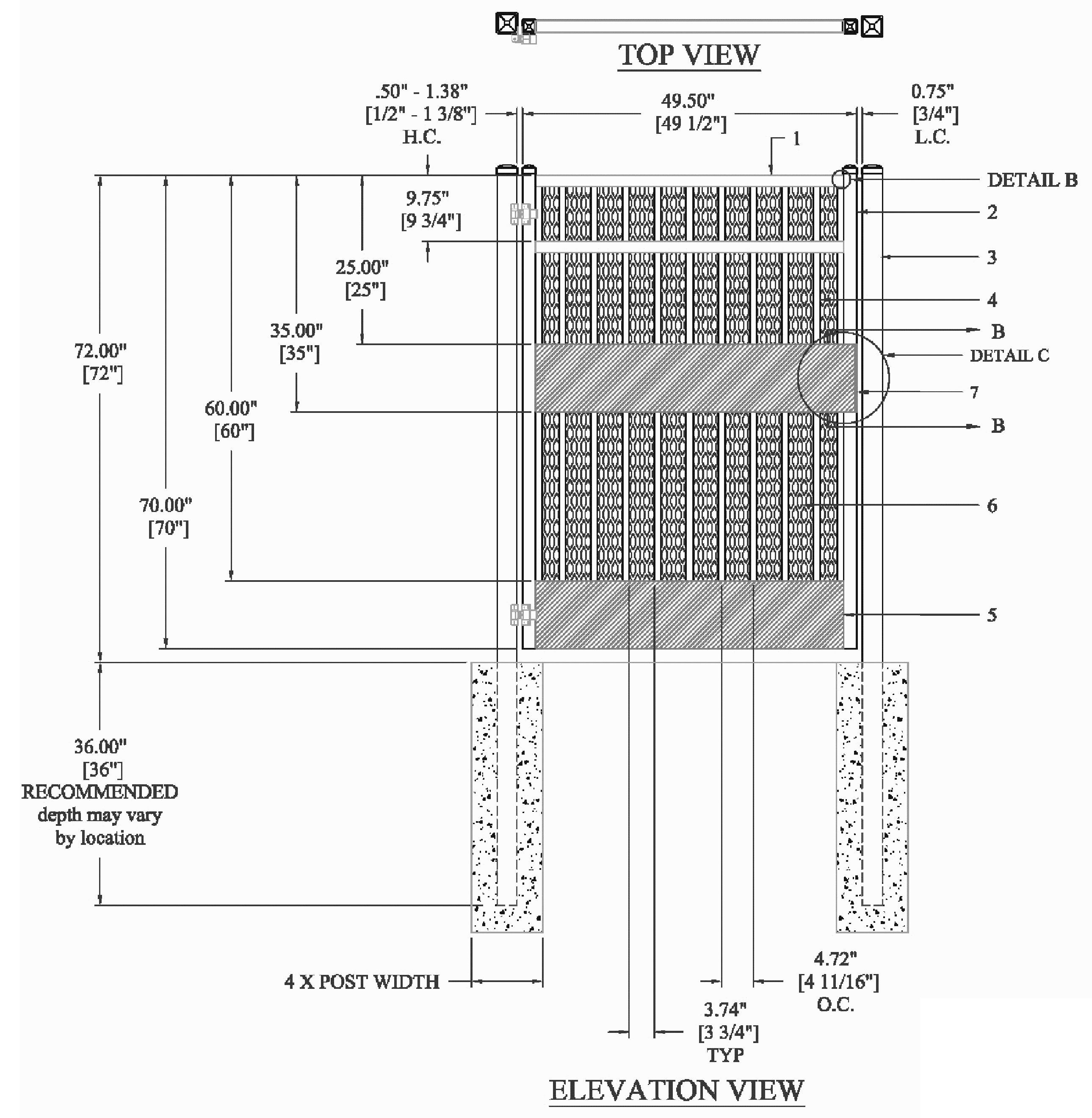
IN PROGRESS - NOT FOR CONSTRUCTION



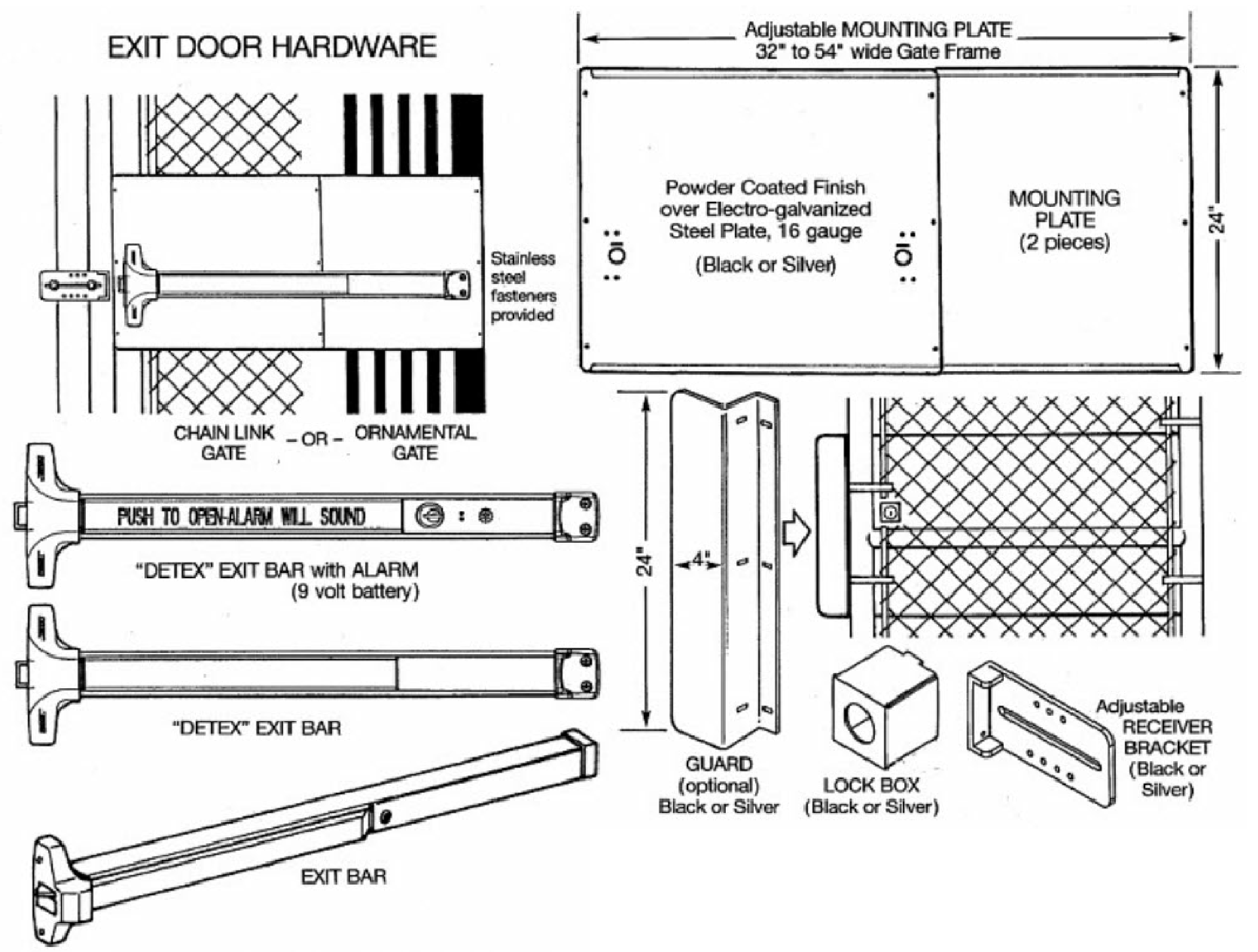
NOTES:

1. POST SIZE DEPENDS ON FENCE HEIGHT, WEIGHT AND WIND LOADS. SEE SPECIFICATIONS FOR POST SIZING CHART.
2. SEE MANUFACTURER'S GATE TABLE FOR STANDARD OUT TO OUTS. CUSTOM GATE OPENINGS AVAILABLE FOR SPECIAL OUT TO OUT/LEAF WIDTHS.
3. PROVIDE PUSH BAR ACCESSIBLE LATCH, SELF-CLOSING, SELF LOCKING.

① PEDESTRIAN GATE DETAIL
SCALE: NT5



③ PEDESTRIAN GATE DETAIL
SCALE: NT5



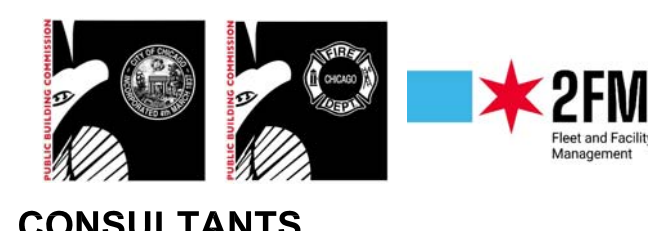
② PUSH BAR DETAIL
SCALE: NT5

NOTES:

1. REMOVE EXISTING FENCE SECTIONS, MODIFY FENCE FOR NEW PEDESTRIAN GATES AND INSTALL NEW FENCING AND PEDESTRIAN GATE, TO CREATE COMPLETELY SECURED AREAS WHEN COMPLETE.
2. SEE NOTES ON SHEET L301.



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
AECOM
ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-373-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-520-9159

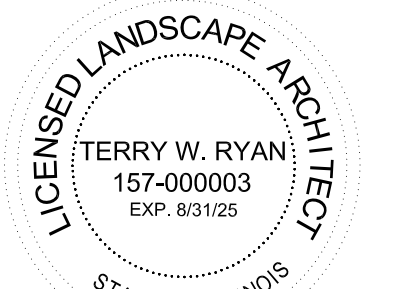
INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

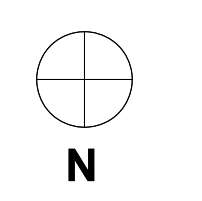
LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION



Terry W. Ryan

NORTH ARROW



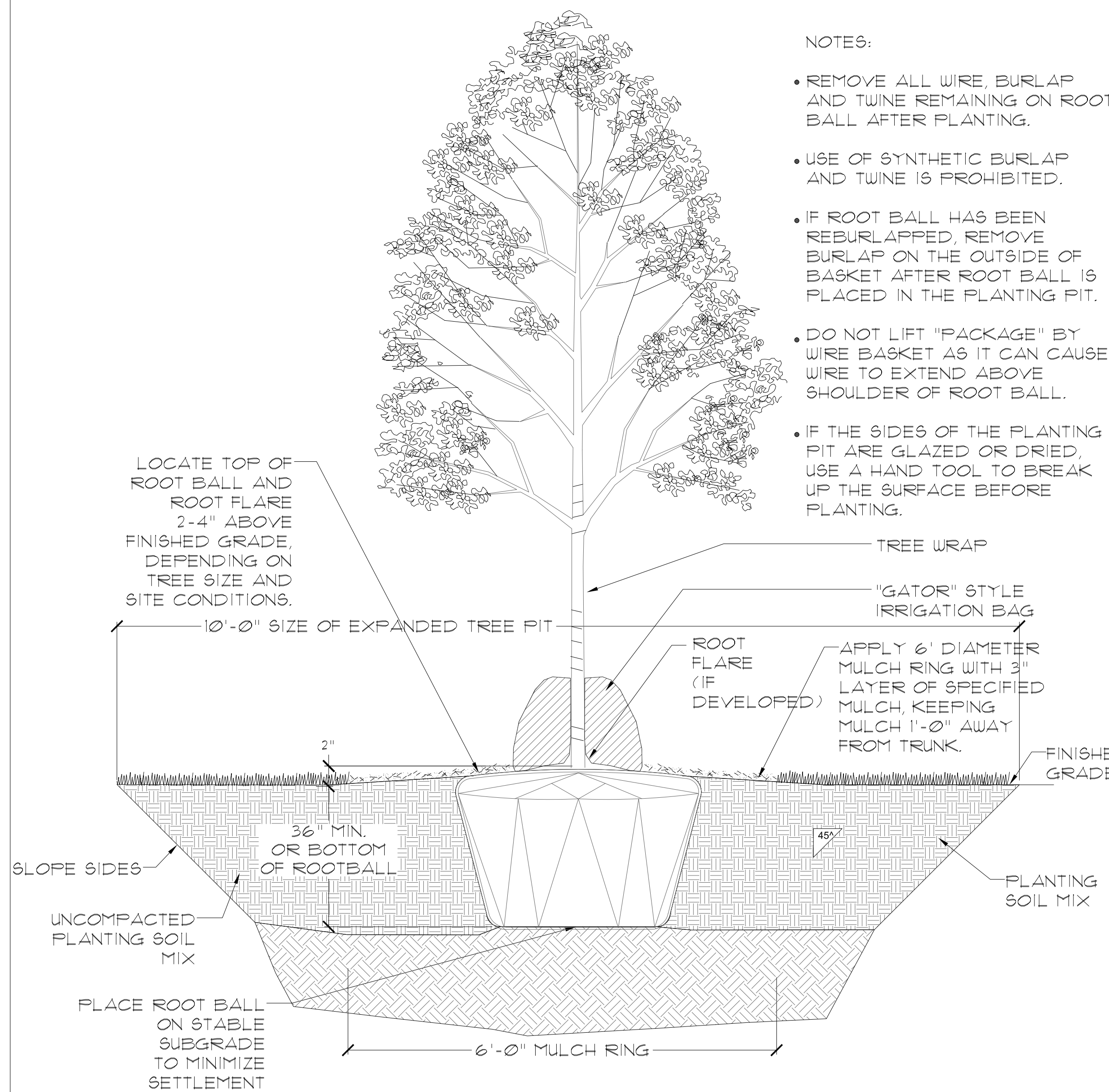
ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
IR	DATE	DESCRIPTION

PROJECT NUMBER
PBC: #07215 AECOM: 60710711

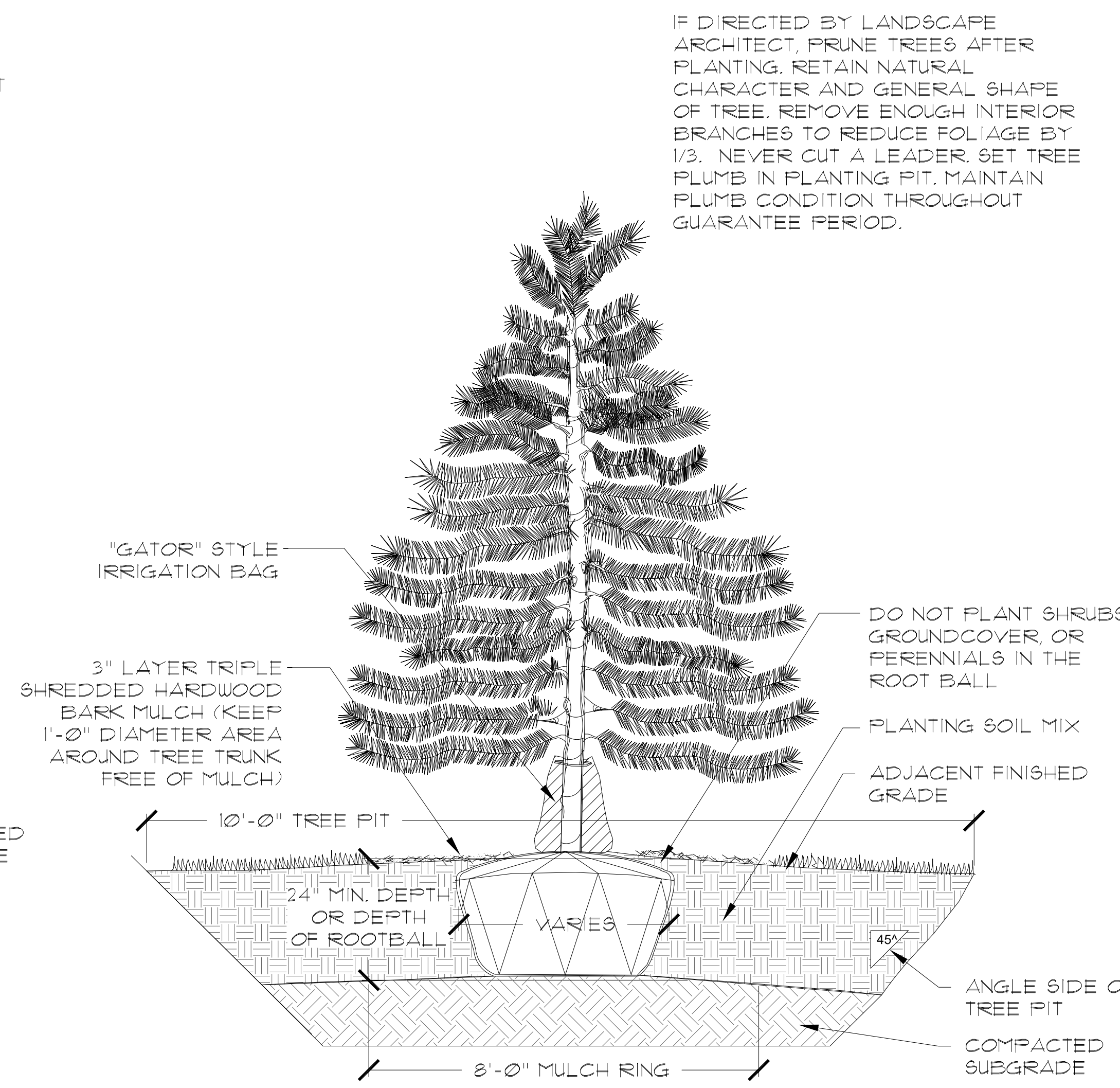
SHEET TITLE
PEDESTRIAN GATE DETAILS

SHEET NUMBER
L304 ③



1 SHADE TREE PLANTING DETAIL
SCALE: NTS

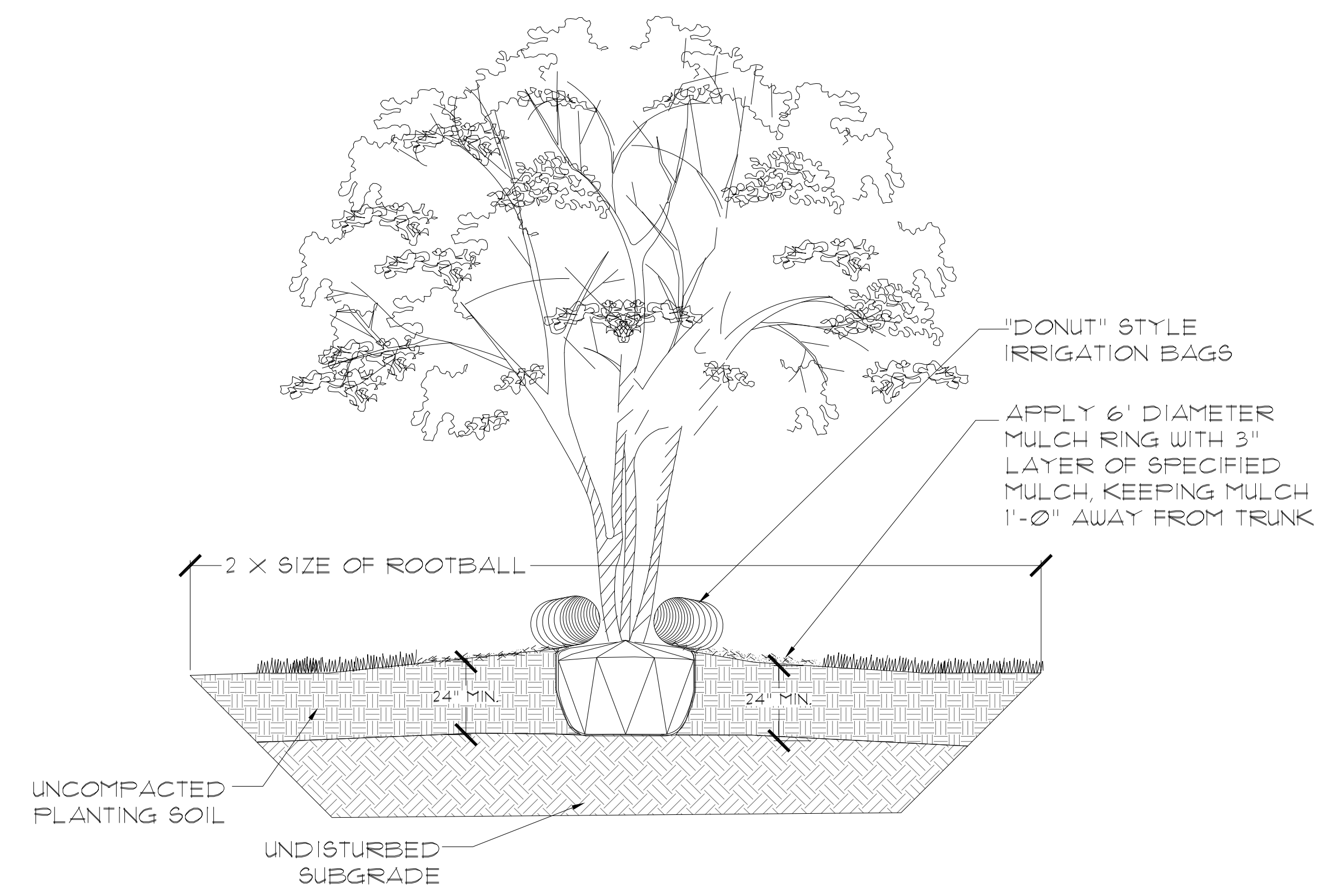
- NOTES:
- REMOVE ALL WIRE, BURLAP AND TWINE REMAINING ON ROOT BALL AFTER PLANTING.
 - USE OF SYNTHETIC BURLAP AND TWINE IS PROHIBITED.
 - IF ROOT BALL HAS BEEN REBURLAPPED, REMOVE BURLAP ON THE OUTSIDE OF BASKET AFTER ROOT BALL IS PLACED IN THE PLANTING PIT.
 - DO NOT LIFT "PACKAGE" BY WIRE BASKET AS IT CAN CAUSE WIRE TO EXTEND ABOVE SHOULDER OF ROOT BALL.
 - IF THE SIDES OF THE PLANTING PIT ARE GLAZED OR DRIED, USE A HAND TOOL TO BREAK UP THE SURFACE BEFORE PLANTING.



2 EVERGREEN TREE PLANTING DETAIL
SCALE: NTS

IF DIRECTED BY LANDSCAPE ARCHITECT, PRUNE TREES AFTER PLANTING. RETAIN NATURAL CHARACTER AND GENERAL SHAPE OF TREE. REMOVE ENOUGH INTERIOR BRANCHES TO REDUCE FOLIAGE BY 1/3. NEVER CUT A LEADER. SET TREE PLUMB IN PLANTING PIT. MAINTAIN PLUMB CONDITION THROUGHOUT GUARANTEE PERIOD.

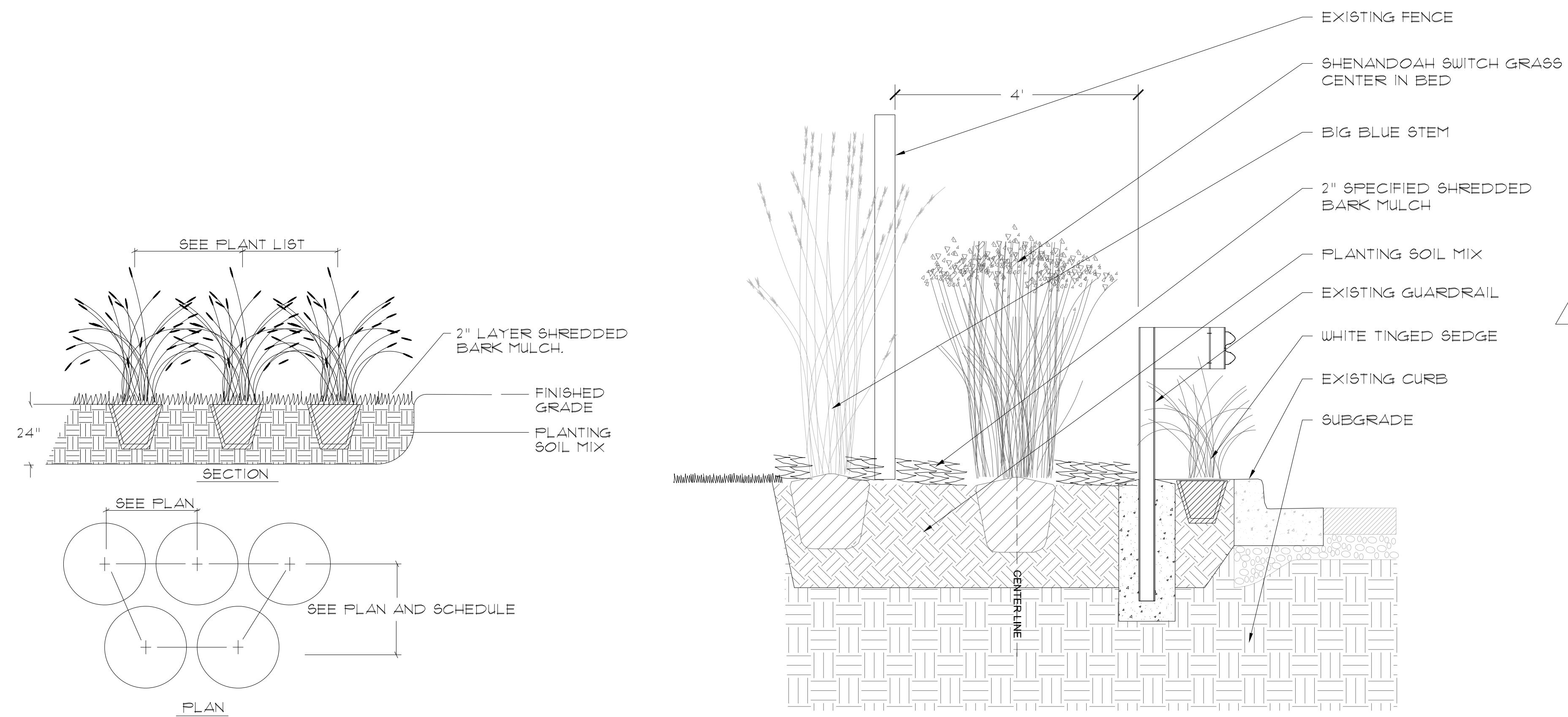
- NOTES:
- THESE TREE PLANTING DETAILS APPLY TO NEW AND REPLACEMENT TREES.



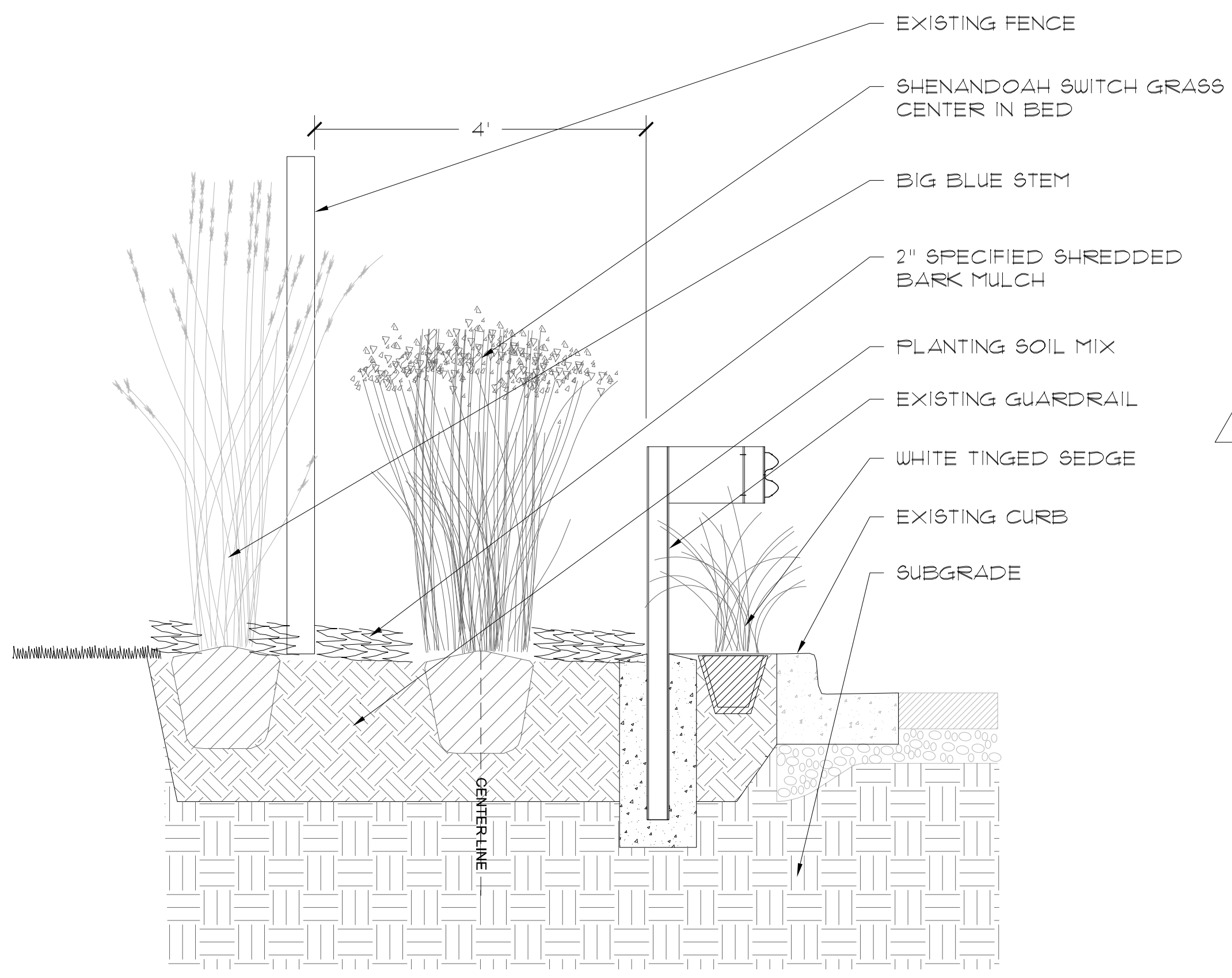
3 ORNAMENTAL TREE PLANTING DETAIL
SCALE: NTS

PLANT LIST						
Key	Quantity	Botanical Name	Common Name	Size	Spacing	Comments
SHADE TREES						
QIM	4	Quercus imbricaria	Shingle Oak	2-1/2" cal. B&B	on plan	matched; 6' clear; spring dig only
GRASSES						
AGE	144	Andropogon gerardii	Big Bluestem	#1 container	18" o.c.	
CAL	282	Carex albicans	White-Tinged Sedge	#1 container	18" o.c.	
PVI	107	Panicum virgatum 'Shenandoah'	Shenandoah Switch Grass	#1 container	24" o.c.	
REPLACEMENT TREES						
CAS	1	Catalpa speciosa	Northern Catalpa	2.5" caliper B&B	on plan	
CHV	1	Chionanthus virginicus	White Fringetree	5' height B&B	on plan	Spring Dig Only
PGL	1	Picea glauca	Black Hills Spruce	8-10' height B&B	on plan	Spring Dig Only
ARF	1	Acer rubrum 'Frank Jr.'	Redpointe® Maple	2.5" caliper B&B	on plan	Spring Dig Only

3



4 GRASSES PLANTING DETAIL
SCALE: NTS



5 GUARDRAIL PLANTING DETAIL
SCALE: 1/2"=1'-0"

- NOTES:
- LOCATE TOP OF ROOT BALL AND ROOT FLARE 2" ABOVE FINISHED GRADE, DEPENDING ON TREE SIZE AND SITE CONDITIONS.
 - SUPPORT APPURTENANCES TO BE USED ONLY IF TREE FAILS TO REMAIN PLUMB.
 - PROVIDE ALL TREES AND PLANTS AS SPECIMEN QUALITY, TRUE TO SPECIES, VARIETY AND SIZE SHOWN.
 - DIG AND INSTALL TREES IN SPRING ONLY.
 - LOCATE TOP OF ROOT BALL AND ROOT FLARE 2" ABOVE FINISHED GRADE, DEPENDING ON TREE SIZE AND SITE CONDITIONS.
 - USE SUPPORT APPURTENANCES ONLY IF TREE FAILS TO REMAIN PLUMB.
 - PRUNE TREES AFTER PLANTING AND AT DIRECTION OF THE LANDSCAPE ARCHITECT.
 - ALL CONTAINER PLANTS SHALL BE FULLY ROOTED IN THEIR CONTAINERS AND SHALL BE FULLY SYMMETRICAL PLANTS WITH MANY CANES, BRANCHES, STEMS, AND FLOWER SPIKES.
 - PROVIDE 8'-0" DIAMETER TREE PITS AND 6'-0" MULCH RINGS FOR ALL NEW TREES. KEEP MULCH AWAY FROM TRUNKS.
 - MULCH ALL PITS AND BEDS IN THEIR ENTIRETY. MULCH EXISTING TREE TO REMAIN. PROVIDE PREMIUM TRIPLE SHREDDED HARDWOOD BARK MULCH, 3" FOR TREES AND 2" THROUGHOUT BEDS.
 - INSTALLED TREES SHALL SET CROWN OF ROOT BALL 2" ABOVE FINISH GRADE.
 - MULCH AND WATER IN PLANTS IMMEDIATELY AFTER PLANTING.



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kildbourn Avenue, Chicago, IL 60651



CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-620-5195

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-418-7185

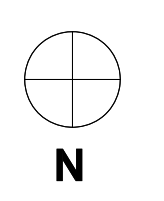
JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION



NORTH ARROW



ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

PROJECT NUMBER

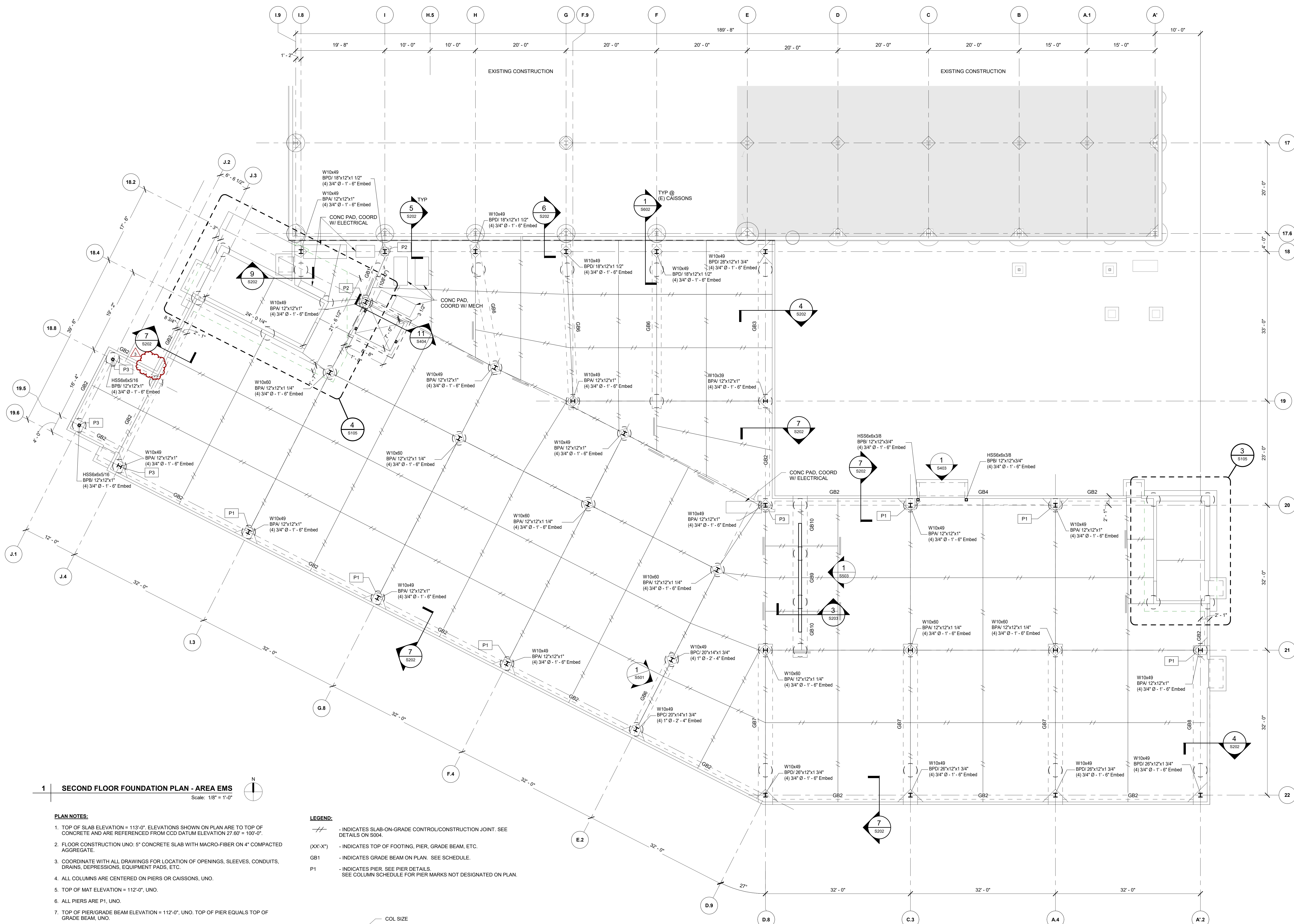
PBC: #07215 AECOM: 60710711

SHEET TITLE

SITE DETAILS & PLANT SCHEDULE

SHEET NUMBER

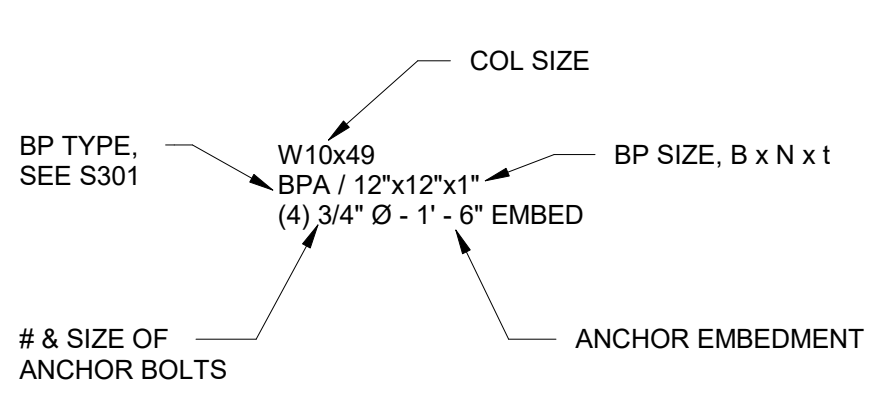
L200



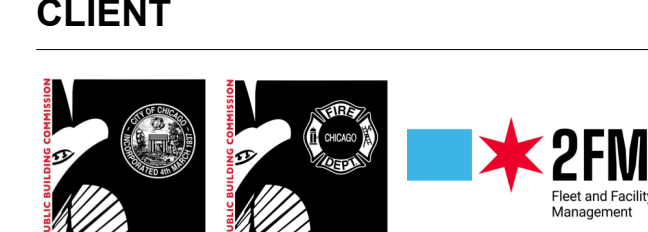
1 SECOND FLOOR FOUNDATION PLAN - AREA EMS
Scale: 1/8" = 1'-0"

- PLAN NOTES:**
- TOP OF SLAB ELEVATION = 113'-0". ELEVATIONS SHOWN ON PLAN ARE TO TOP OF CONCRETE AND ARE REFERENCED FROM CCD DATUM ELEVATION 27.60' = 100'-0".
 - FLOOR CONSTRUCTION UNO: 5" CONCRETE SLAB WITH MACRO-FIBER ON 4" COMPACTED AGGREGATE.
 - COORDINATE WITH ALL DRAWINGS FOR LOCATION OF OPENINGS, SLEEVES, CONDUITS, DRAINS, DEPRESSIONS, EQUIPMENT PADS, ETC.
 - ALL COLUMNS ARE CENTERED ON PIERS OR CAISSONS, UNO.
 - TOP OF MAT ELEVATION = 112'-0", UNO.
 - ALL PIERS ARE P1, UNO.
 - TOP OF PIER/GRADE BEAM ELEVATION = 112'-0", UNO. TOP OF PIER EQUALS TOP OF GRADE BEAM, UNO.
 - SEE GENERAL NOTES ON SHEETS S202 AND S203.
 - SEE TYPICAL DETAILS ON SHEETS S204 AND S205.
 - SEE SHEETS S201 AND S202 FOR PIER, GRADE BEAM, WALL, CAISSON DETAILS AND SCHEDULES.
 - NOTE 1: PROVIDE (2) #4 x 4'-0" SPACED AT 3" OC IN SLAB, PLACED AT 1 1/2" FROM TOP OF SLAB.

- LEGEND:**
- INDICATES SLAB-ON-GRADE CONTROL/CONSTRUCTION JOINT. SEE DETAILS ON S204.
 - (XX-XX) INDICATES TOP OF FOOTING, PIER, GRADE BEAM, ETC.
 - GB1 INDICATES GRADE BEAM ON PLAN. SEE SCHEDULE.
 - P1 INDICATES PIER. SEE PIER DETAILS. SEE COLUMN SCHEDULE FOR PIER MARKS NOT DESIGNATED ON PLAN.



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS

AECOM
ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-373-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
308 Overton Park Dr W
Fort Worth, TX 76109
817-820-9188

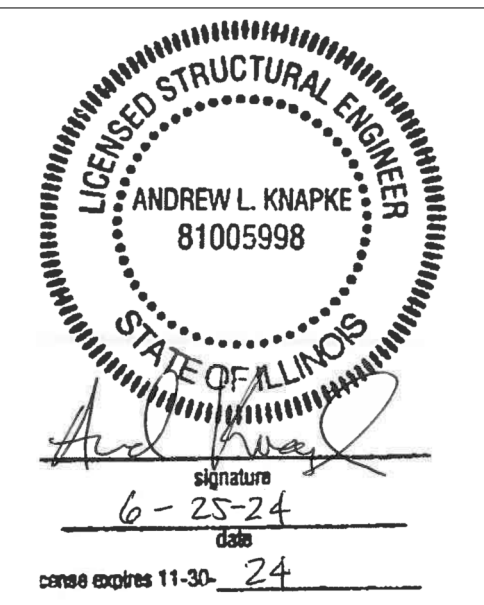
INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION



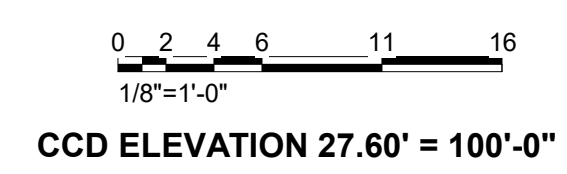
ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
1/R		DESCRIPTION

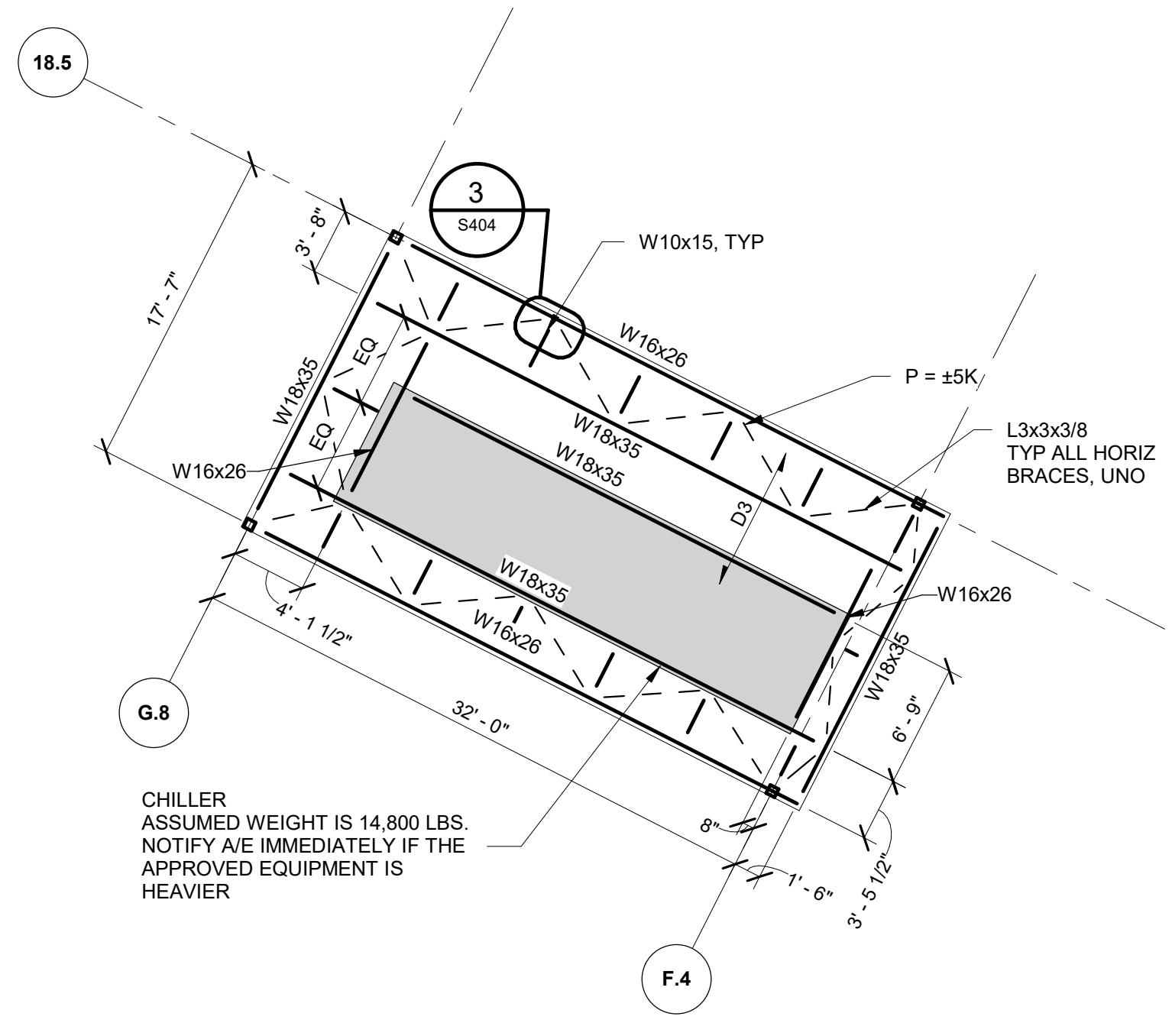
PROJECT NUMBER
PBC: #07215 AECOM: 60710711

SHEET TITLE
SECOND FLOOR FOUNDATION PLAN

SHEET NUMBER
S101



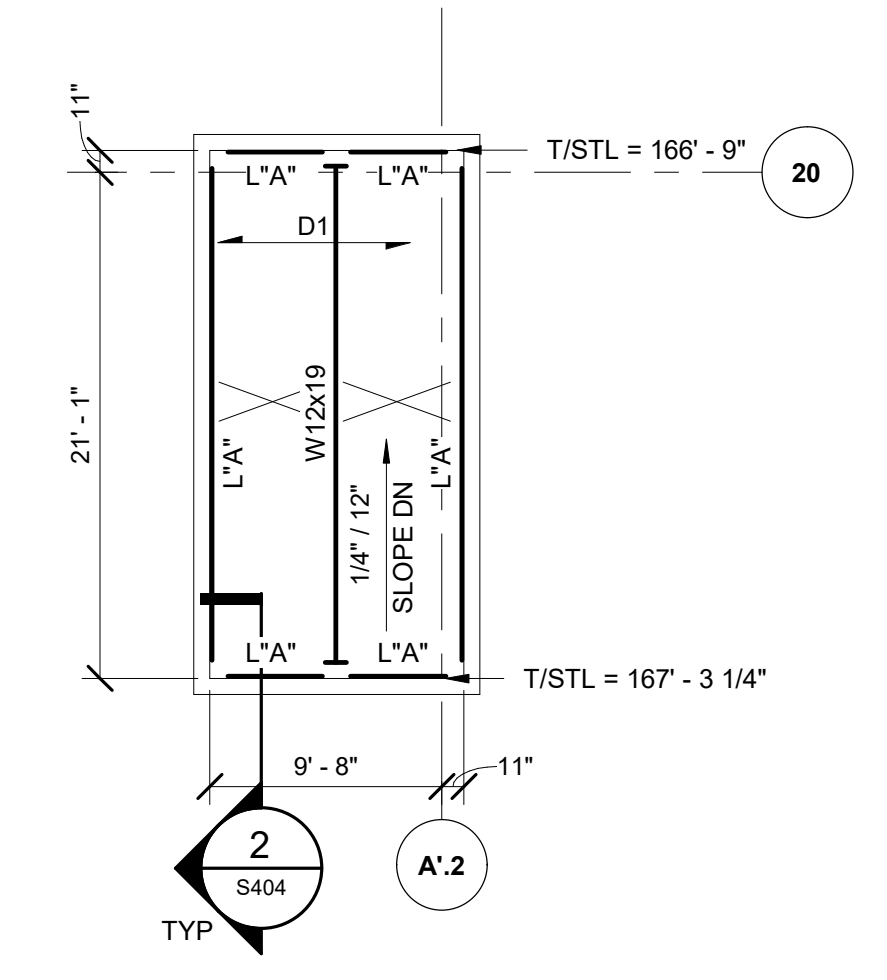
This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or relied upon by third parties, except as agreed by AECOM and its client. AECOM and its client accept no responsibility for any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



1 CHILLER PLATFORM FRAMING PLAN - AREA EMS
Scale: 1/8" = 1'-0"

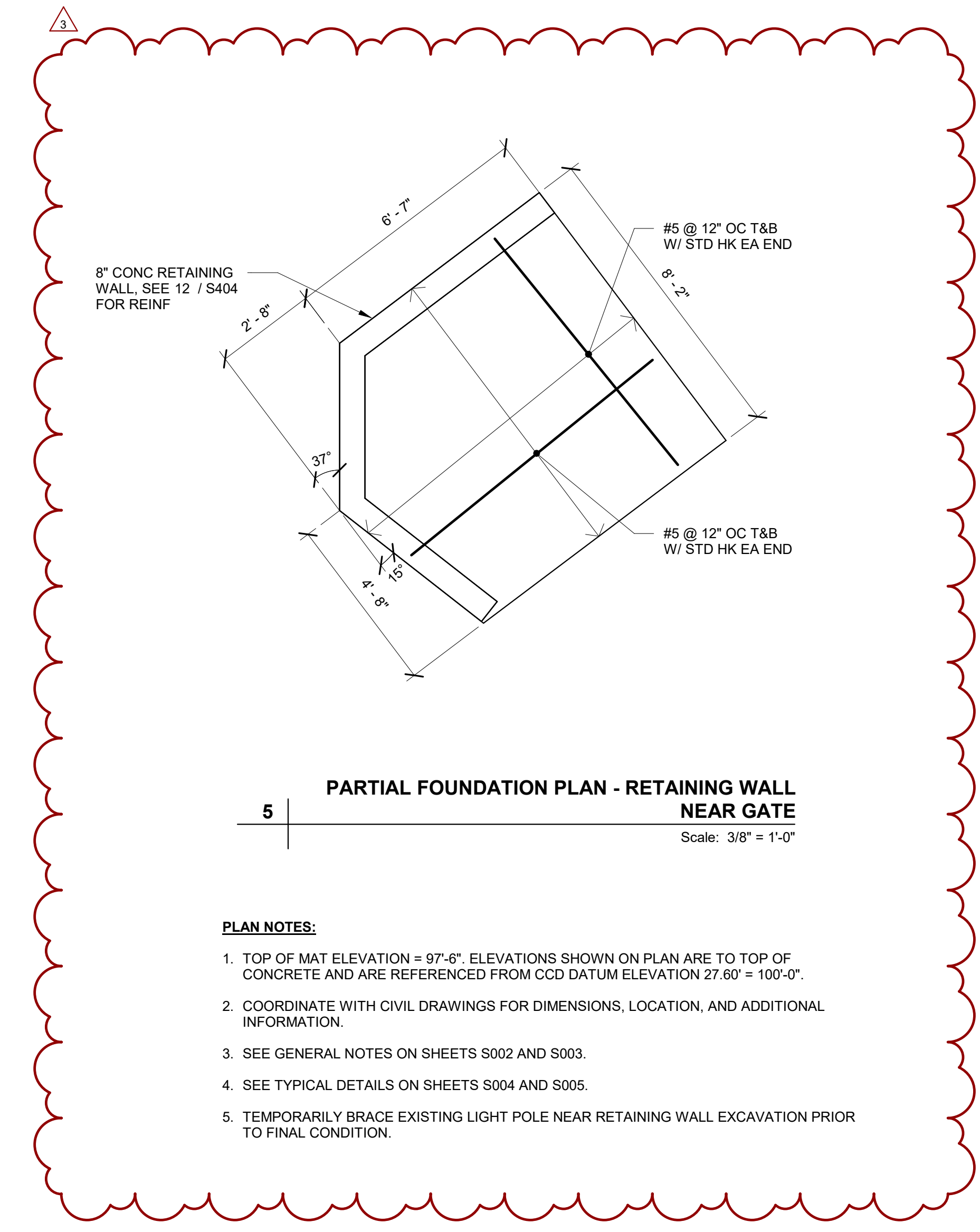
- PLAN NOTES:**
- TOP OF STEEL ELEVATION = 163'-6". ELEVATIONS SHOWN ON PLAN ARE TO TOP OF STEELJOIST BEARING ELEVATION AND ARE REFERENCED FROM CCD DATUM ELEVATION 27.60' = 100'-0".
 - PLATFORM CONSTRUCTION UNO (D3): 1 1/2"x3/16" TYPE 19-4 STANDARD STEEL GRATING, GALVANIZED, ATTACH TO STEEL BEAMS PER GENERAL NOTES. TOP OF GRATING ELEVATION = 163'-7 1/2". EXTEND GRATING TO EXTERIOR EDGE OF BEAM FLANGE.
 - ALL STEEL SHALL BE HOT-DIPPED GALVANIZED.
 - COORDINATE WITH ALL DRAWINGS FOR LOCATION OF OPENINGS, SLEEVES, CONDUITS, DRAINS, DEPRESSIONS, EQUIPMENT PADS, ETC.
 - BEAMS ARE EQUALLY SPACED BETWEEN COLUMN OR INTERSECTING GIRDERS, UNO.
 - SEE GENERAL NOTES ON SHEETS S002 AND S003.
 - SEE TYPICAL DETAILS ON SHEETS S006 AND S007.
 - SEE ARCHITECTURAL DRAWINGS FOR HANDRAIL AND ACCESS LADDER.

- LEGEND:**
- INDICATES ROOF OPENING, SEE DETAIL 6/S006. COORDINATE WITH MECHANICAL DRAWINGS.
 - INDICATES MOMENT CONNECTION ON PLAN. MOMENT CONNECTION SYMBOLS WITH THE LETTER "MS" BESIDE IT INDICATES A MOMENT CONNECTION THAT DOES NOT REQUIRE COLUMN STIFFENER PLATES.
 - INDICATES SLAB OR DECK SPAN DIRECTION.
 - INDICATES KNEE BRACE, SEE DETAIL 17/S007.
 - INDICATES CROSS BRACING, SEE DETAIL 3/S006.
 - COORDINATE DIMENSION TO ALIGN WITH CHILLER SUPPLIER (SPRING ISOLATOR LOCATIONS).
 - INDICATES L6x4x3/8 LVL W/ 3/4" DIA EXPANSION ANCHORS AT 2'-0" OC.



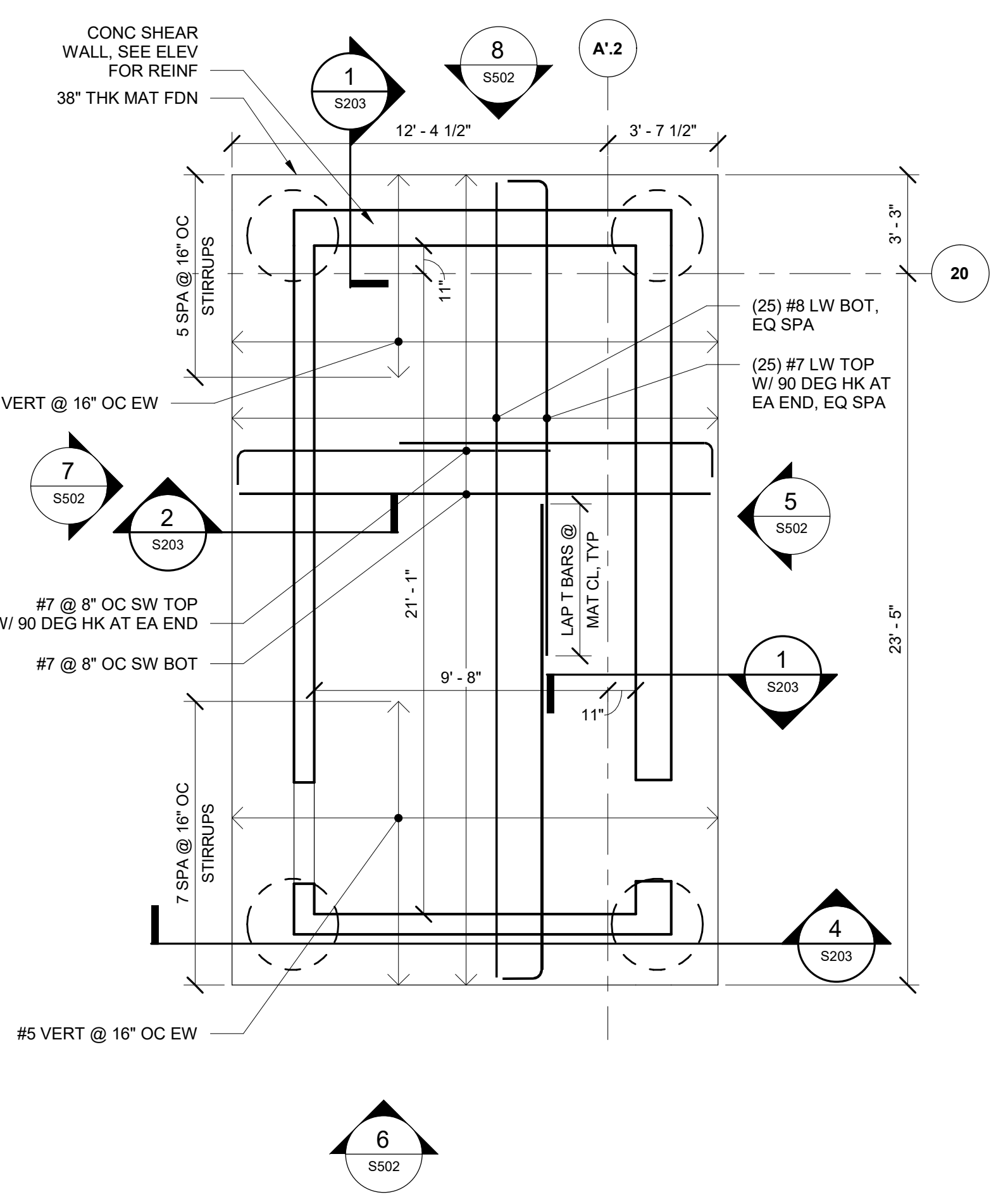
2 STAIR ROOF FRAMING PLAN - AREA EMS
Scale: 1/8" = 1'-0"

- PLAN NOTES:**
- TOP OF STEEL ELEVATION = 166'-9". ELEVATIONS SHOWN ON PLAN ARE TO TOP OF STEEL ELEVATION AND ARE REFERENCED FROM CCD DATUM ELEVATION 27.60' = 100'-0".
 - (+/-) INDICATES CHANGE IN ELEVATION FROM TOP OF STEEL REFERENCE ELEVATION.
 - ROOF CONSTRUCTION UNO (D1): 3"x20 GAGE GALVANIZED STEEL DECK ATTACHED TO STEEL BEAMS PER GENERAL NOTES.
 - COORDINATE WITH ALL DRAWINGS FOR LOCATION OF OPENINGS, SLEEVES, CONDUITS, DRAINS, DEPRESSIONS, EQUIPMENT PADS, ETC.
 - BEAMS ARE EQUALLY SPACED BETWEEN WALLS, UNO.
 - SEE GENERAL NOTES ON SHEETS S002 AND S003.
 - SEE TYPICAL DETAILS ON SHEETS S006 AND S007.



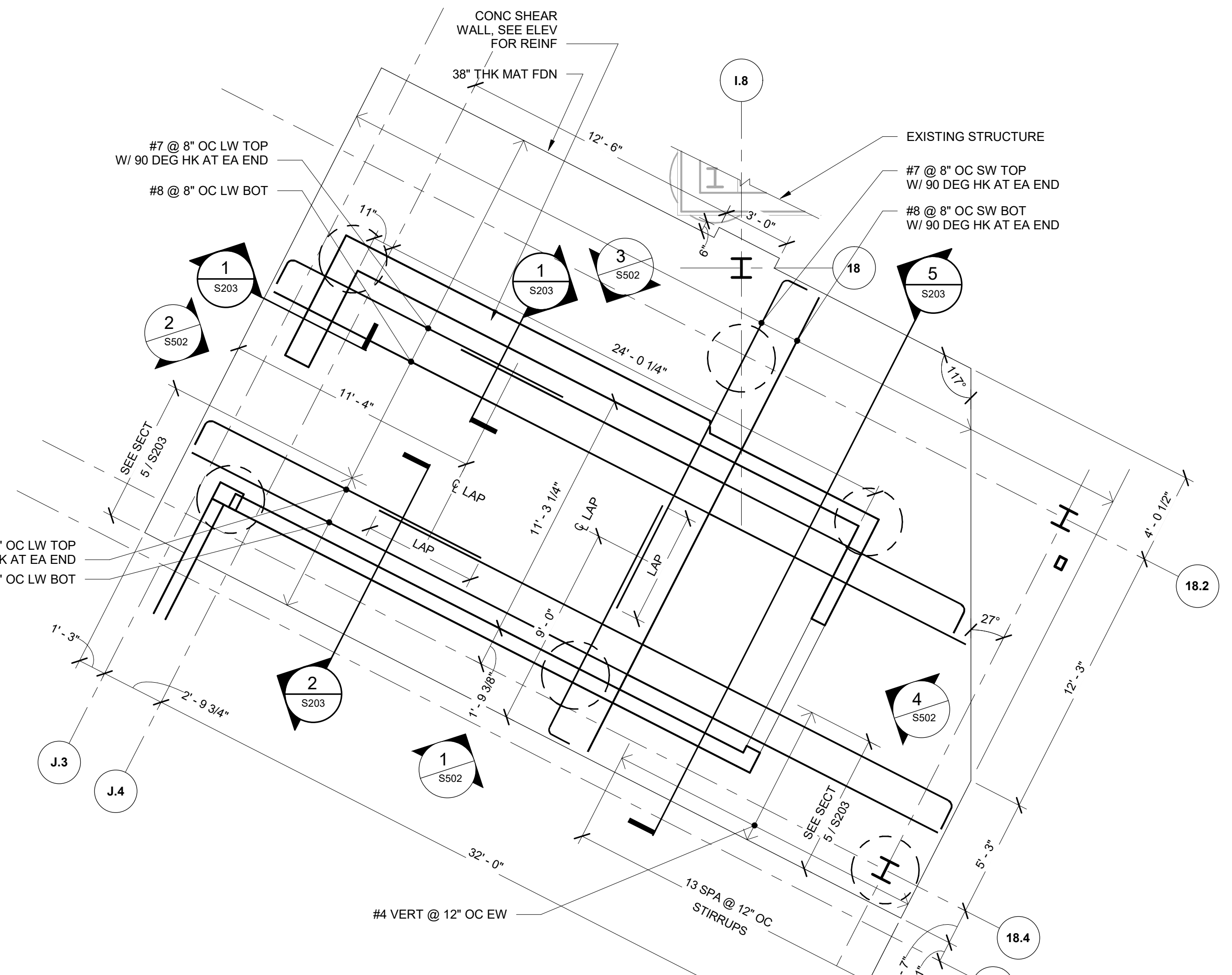
5 PARTIAL FOUNDATION PLAN - RETAINING WALL NEAR GATE
Scale: 3/8" = 1'-0"

- PLAN NOTES:**
- TOP OF MAT ELEVATION = 97'-6". ELEVATIONS SHOWN ON PLAN ARE TO TOP OF CONCRETE AND ARE REFERENCED FROM CCD DATUM ELEVATION 27.60' = 100'-0".
 - COORDINATE WITH CIVIL DRAWINGS FOR DIMENSIONS, LOCATION, AND ADDITIONAL INFORMATION.
 - SEE GENERAL NOTES ON SHEETS S002 AND S003.
 - SEE TYPICAL DETAILS ON SHEETS S004 AND S005.
 - TEMPORARILY BRACE EXISTING LIGHT POLE NEAR RETAINING WALL EXCAVATION PRIOR TO FINAL CONDITION.



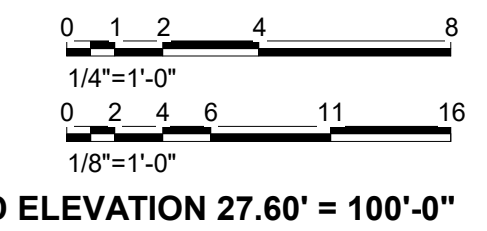
3 PARTIAL FOUNDATION PLAN - EAST MAT
Scale: 1/4" = 1'-0"

- PLAN NOTES:**
- TOP OF MAT ELEVATION = 112'-0". ELEVATIONS SHOWN ON PLAN ARE TO TOP OF CONCRETE AND ARE REFERENCED FROM CCD DATUM ELEVATION 27.60' = 100'-0".
 - ONLY THE CAISSONS, CONCRETE SHEAR WALLS, AND MAT FOUNDATION ARE SHOWN ON PLAN FOR CLARITY. REFERENCE S101 FOR ADDITIONAL INFORMATION.
 - NO OPENINGS, SLEEVES, CONDUITS, ETC. SHALL BE PLACED IN THE MAT FOUNDATION WITHOUT REVIEW AND APPROVAL BY THE EOR.
 - SEE GENERAL NOTES ON SHEETS S002 AND S003.
 - SEE TYPICAL DETAILS ON SHEETS S004 AND S005.
 - SEE SHEETS S201, S202, AND S203 FOR PIER, GRADE BEAM, WALL, CAISSON DETAILS, MAT DETAILS AND SCHEDULES.
A. REFERENCE MAT DETAILS FOR BAR LAYERING.
 - SEE SHEAR WALL ELEVATIONS AND DETAILS ON SHEETS S502 AND S503.



4 PARTIAL FOUNDATION PLAN - WEST MAT
Scale: 1/4" = 1'-0"

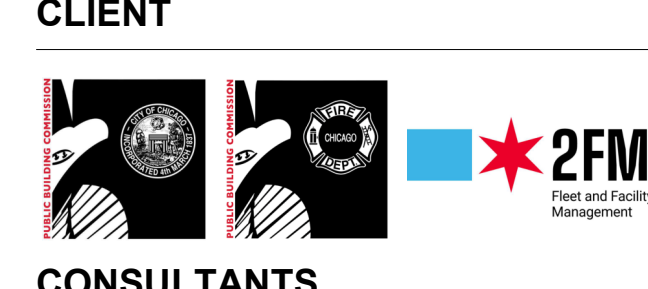
- PLAN NOTES:**
- TOP OF MAT ELEVATION = 112'-0". ELEVATIONS SHOWN ON PLAN ARE TO TOP OF CONCRETE AND ARE REFERENCED FROM CCD DATUM ELEVATION 27.60' = 100'-0".
 - ONLY THE STEEL COLUMNS, CAISSONS, CONCRETE SHEAR WALLS, AND MAT FOUNDATION ARE SHOWN ON PLAN FOR CLARITY. REFERENCE S101 FOR ADDITIONAL INFORMATION.
 - NO OPENINGS, SLEEVES, CONDUITS, ETC. SHALL BE PLACED IN THE MAT FOUNDATION WITHOUT REVIEW AND APPROVAL BY THE EOR.
 - SEE GENERAL NOTES ON SHEETS S002 AND S003.
 - SEE TYPICAL DETAILS ON SHEETS S004 AND S005.
 - SEE SHEETS S201, S202, AND S203 FOR PIER, GRADE BEAM, WALL, CAISSON DETAILS, MAT DETAILS AND SCHEDULES.
A. REFERENCE MAT DETAILS FOR BAR LAYERING.
 - SEE SHEAR WALL ELEVATIONS AND DETAILS ON SHEETS S502 AND S503.



CCD ELEVATION 27.60' = 100'-0"



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
AECOM
ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-373-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-920-9198

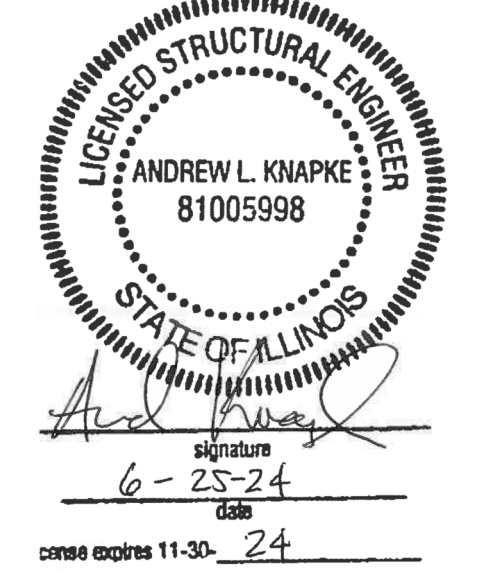
INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION



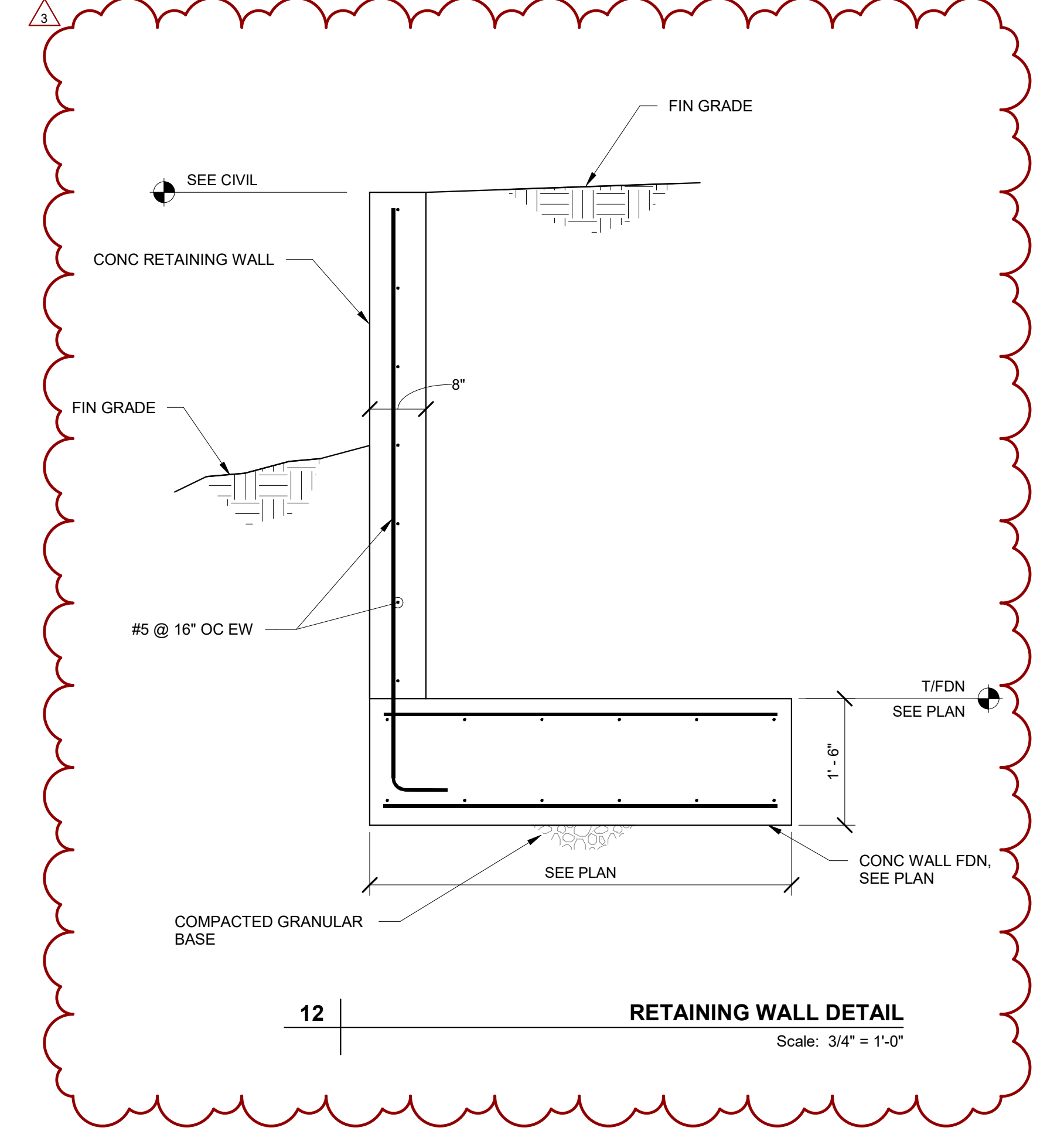
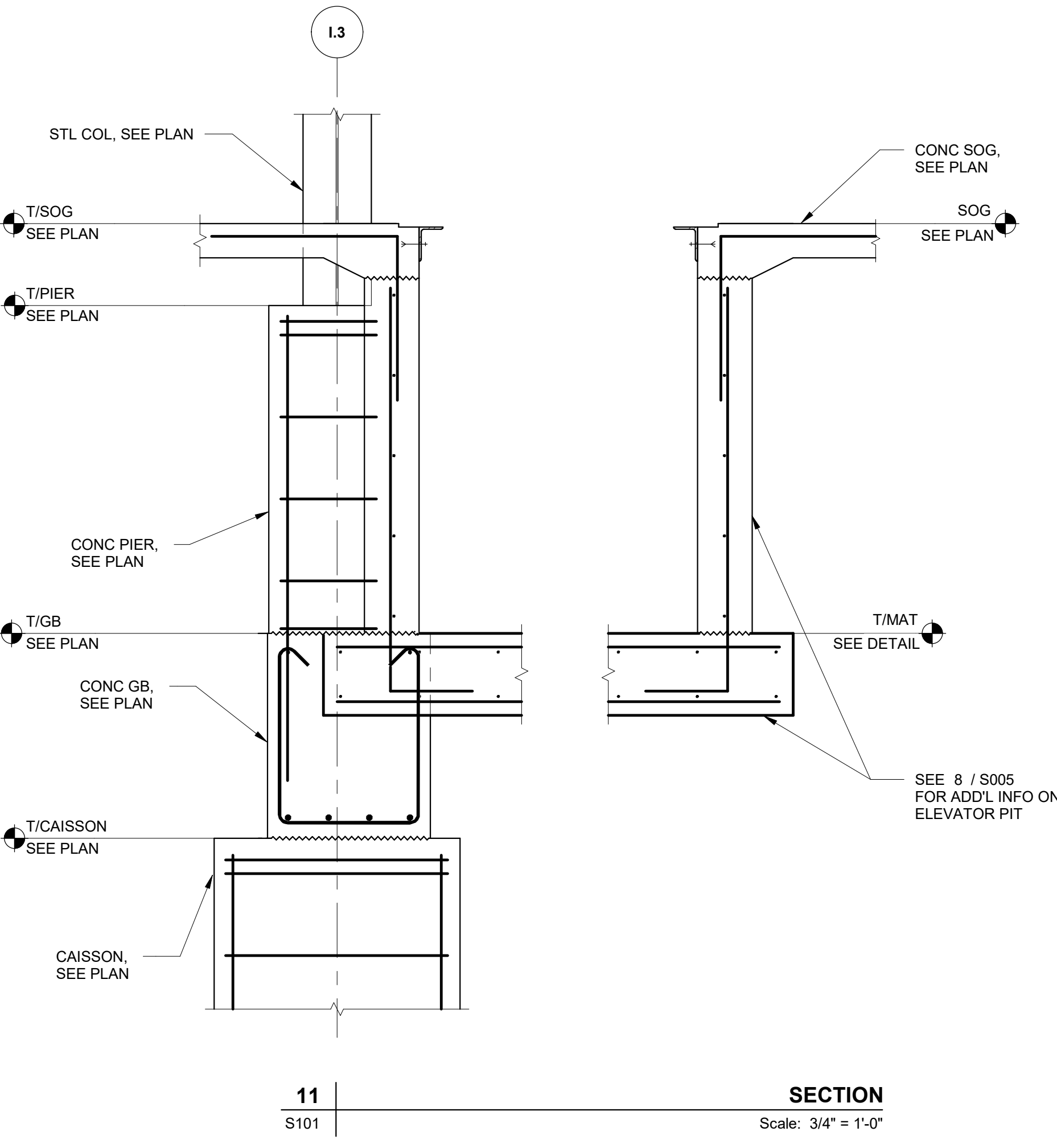
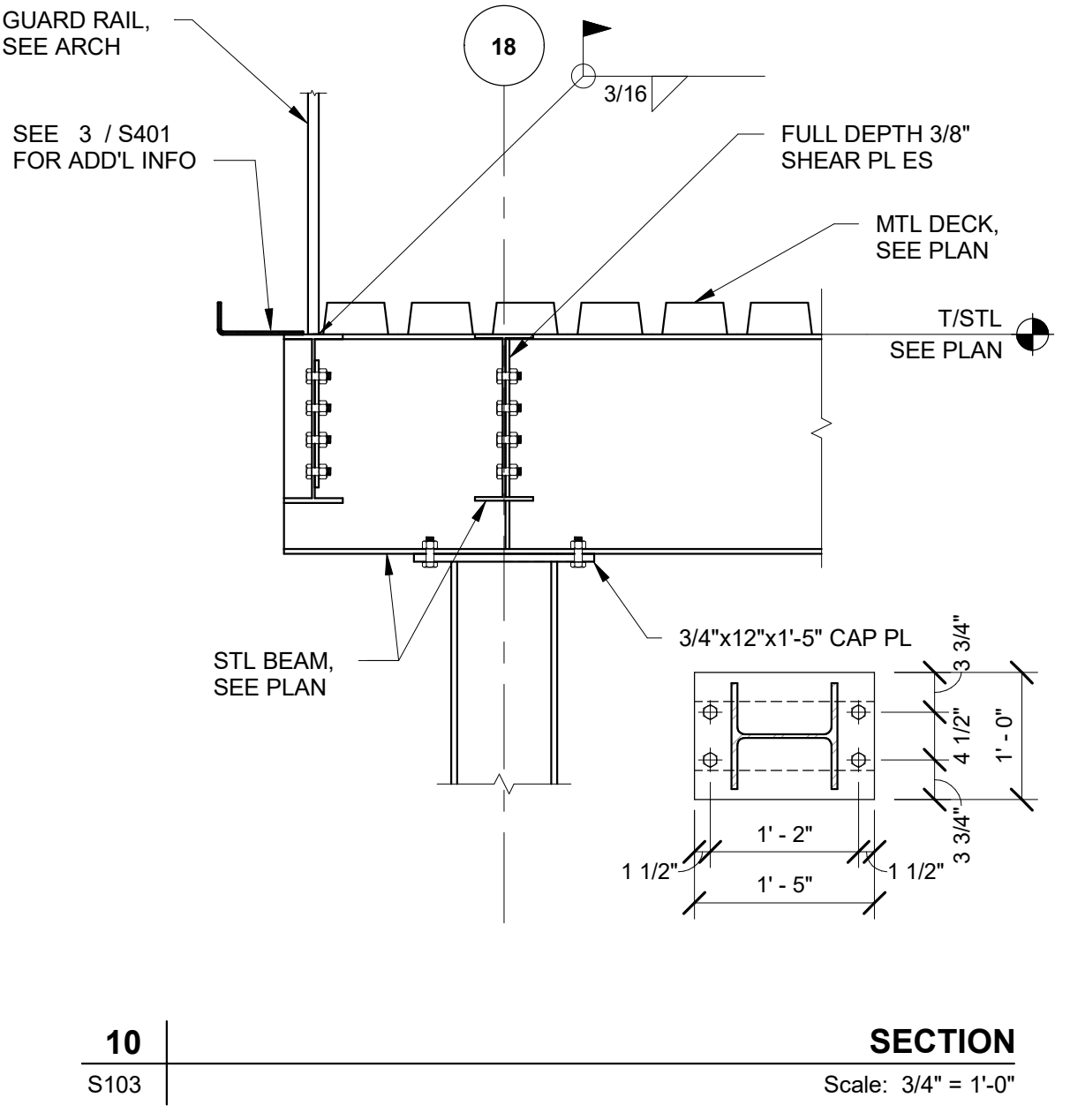
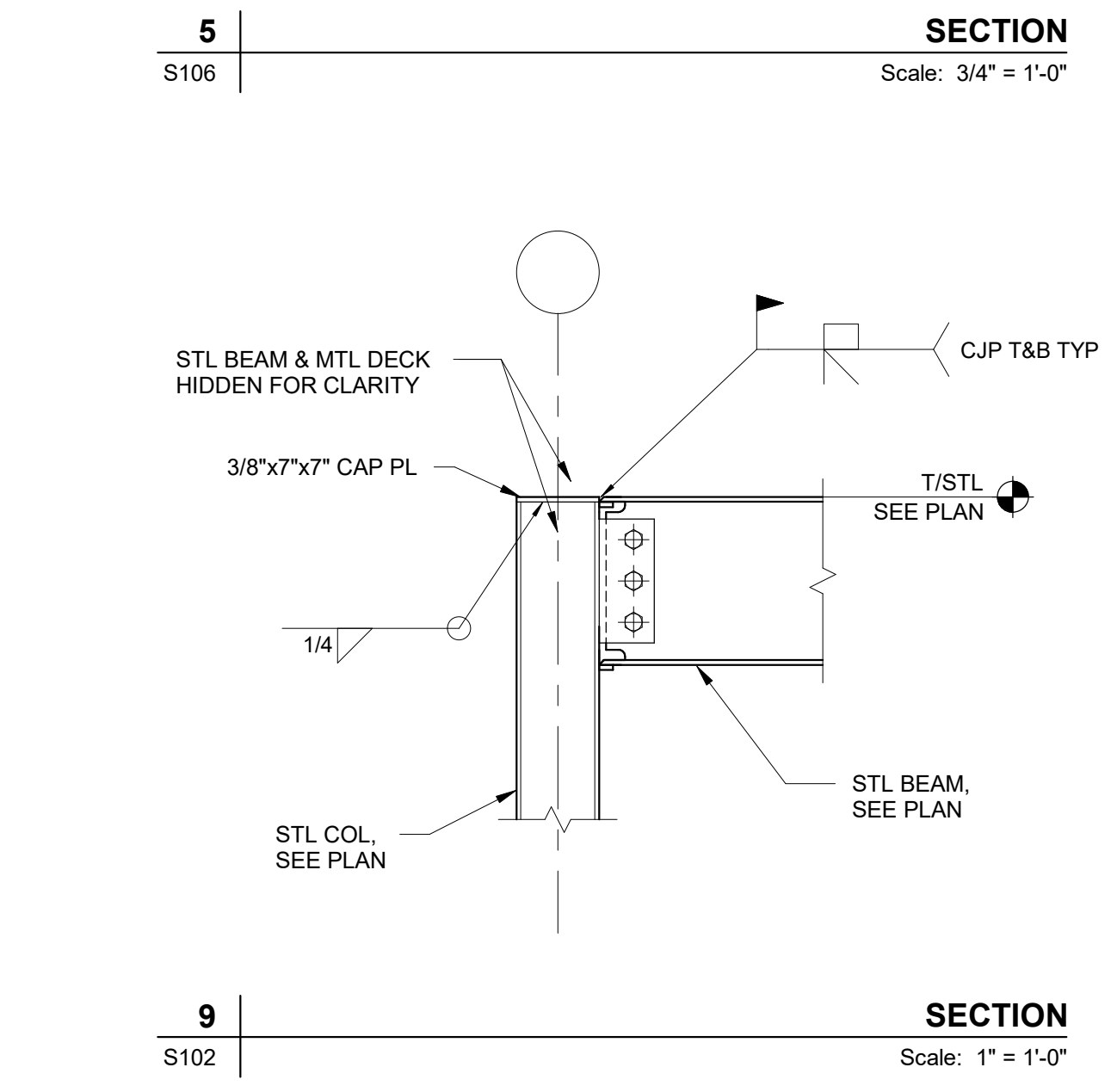
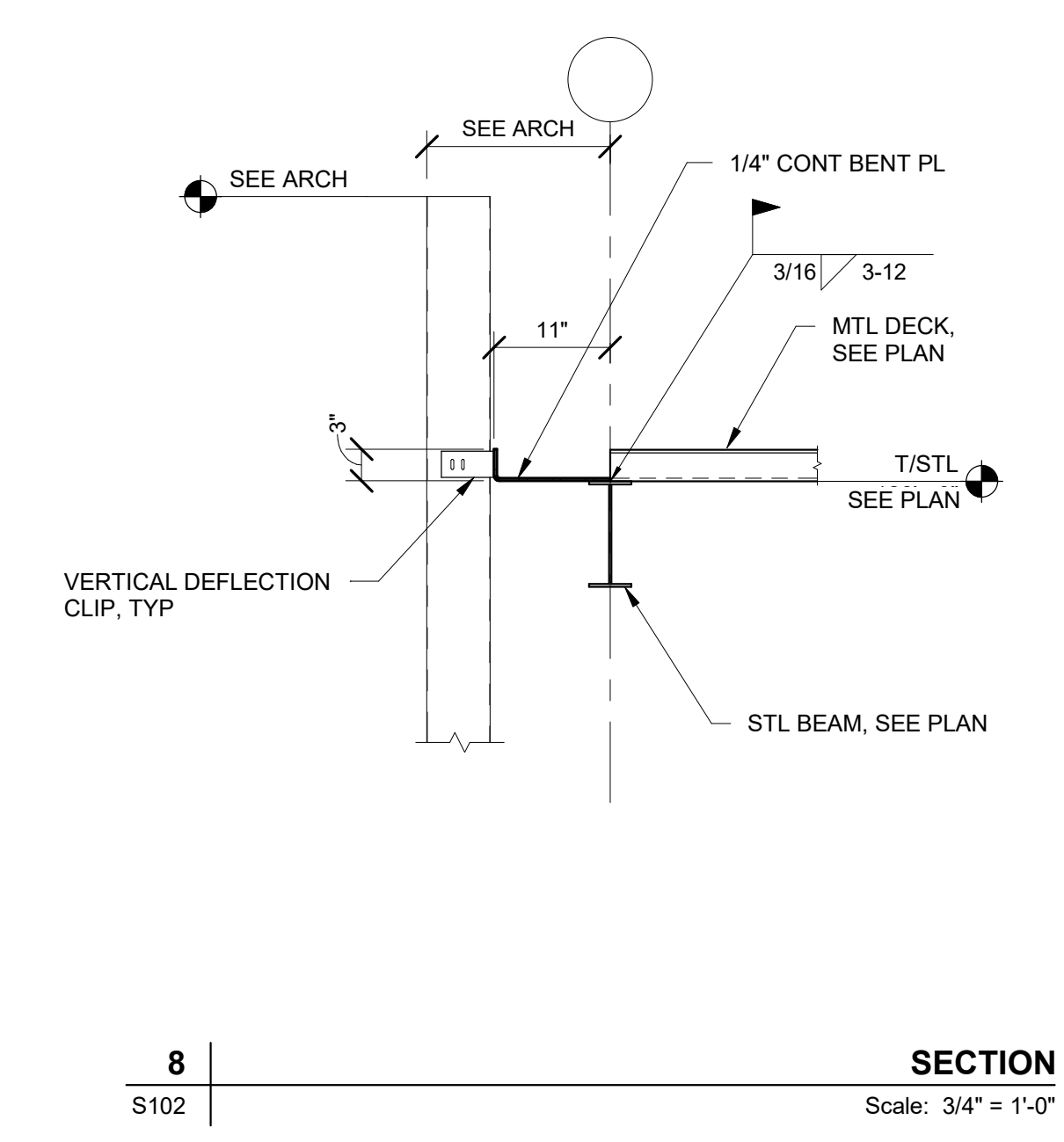
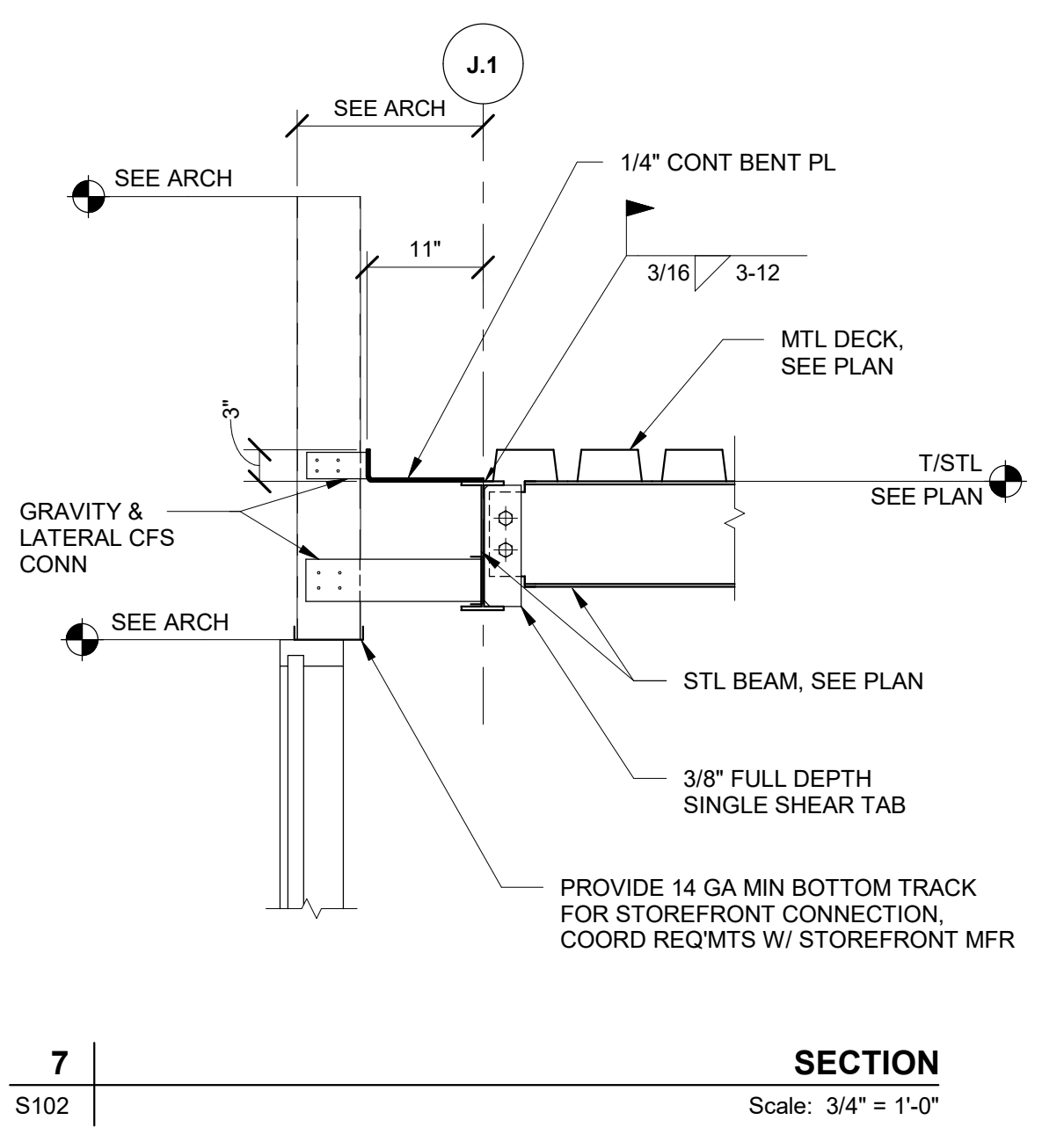
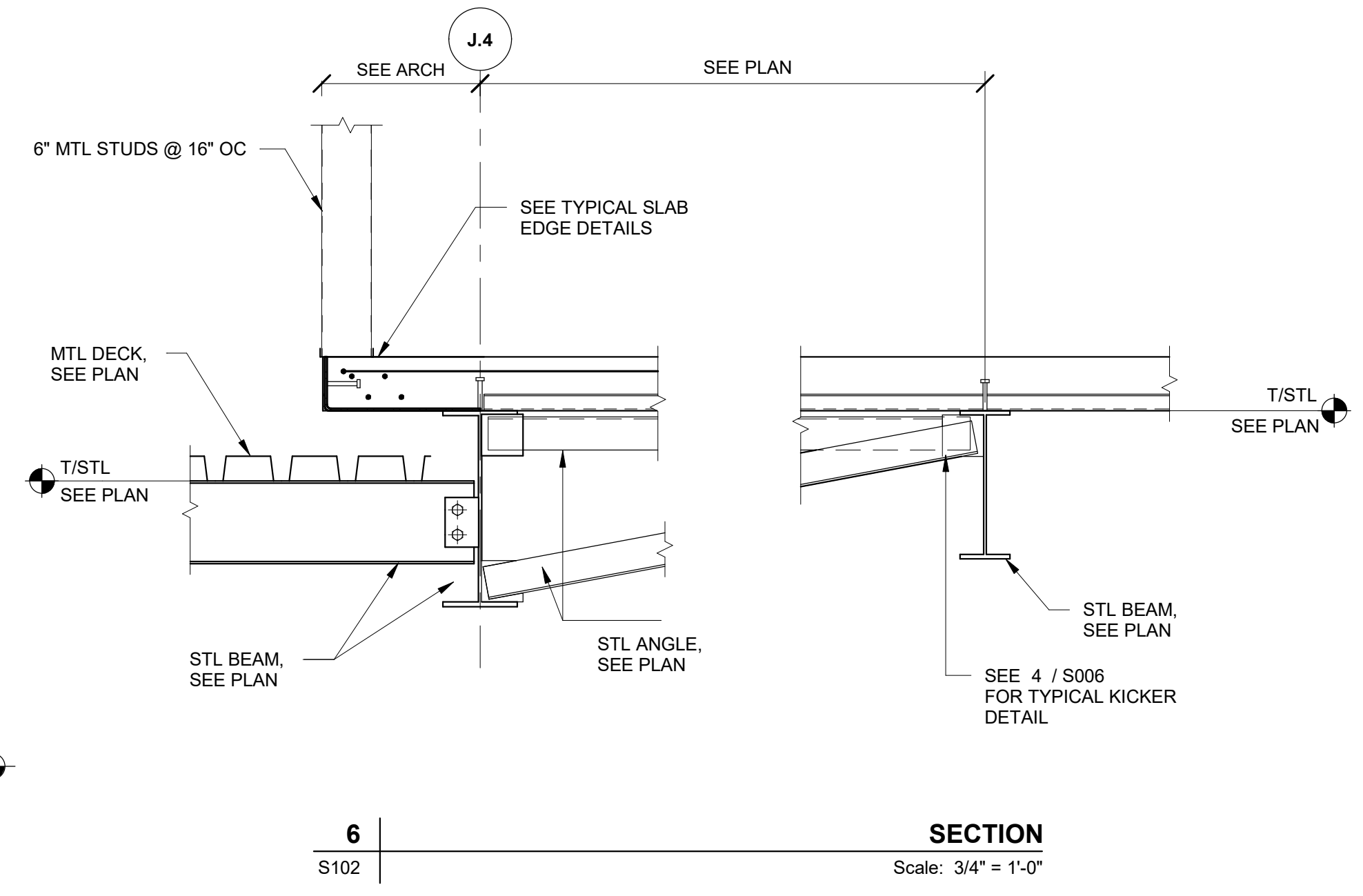
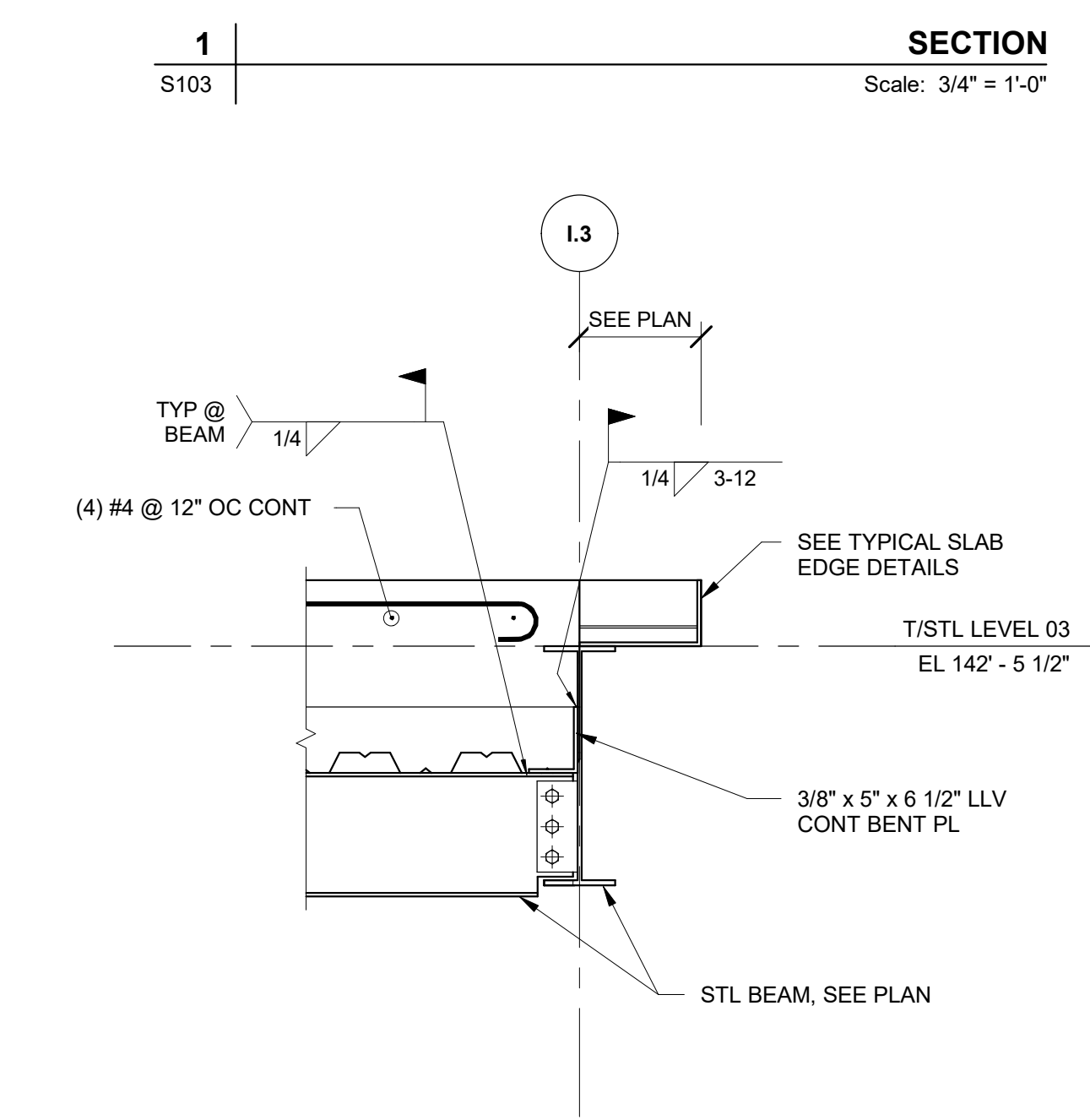
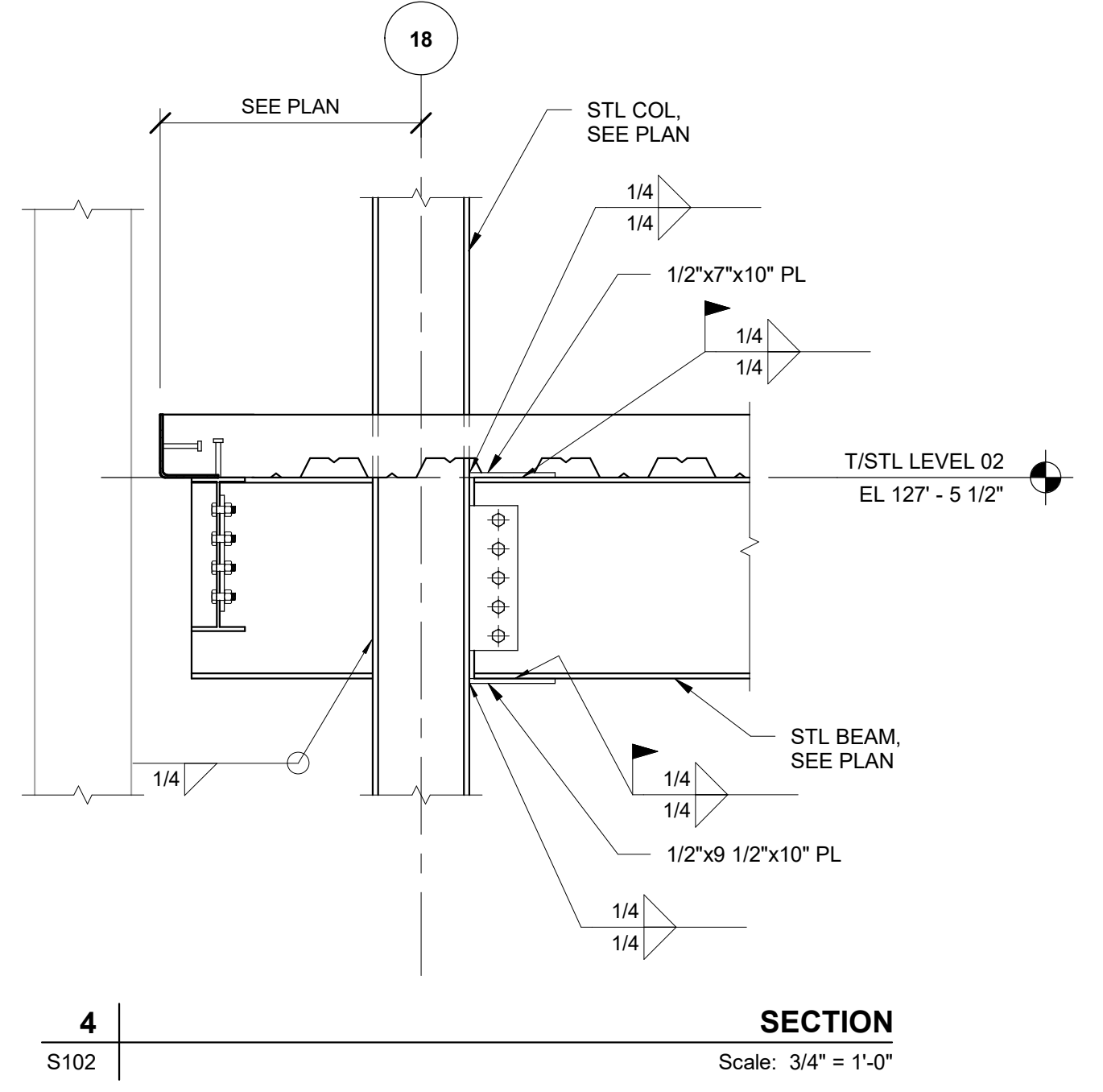
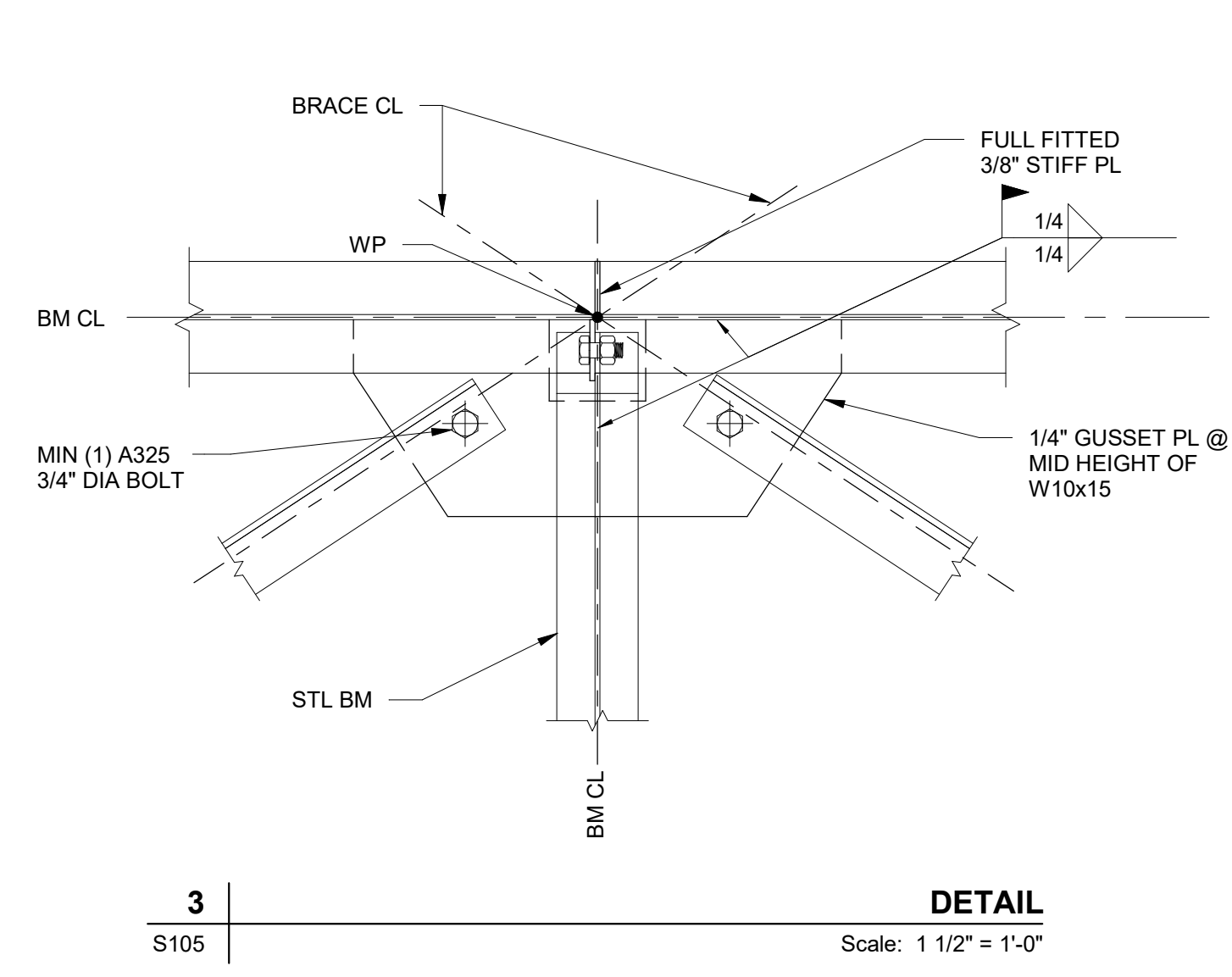
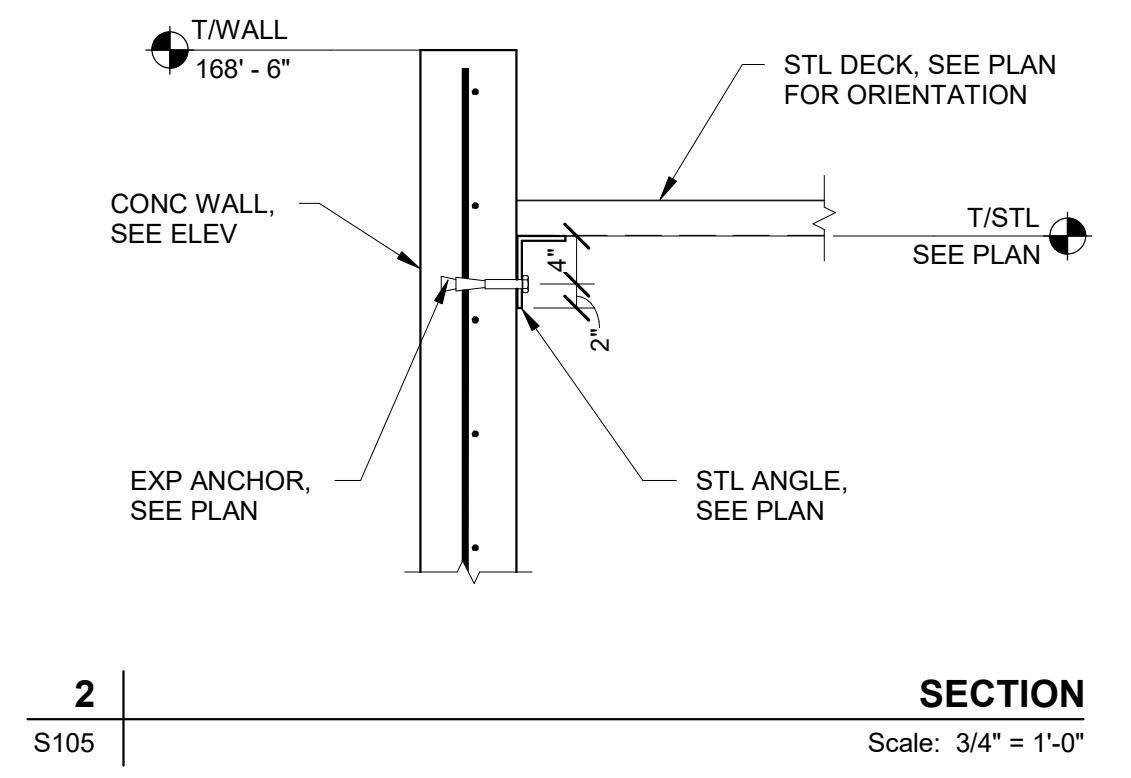
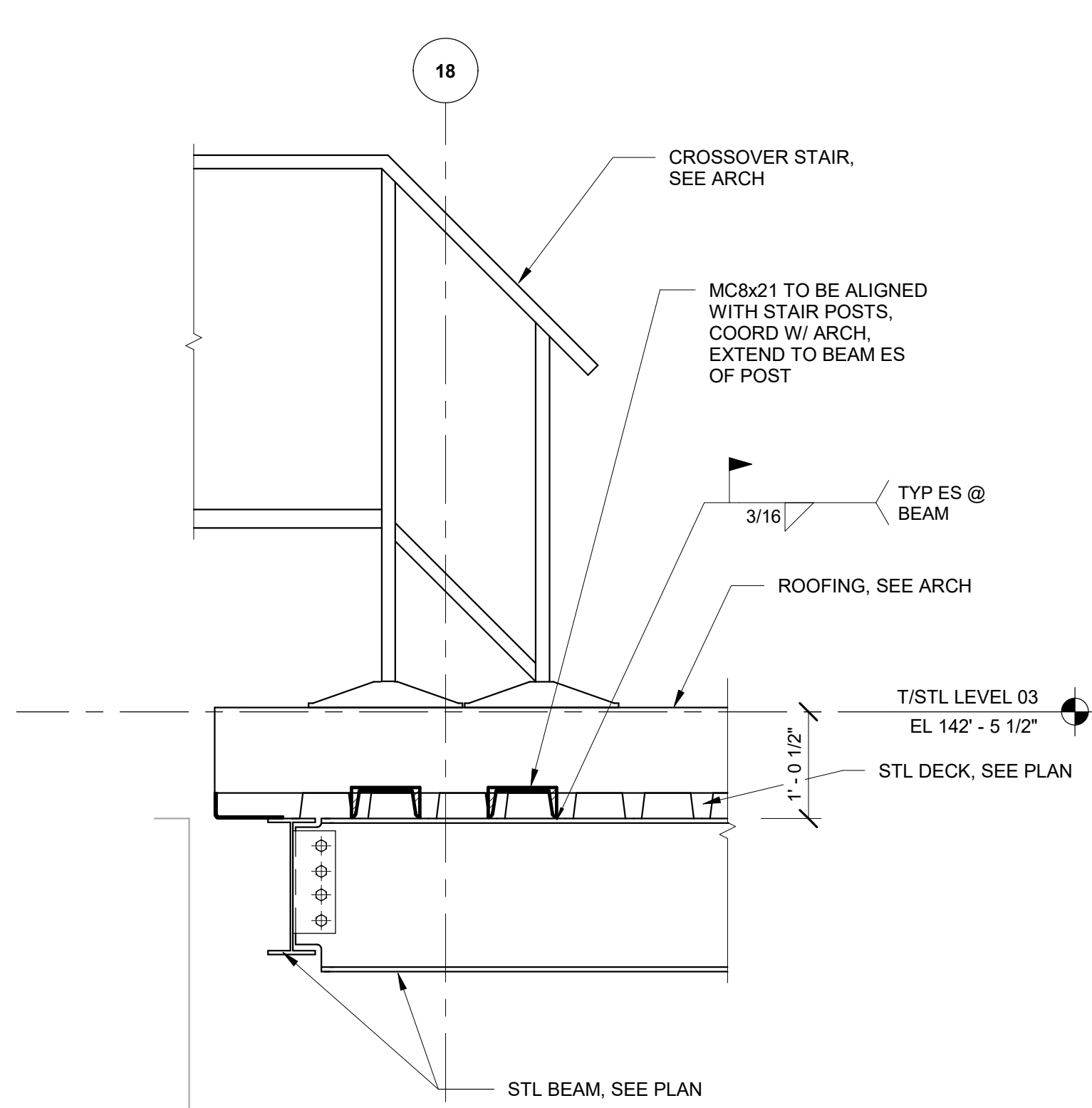
ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID

PROJECT NUMBER
PBC: #07215 AECOM: 60710711

SHEET TITLE
PARTIAL PLANS

SHEET NUMBER
S105





PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT


CONSULTANTS
 AECOM ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-375-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-820-9188

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

 Andrew L. Knapke
 6-25-24
 expires 11-30-24

ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
I/R	DATE	DESCRIPTION

PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
 SECTIONS & DETAILS

SHEET NUMBER
S404

CCD ELEVATION 27.60' = 100'-0"

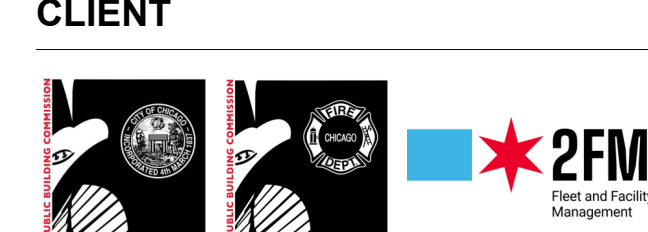
©2022 AECOM Corporation
 7.1_7.44_STRUCTURAL_S404



1 REFERENCE FLOOR PLAN - 02 SECOND FLOOR / GRADE LEVEL @ ADDITION
Scale: 1/8" = 1'-0"



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CLIENT

CONSULTANTS
AECOM
ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-373-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-920-9198

INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

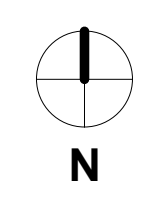
MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION

NORTH ARROW



ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
I/R	DATE	DESCRIPTION

PROJECT NUMBER
PBC: #07215 AECOM: 60710711

SHEET TITLE
SECOND FLOOR - REFERENCE FLOOR PLAN

SHEET NUMBER

A101

This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or disseminated by third parties, except as agreed by AECOM and its client, as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.

LIGHTING SCHEDULE				
TAG	MANUFACTURER	MODEL	COUNT	DESCRIPTION
SECOND FLOOR				
DB	CSL	Acrobat A4-SP	42	RECESSED 4" CAN LIGHT
KA	Day-Brite	FSS	21	4' LINEAR STRIP LIGHT
KB	Day-Brite	FSS	24	6' LINEAR STRIP LIGHT
LA	XAL Inc.	BASO 2.5 Indirect	33	4' LINEAR UP/DOWN PENDANT
LC	XAL Inc.	BASO 2.5 Indirect	6	6' LINEAR UP/DOWN PENDANT
LD	XAL Inc.	BASO 2.5 Indirect	78	8' LINEAR UP/DOWN PENDANT
LE	XAL Inc.	BASO 2.5 Indirect	22	4' LINEAR DOWN PENDANT
LG	XAL Inc.	BASO 2.5 Indirect	14	6' LINEAR DOWN PENDANT
LM	XAL Inc.	BASO 2.5 Indirect	6	7' LINEAR UP/DOWN WALL
LN	XAL Inc.	BASO 2.5 Indirect	12	8' LINEAR UP/DOWN WALL
THIRD FLOOR				
DB	CSL	Acrobat A4-SP	4	RECESSED 4" CAN LIGHT
KA	Day-Brite	FSS	20	4' LINEAR STRIP LIGHT
KB	Day-Brite	FSS	6	6' LINEAR STRIP LIGHT
LA	XAL Inc.	BASO 2.5 Indirect	36	4' LINEAR UP/DOWN PENDANT
LB	XAL Inc.	BASO 2.5 Indirect	10	5' LINEAR UP/DOWN PENDANT
LC	XAL Inc.	BASO 2.5 Indirect	8	6' LINEAR UP/DOWN PENDANT
LD	XAL Inc.	BASO 2.5 Indirect	100	8' LINEAR UP/DOWN PENDANT
LE	XAL Inc.	BASO 2.5 Indirect	15	4' LINEAR DOWN PENDANT
LG	XAL Inc.	BASO 2.5 Indirect	13	8' LINEAR DOWN PENDANT

LIGHTING SCHEDULE				
TAG	MANUFACTURER	MODEL	COUNT	DESCRIPTION
FOURTH FLOOR				
KA	Day-Brite	FSS	12	4' LINEAR STRIP LIGHT
KB	Day-Brite	FSS	2	8' LINEAR STRIP LIGHT
LA	XAL Inc.	BASO 2.5 Indirect	40	4' LINEAR UP/DOWN PENDANT
LC	XAL Inc.	BASO 2.5 Indirect	4	6' LINEAR UP/DOWN PENDANT
LD	XAL Inc.	BASO 2.5 Indirect	77	8' LINEAR UP/DOWN PENDANT
LE	XAL Inc.	BASO 2.5 Indirect	14	4' LINEAR DOWN PENDANT
LG	XAL Inc.	BASO 2.5 Indirect	7	8' LINEAR DOWN PENDANT
ROOF				
KA	Day-Brite	FSS	2	4' LINEAR STRIP LIGHT
WC	Cooper Lighting	LUMASPORT	6	AREA LIGHT

LEGEND - REFLECTED CEILING PLAN

- ANNOTATIONS**
- ⊖ WALL WASHER RECESSED DOWNLIGHT
 - SUSPENDED LINEAR
 - SUSPENDED LINEAR WITH NIGHT LIGHT
 - 2x2 RECESSED DIRECT/INDIRECT LED
 - 2x4 RECESSED DIRECT/INDIRECT LED
 - ↔ EXIT SIGN WITH DIRECTIONAL ARROWS WHERE INDICATED
 - LINEAR SUPPLY DIFFUSER
 - LINEAR RETURN/EXHAUST GRILLE
 - ⊠ SUPPLY DIFFUSER
 - ⊠ RETURN/EXHAUST GRILLE
 - ⊠ ACCESS DOOR
 - ⊙ OCCUPANCY SENSOR

- MATERIALS**
- 2' x 2' GRID AND TILE SYSTEM - SEE FINISH SCHEDULE FOR ADDITIONAL INFORMATION **Ac.1**
 - GYPSUM BOARD CEILING AS INDICATED ON PLAN. SEE FINISH PLAN FOR PAINT SPECIFICATIONS. **GYP**
 - EXPOSED
 - EXPOSED PAINTED STRUCTURE AND MEP / FIRE INFRASTRUCTURE. SEE FINISH SCHEDULE FOR ADDITIONAL INFO.
 - EXPOSED ACOUSTIC SPRAY ON DECK, PAINT MEP AND INFRASTRUCTURE. SEE FINISH SCHEDULE FOR ADDITIONAL INFO.

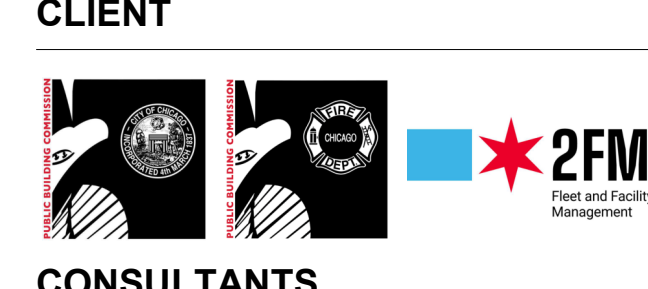
- ANNOTATIONS**
- ALIGN SYMBOL
 - FINISHED CEILING HEIGHT AS INDICATED ON PLAN U.O.N.
 - FINISH TAG. REFER TO FINISH SCHEDULE FOR ADDITIONAL INFORMATION.
 - START POINT
- NOTE: NOT ALL SYMBOLS MAY BE USED

GENERAL NOTES - REFLECTED CEILING PLANS

- A. REFER TO THE PROJECT GENERAL NOTES FOR GENERAL PROJECT REQUIREMENTS.
- B. THE TYPICAL CEILING HEIGHT SHALL BE 9' - 0" UNLESS OTHERWISE NOTED.
- C. TYPICAL ACOUSTIC CEILING TILE SYSTEM SHALL BE AC-1 UNLESS OTHERWISE NOTED.
- D. ALL CEILING HEIGHTS ARE ABOVE FINISHED FLOOR, UNLESS OTHERWISE NOTED.
- E. THE REFLECTED CEILING PLANS SHALL BE USED FOR LAYOUT OF ALL CEILING DEVICES. CONSULT ARCHITECT IF A CONFLICT ARISES WITH STRUCTURAL OR MEP DRAWINGS.
- F. CENTER CEILING TILES IN ROOM AS SHOWN TO PROVIDE EQUAL TILES AT EACH END WALL IN EACH DIRECTION UNLESS OTHERWISE NOTED OR DIMENSIONED.
- G. CENTER RECESSED LIGHT FIXTURES, ELECTRICAL AND MECHANICAL DEVICES, AND SPRINKLER HEADS WITHIN A CEILING TILE UNLESS OTHERWISE NOTED. COORDINATE LAYOUT WITH ALL OTHER CEILING MOUNTED DEVICES.
- H. ROOMS WITH NO CEILINGS SHALL HAVE EXPOSED STRUCTURE PAINTED.
- I. GYPSUM BOARD SOFFITS ARE SHOWN TO INDENED SIZES. PAINT ALL GYPSUM BOARD SOFFITS AND HEADERS THE TYPICAL GYPSUM CEILING PAINT COLOR UNLESS OTHERWISE NOTED.
- J. AT TOILETS, SHOWERS, AND JANITOR CLOSETS, PROVIDE WATER RESISTANT GYPSUM BOARD AT CEILINGS AND SOFFITS.
- K. CAREFULLY REMOVE CEILINGS AS REQUIRED FOR ABOVE CEILING WORK IN AREAS WITH NO OR LIMITED ARCHITECTURAL DEMOLITION WORK. REINSTALL CEILING AND PATCH TO MATCH EXISTING.
- L. COORDINATE EXACT LOCATIONS OF ACCESS PANELS IN THE FIELD, AND WITH CEILING MOUNTED EQUIPMENT VENDORS OR FOR UTILITY CONTROLS ACCESS, WHERE APPLICABLE. ACCESS PANEL PAINT FINISH SHALL MATCH ADJACENT CEILING COLOR.
- M. NOT ALL CEILING MOUNTED DEVICES ARE SHOWN ON THE ARCHITECTURAL REFLECTED CEILING PLANS. REFER TO PLUMBING, MECHANICAL, AND ELECTRICAL DRAWINGS FOR LOCATIONS OF SPRINKLER HEADS, EXIT SIGNS, AND ADDITIONAL CEILING MOUNTED DEVICES.
- N. NOT ALL SPRINKLER HEADS ARE SHOWN, HOWEVER, ALL AREAS SHALL BE SPRINKLERED AS SPECIFIED. HEADS ARE SHOWN IN SELECTED SPACES TO CONTROL THE LOCATIONS FOR AESTHETIC PURPOSES ONLY. WHEN ADDITIONAL HEADS ARE REQUIRED, COORDINATE LOCATIONS WITH ARCHITECT.
- O. REFER FIRE PROTECTION SPECS FOR PAINTING OF FIRE ALARM INFRASTRUCTURE REQTS. AT EXPOSED CEILINGS.



PROJECT
Emergency Medical Services (EMS) Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60601
312-375-7700

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-620-9190

INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION

NORTH ARROW



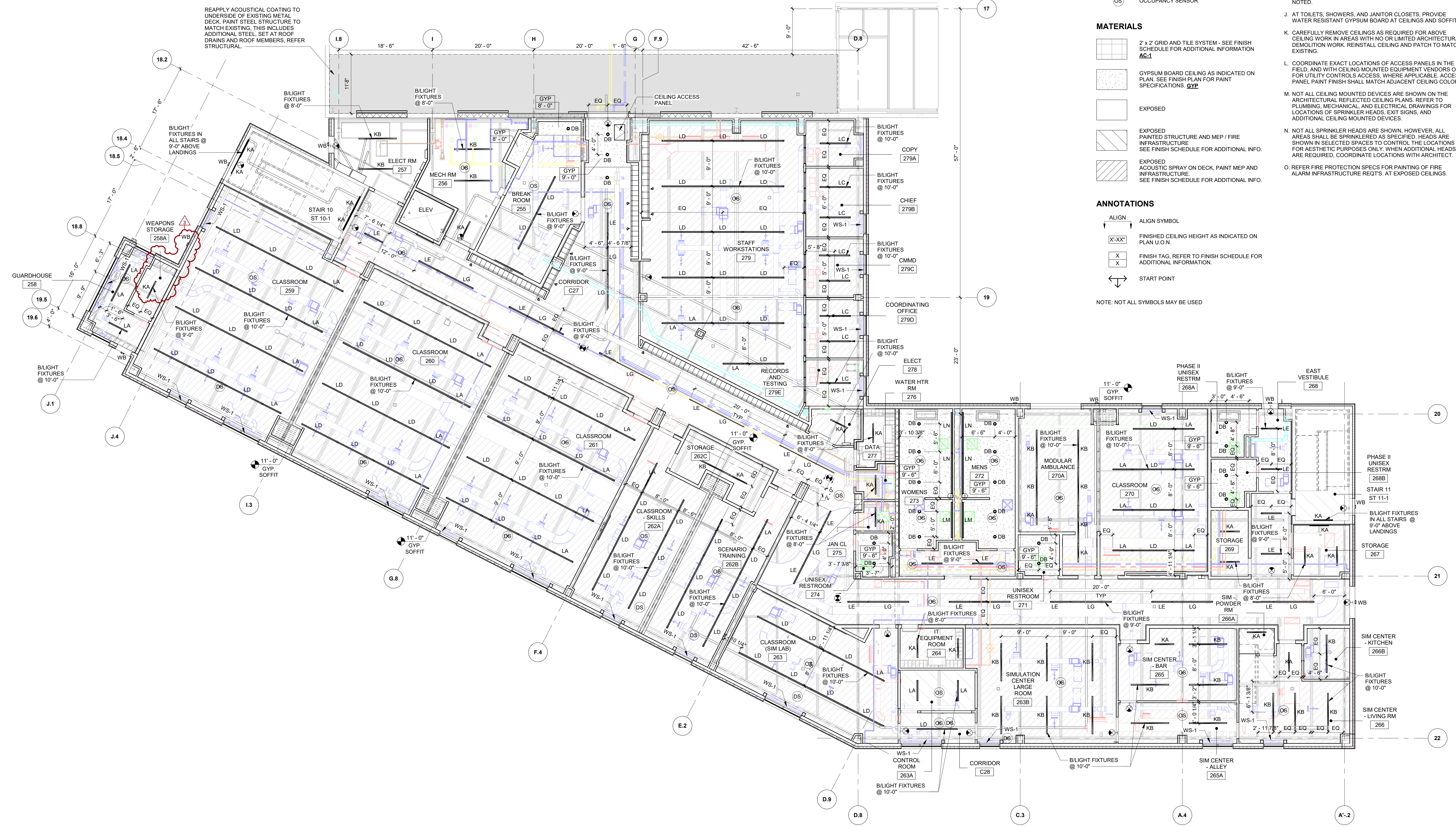
ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
I/R		DESCRIPTION

PROJECT NUMBER
PBC: #07215 AECOM: 60710711

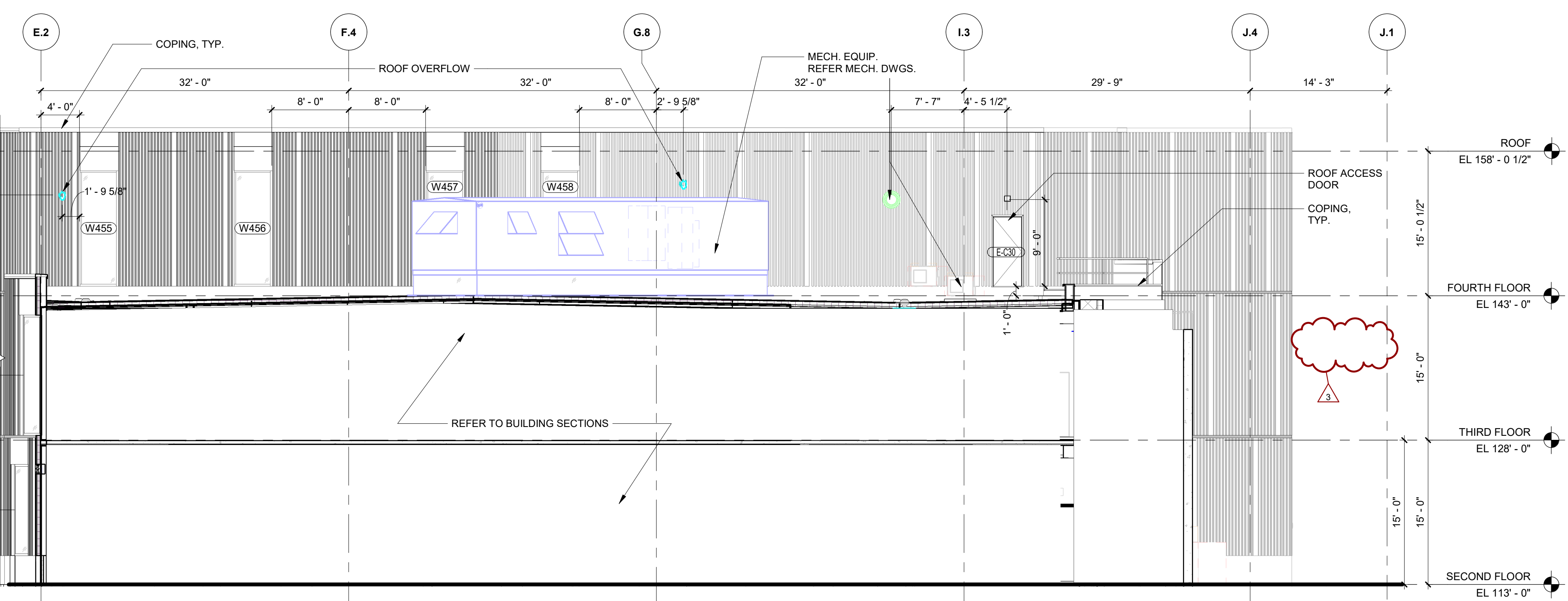
SHEET TITLE
SECOND FLOOR - CEILING PLAN

SHEET NUMBER
A151

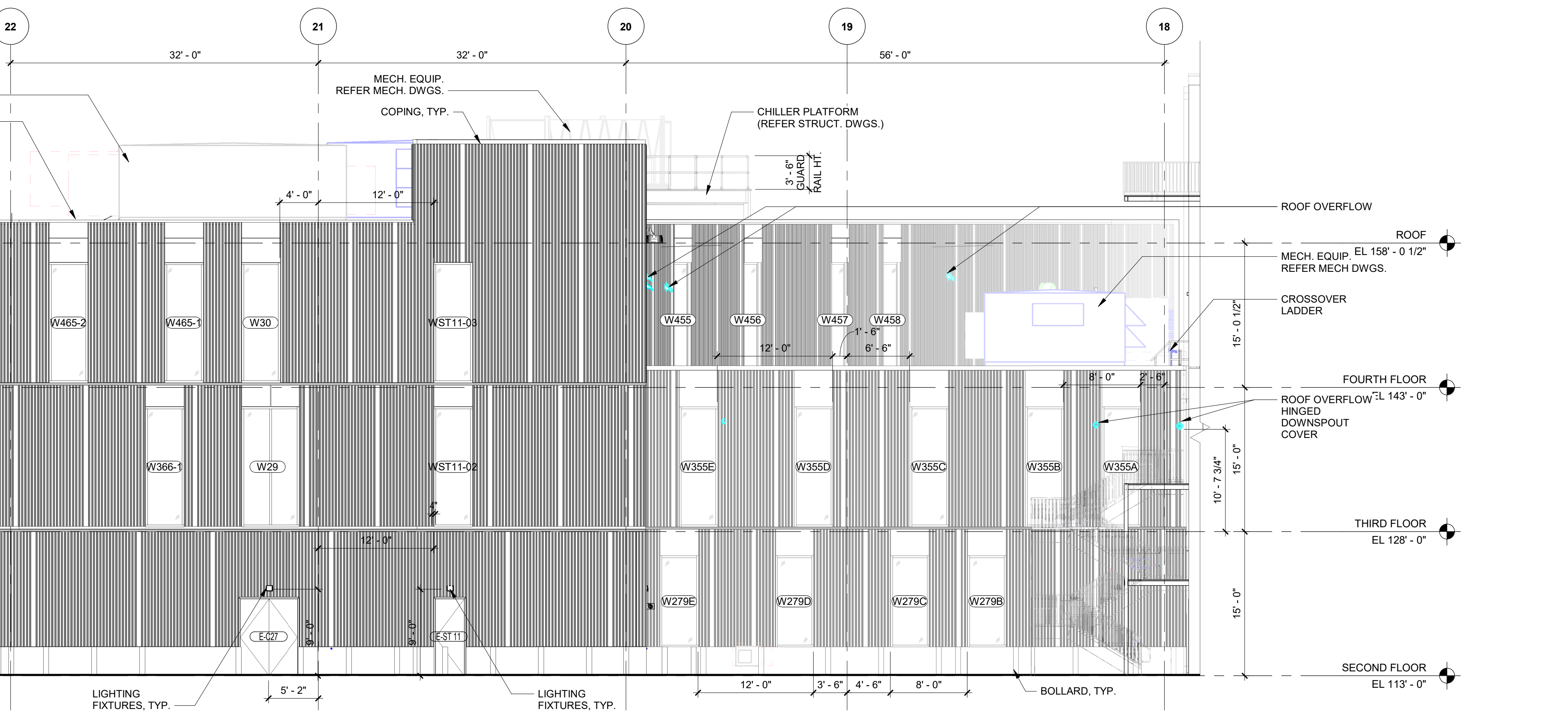


1 | CEILING PLAN - 02 SECOND FLOOR
Scale: 1/8" = 1'-0"

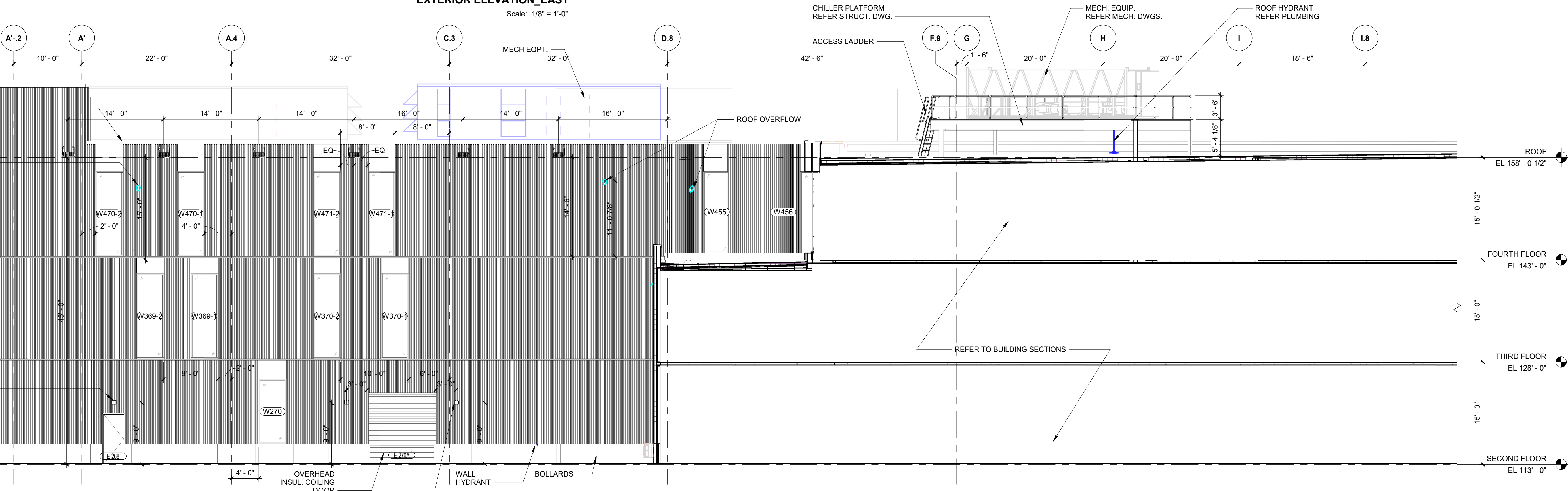
This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or transmitted in any form or by any means, except as agreed by AECOM and its client, without the prior written consent of AECOM. AECOM accepts no responsibility for any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



3
 A123
EXTERIOR ELEVATION_NORTH_WEST WING
 Scale: 1/8" = 1'-0"



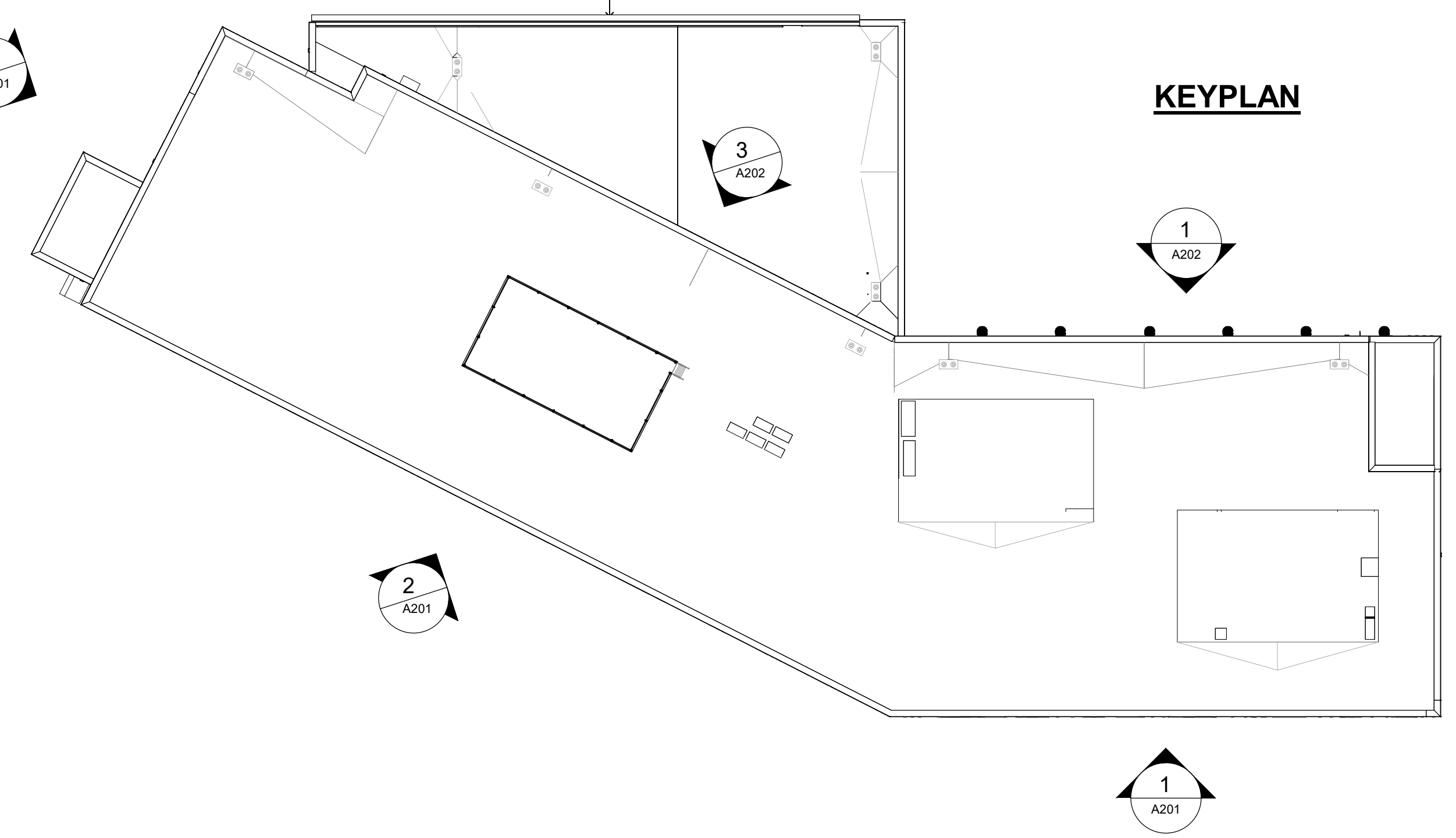
2
 A121
EXTERIOR ELEVATION_EAST
 Scale: 1/8" = 1'-0"



1
 A121
EXTERIOR ELEVATION_NORTH
 Scale: 1/8" = 1'-0"

GENERAL NOTES

1. ALL EXTERIOR GLAZING IS IG-1 (INSULATED GLAZING UNIT - TEMPERED VISION GLAZING) UNLESS NOTED OTHERWISE.
2. ALL EXTERIOR CLADDING IS VERTICAL, CONCEALED FASTENER METAL PANELS, UNLESS NOTED OTHERWISE.
3. EXTERIOR HOLLOW METAL DOORS AND FRAMES TO BE PAINTED. COLOR TO BE SELECTED BY A/E.
4. PRE-FINISHED LOUVERS, FASCIA, AND METAL COPING TO MATCH ADJACENT FINISH USING MANUFACTURERS COLOR EQUIVALENT.
5. REFER TO ELECTRICAL DRAWINGS FOR ADDITIONAL INFORMATION RELATED TO BUILDING-MOUNTED EXTERIOR LIGHTING.



KEYPLAN



PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT
 2FM
 Health Facility Management

CONSULTANTS
ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-820-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

ISSUE/REVISION

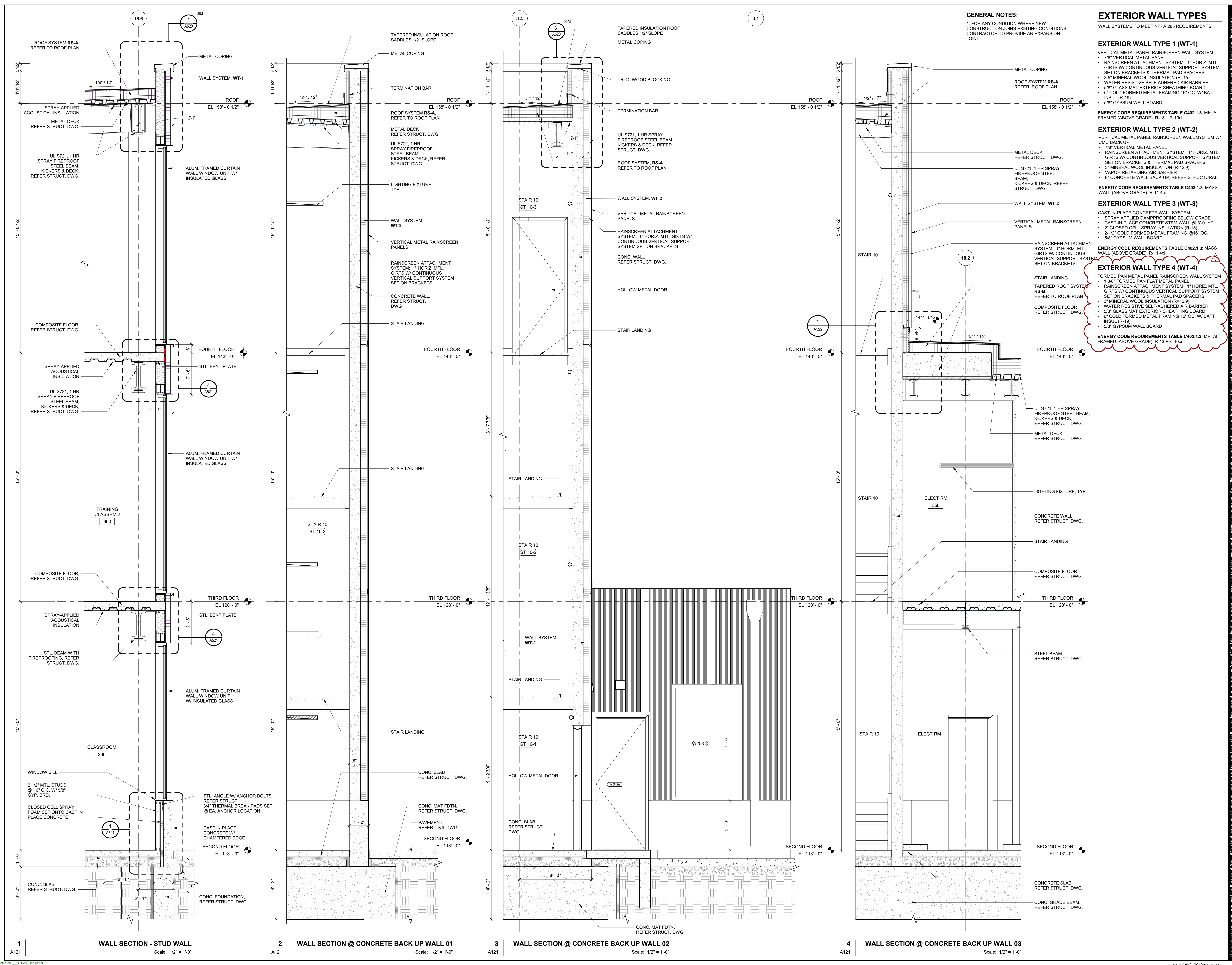
NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
1/R		

PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
 EXTERIOR ELEVATIONS

SHEET NUMBER
A202

This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or transmitted in any form or by any means, except as agreed by third parties, without the prior written consent of AECOM. AECOM and its client accept no responsibility for any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



GENERAL NOTES:
 1. FOR ANY CONDITION WHERE NEW CONSTRUCTION JOINS EXISTING CONDITIONS CONTRACTOR TO PROVIDE AN EXPANSION JOINT.

EXTERIOR WALL TYPES
 WALL SYSTEMS TO MEET NFPA 285 REQUIREMENTS

EXTERIOR WALL TYPE 1 (WT-1)
 VERTICAL METAL PANEL RAINSCREEN WALL SYSTEM
 • 7/8" VERTICAL METAL PANEL
 • RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
 • 3.5" MINERAL WOOL INSULATION (R=15)
 • WATER RESISTIVE SELF-ADHERED AIR BARRIER
 • 5/8" GLASS MAT EXTERIOR SHEATHING BOARD
 • 6" COLD FORMED METAL FRAMING 16" OC. W/ BATT INSUL (R-19)
 • 5/8" GYPSUM WALL BOARD

EXTERIOR WALL TYPE 2 (WT-2)
 VERTICAL METAL PANEL RAINSCREEN WALL SYSTEM W/ CMU BACK UP
 • 7/8" VERTICAL METAL PANEL
 • RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
 • 3" MINERAL WOOL INSULATION (R-12.9)
 • VAPOR RETARDING AIR BARRIER
 • 8" CONCRETE WALL BACK-UP. REFER STRUCTURAL WALL (ABOVE GRADE); R-13 + R-10ci

EXTERIOR WALL TYPE 3 (WT-3)
 CAST-IN-PLACE CONCRETE WALL SYSTEM
 • SPRAY APPLIED DAMPROOFING BELOW GRADE
 • CAST-IN-PLACE CONCRETE STEM WALL @ 3'-0" HT
 • 2" CLOSED CELL SPRAY INSULATION (R-13)
 • 2-1/2" COLD FORMED METAL FRAMING @ 16" OC.
 • 5/8" GYPSUM WALL BOARD

EXTERIOR WALL TYPE 4 (WT-4)
 FORMED PAN METAL PANEL RAINSCREEN WALL SYSTEM
 • 1 3/8" FORMED PAN FLAT METAL PANEL
 • RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
 • 3" MINERAL WOOL INSULATION (R-12.9)
 • WATER RESISTIVE SELF-ADHERED AIR BARRIER
 • 5/8" GLASS MAT EXTERIOR SHEATHING BOARD
 • 6" COLD FORMED METAL FRAMING 16" OC. W/ BATT INSUL (R-19)
 • 5/8" GYPSUM WALL BOARD

AECOM
 PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651

CLIENT
 2FM
 CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-375-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-9198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
U/R	PROJECT	DESCRIPTION

PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
WALL SECTIONS

SHEET NUMBER
A320

©2022 AECOM Corporation
 08_08.30_ARCHITECTURE_A320

GENERAL NOTES:
 1. FOR ANY CONDITION WHERE NEW CONSTRUCTION JOINS EXISTING CONDITIONS CONTRACTOR TO PROVIDE AN EXPANSION JOINT.

EXTERIOR WALL TYPES

WALL SYSTEMS TO MEET NFPA 285 REQUIREMENTS

EXTERIOR WALL TYPE 1 (WT-1)

- VERTICAL METAL PANEL RAINSCREEN WALL SYSTEM
- 7/8" VERTICAL METAL PANEL
- RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
- 3" MINERAL WOOL INSULATION (R=15)
- WATER RESISTIVE SELF-ADHERED AIR BARRIER
- 5/8" GLASS MAT EXTERIOR SHEATHING BOARD
- 6" COLD FORMED METAL FRAMING 16" OC. W/ BATT INSUL (R-19)
- 5/8" GYPSUM WALL BOARD

ENERGY CODE REQUIREMENTS TABLE C402.1.3: METAL FRAMED (ABOVE GRADE): R-13 + R-10ci

EXTERIOR WALL TYPE 2 (WT-2)

- VERTICAL METAL PANEL RAINSCREEN WALL SYSTEM W/ CMU BACK UP
- 7/8" VERTICAL METAL PANEL
- RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
- 3" MINERAL WOOL INSULATION (R=15)
- VAPOR RETARDING AIR BARRIER
- 8" CONCRETE WALL BACK-UP, REFER STRUCTURAL

ENERGY CODE REQUIREMENTS TABLE C402.1.3: MASS WALL (ABOVE GRADE): R-11.4ci

EXTERIOR WALL TYPE 3 (WT-3)

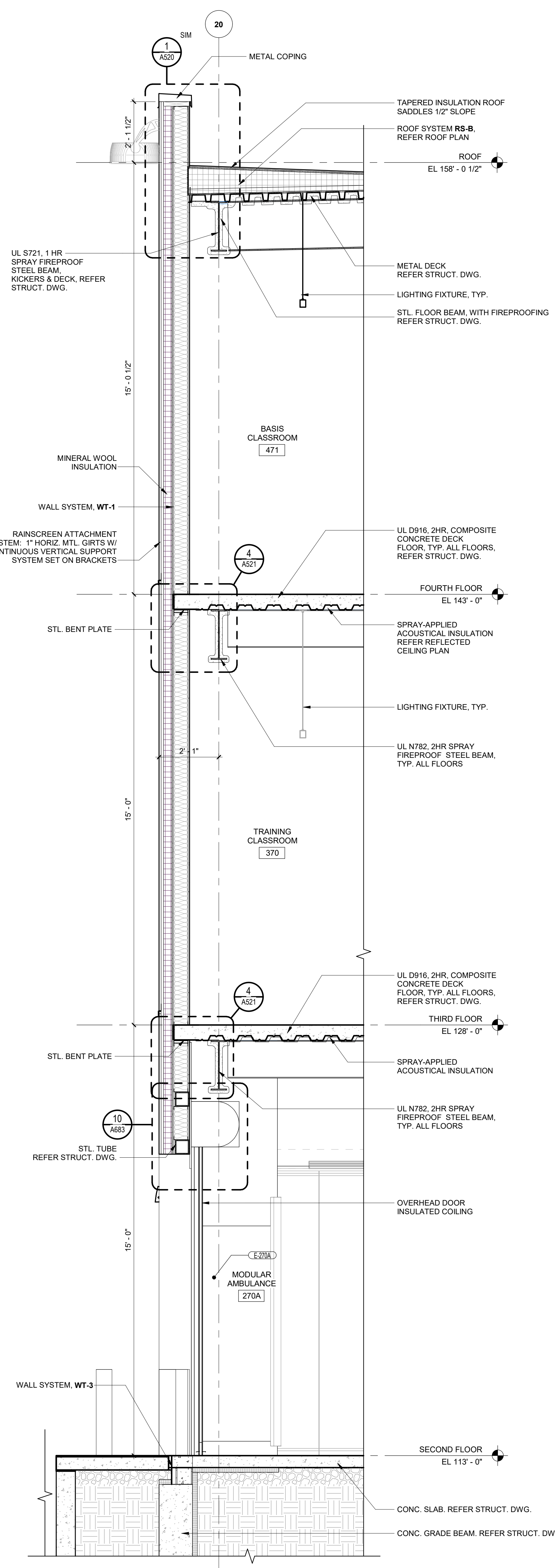
- CAST-IN-PLACE CONCRETE WALL SYSTEM
- SPRAY APPLIED DAMPROOFING BELOW GRADE
- CAST-IN-PLACE CONCRETE STEM WALL @ 3'-0" HT
- 2" CLOSED CELL SPRAY INSULATION (R-13)
- 2-1/2" COLD FORMED METAL FRAMING @16" OC.
- 5/8" GYPSUM WALL BOARD

ENERGY CODE REQUIREMENTS TABLE C402.1.3: MASS WALL (ABOVE GRADE): R-11.4ci

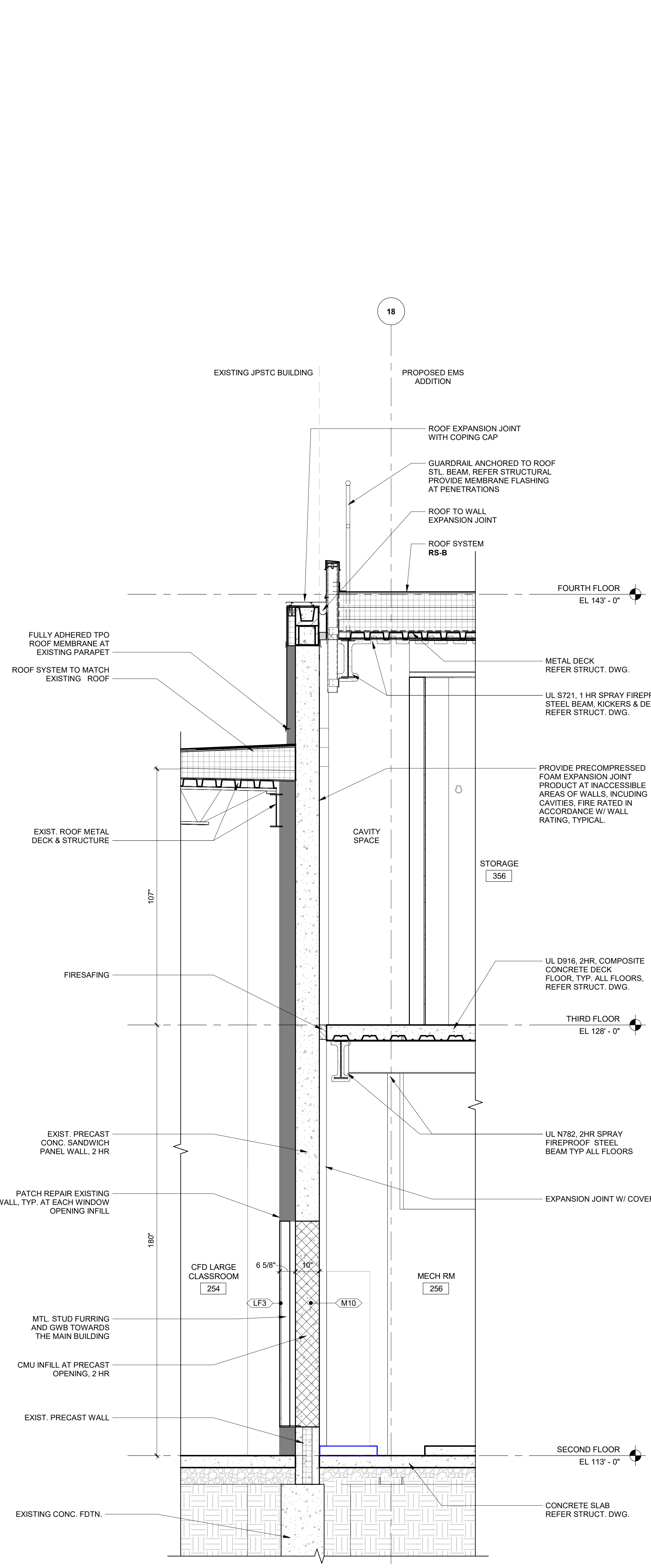
EXTERIOR WALL TYPE 4 (WT-4)

- FORMED PAN METAL PANEL RAINSCREEN WALL SYSTEM
- 1 3/8" FORMED PAN FLAT METAL PANEL
- RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
- 3" MINERAL WOOL INSULATION (R=15.9)
- WATER RESISTIVE SELF-ADHERED AIR BARRIER
- 5/8" GLASS MAT EXTERIOR SHEATHING BOARD
- 6" COLD FORMED METAL FRAMING 16" OC. W/ BATT INSUL (R-19)
- 5/8" GYPSUM WALL BOARD

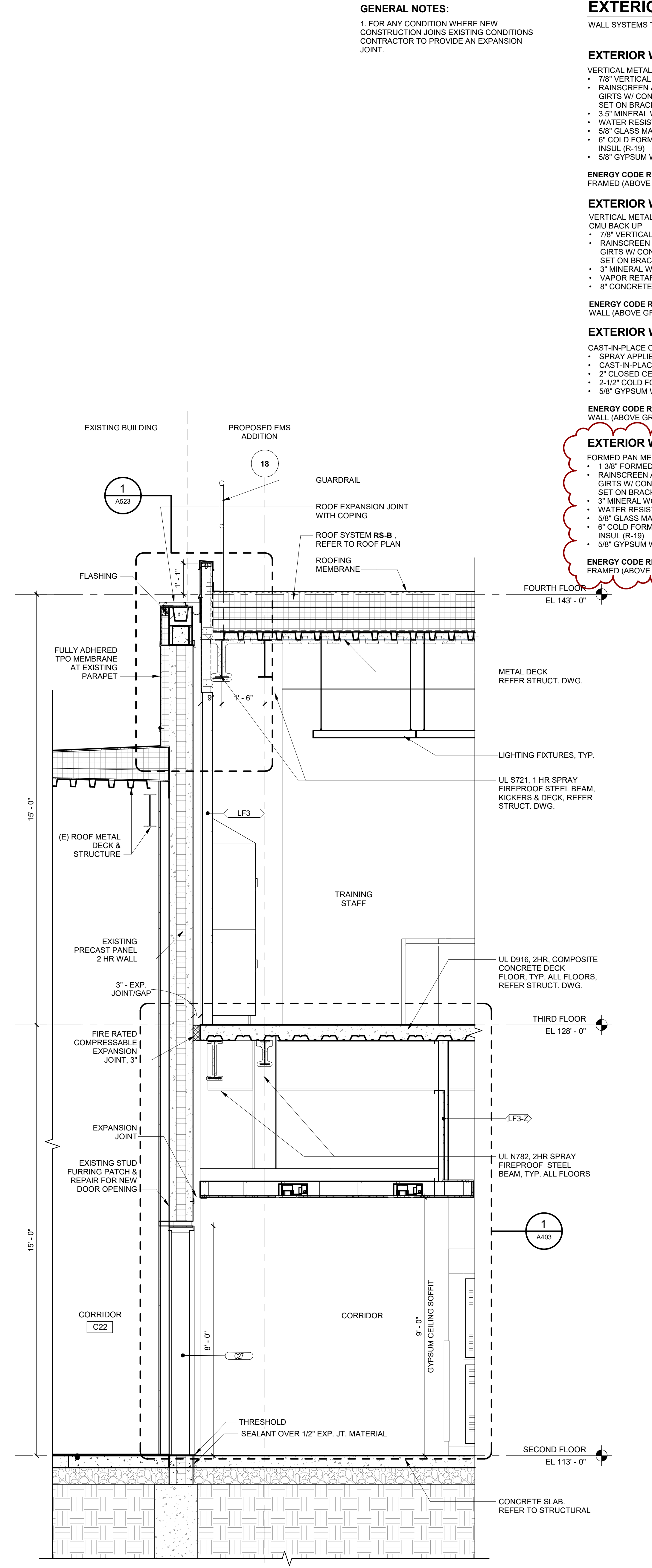
ENERGY CODE REQUIREMENTS TABLE C402.1.3: METAL FRAMED (ABOVE GRADE): R-13 + R-10ci



1 WALL SECTION THROUGH OVERHEAD DOOR
 Scale: 1/2" = 1'-0"



2 WALL SECTION THROUGH WINDOW @ EXISTING JPSTC BUILDING
 Scale: 1/2" = 1'-0"



3 WALL SECTION THROUGH DOOR @ EXISTING JPSTC BUILDING
 Scale: 1/2" = 1'-0"



PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-820-9100

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

PROFESSION	NAME	NO.	STATE
ARCHITECT	JAMES J. JOHNSON	00000000	IL
MECHANICAL ENGINEER	JOHN J. JOHNSON	00000000	IL
ELECTRICAL ENGINEER	JOHN J. JOHNSON	00000000	IL
CIVIL ENGINEER	JOHN J. JOHNSON	00000000	IL
LANDSCAPE ARCHITECT	JOHN J. JOHNSON	00000000	IL
TECHNOLOGY CONSULTANT	JOHN J. JOHNSON	00000000	IL

ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
1/R		DESCRIPTION

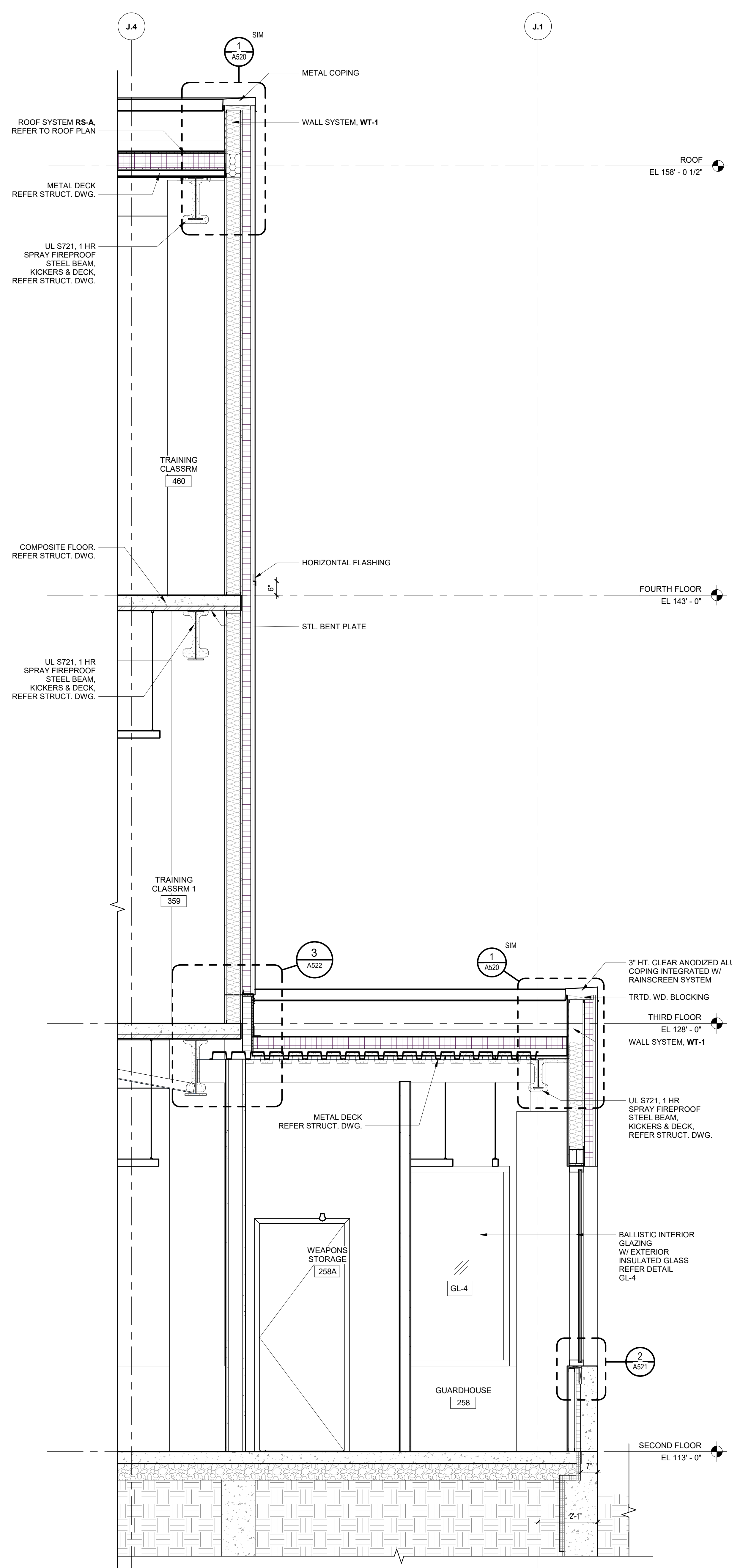
PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
 WALL SECTIONS

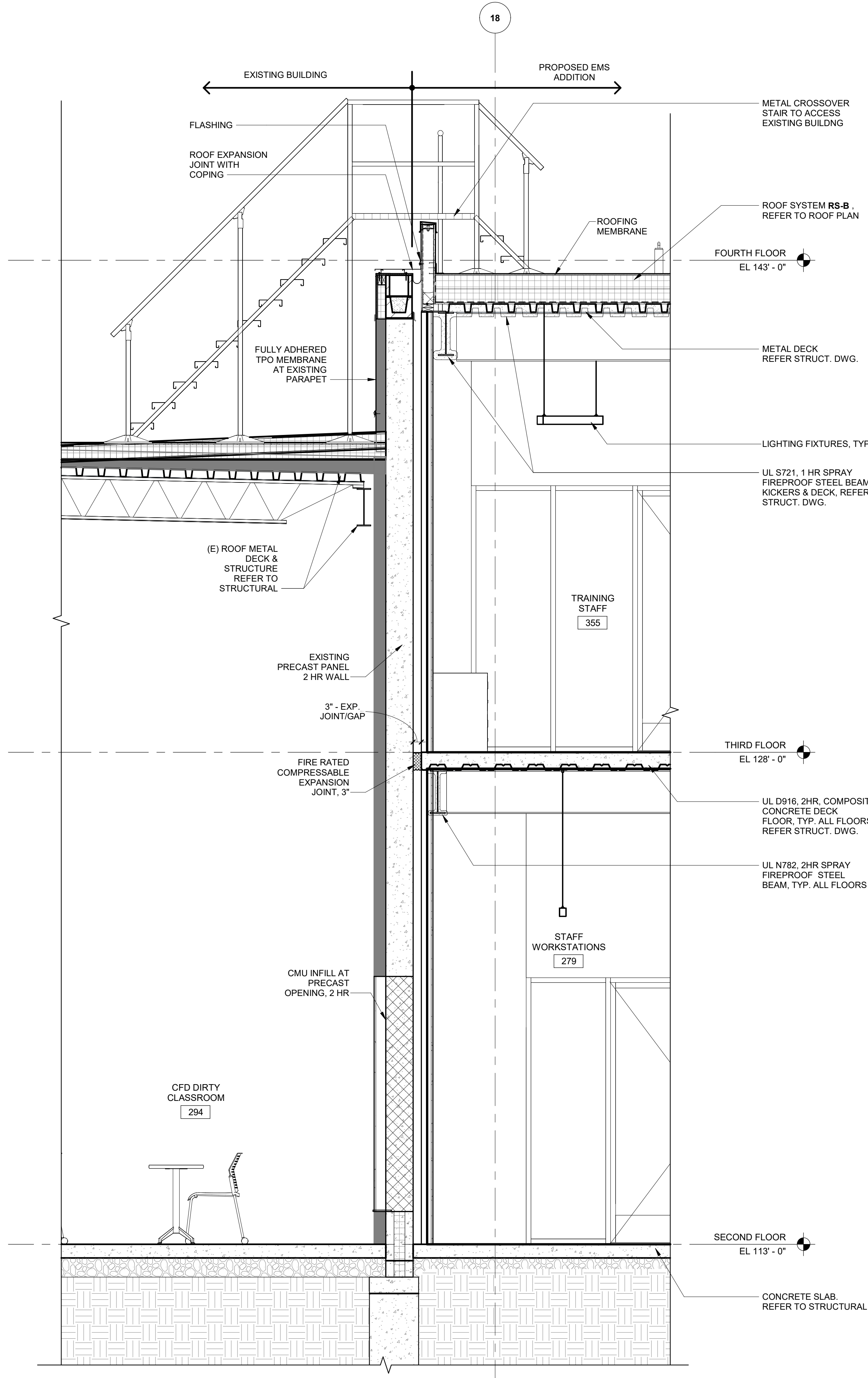
SHEET NUMBER

A321

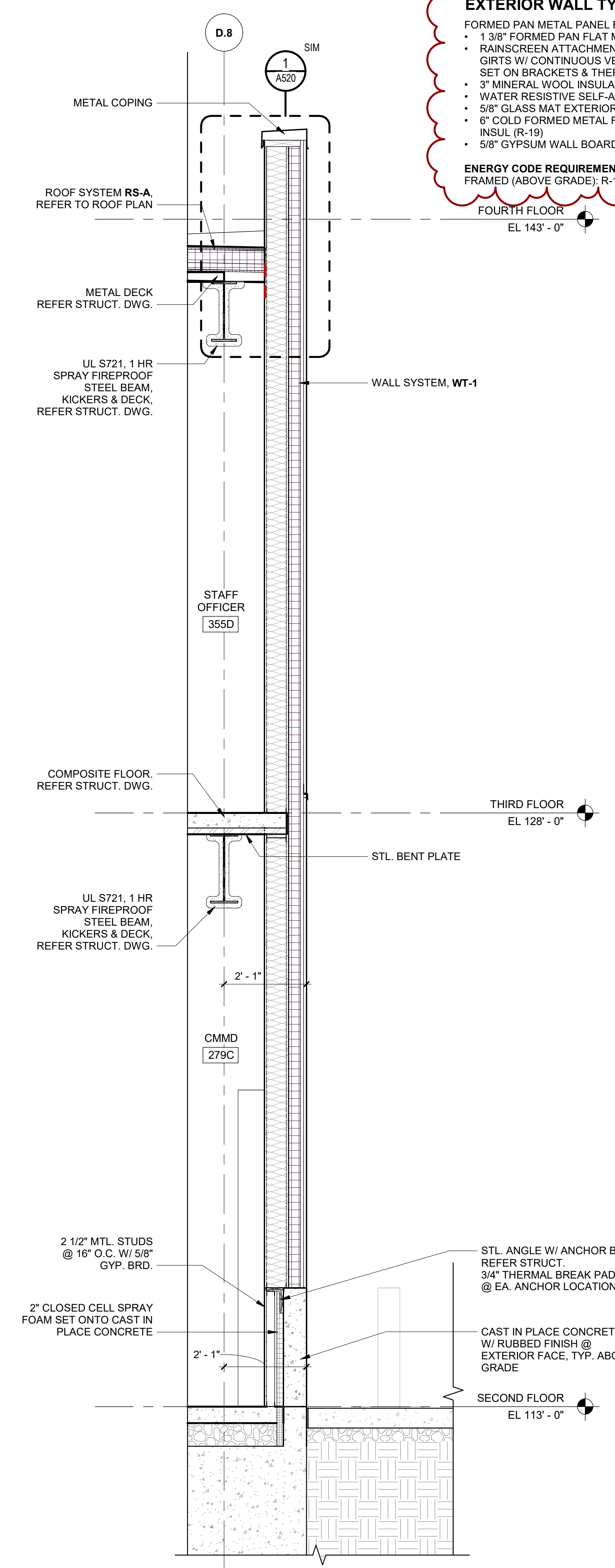
This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or disseminated without the written consent of AECOM. AECOM and its client agree that AECOM shall not be responsible for any errors or omissions in this drawing. AECOM shall not be responsible for any errors or omissions in this drawing. AECOM shall not be responsible for any errors or omissions in this drawing.



1 WALL SECTION THROUGH GUARDHOUSE
 Scale: 1/2" = 1'-0"



2 WALL SECTION THROUGH DOOR @ EXISTING JPSTC BUILDING1
 Scale: 1/2" = 1'-0"



3 WALL SECTION - 2 STORY
 Scale: 1/2" = 1'-0"

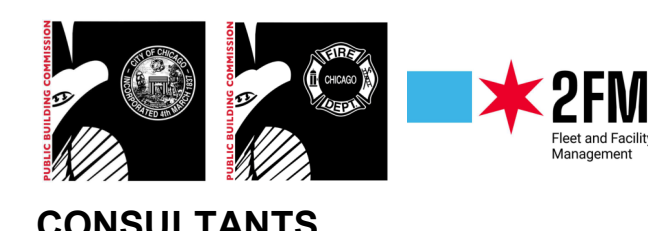
GENERAL NOTES:
 1. FOR ANY CONDITION WHERE NEW CONSTRUCTION JOINS EXISTING CONDITIONS CONTRACTOR TO PROVIDE AN EXPANSION JOINT.

EXTERIOR WALL TYPES
 WALL SYSTEMS TO MEET NFPA 285 REQUIREMENTS

- EXTERIOR WALL TYPE 1 (WT-1)**
 VERTICAL METAL PANEL RAINSCREEN WALL SYSTEM
 • 7/8" VERTICAL METAL PANEL
 • RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
 • 3.5" MINERAL WOOL INSULATION (R-15)
 • WATER RESISTIVE SELF-ADHERED AIR BARRIER
 • 5/8" GLASS MAT EXTERIOR SHEATHING BOARD
 • 6" COLD FORMED METAL FRAMING 16" O.C. W/ BATT INSUL (R-19)
 • 5/8" GYPSUM WALL BOARD
- ENERGY CODE REQUIREMENTS TABLE C402.1.3. METAL FRAMED (ABOVE GRADE):** R-13 + R-10ci
- EXTERIOR WALL TYPE 2 (WT-2)**
 VERTICAL METAL PANEL RAINSCREEN WALL SYSTEM W/ CMU BACK UP
 • 7/8" VERTICAL METAL PANEL
 • RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
 • 3" MINERAL WOOL INSULATION (R-12.9)
 • VAPOR RETARDING AIR BARRIER
 • 8" CONCRETE WALL BACK-UP, REFER STRUCTURAL
- ENERGY CODE REQUIREMENTS TABLE C402.1.3. MASS WALL (ABOVE GRADE):** R-11.4ci
- EXTERIOR WALL TYPE 3 (WT-3)**
 CAST-IN-PLACE CONCRETE WALL SYSTEM
 • SPRAY APPLIED DAMPROOFING BELOW GRADE
 • CAST-IN-PLACE CONCRETE STEM WALL @ 3'-0" HT
 • 2" CLOSED CELL SPRAY INSULATION (R-13)
 • 2-1/2" COLD FORMED METAL FRAMING @ 16" O.C.
 • 5/8" GYPSUM WALL BOARD
- ENERGY CODE REQUIREMENTS TABLE C402.1.3. MASS WALL (ABOVE GRADE):** R-11.4ci
- EXTERIOR WALL TYPE 4 (WT-4)**
 FORMED PAN METAL PANEL RAINSCREEN WALL SYSTEM
 • 1 3/8" FORMED PAN FLAT METAL PANEL
 • RAINSCREEN ATTACHMENT SYSTEM: 1" HORIZ. MTL. GIRTS W/ CONTINUOUS VERTICAL SUPPORT SYSTEM SET ON BRACKETS & THERMAL PAD SPACERS
 • 3" MINERAL WOOL INSULATION (R-12.9)
 • WATER RESISTIVE SELF-ADHERED AIR BARRIER
 • 5/8" GLASS MAT EXTERIOR SHEATHING BOARD
 • 6" COLD FORMED METAL FRAMING 16" O.C. W/ BATT INSUL (R-19)
 • 5/8" GYPSUM WALL BOARD
- ENERGY CODE REQUIREMENTS TABLE C402.1.3. METAL FRAMED (ABOVE GRADE):** R-13 + R-10ci



PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-375-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-9190

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
1/R		DESCRIPTION

PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
 WALL SECTIONS

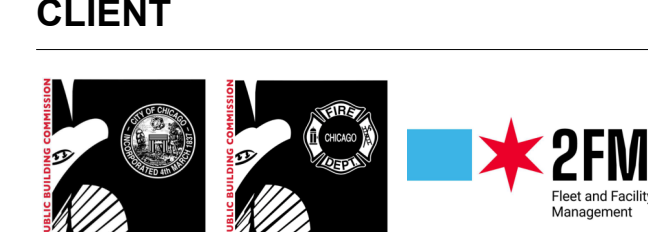
SHEET NUMBER

A322

This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or disseminated without the written consent of AECOM. AECOM accepts no responsibility for the accuracy of the information provided herein. AECOM is not responsible for the accuracy of the information provided herein. AECOM is not responsible for the accuracy of the information provided herein.



PROJECT
Emergency Medical Services (EMS)
Addition
701 N. Kilbourn Avenue, Chicago, IL 60651



CLIENT

CONSULTANTS

AECOM
ARCHITECTURE, STRUCTURAL,
MECHANICAL, PLUMBING, FIRE PROTECTION
303 E. Wacker Dr. #1400
Chicago, IL 60601
312-373-7700

ARCHITRAVE LIMITED
ARCHITECTURE
211 W. Wacker Dr. #1650
Chicago, IL 60606
312-642-2600

ABERCROMBIE PLANNING+DESIGN
PUBLIC SAFETY DESIGN CONSULTANT
3508 Overton Park Dr W
Fort Worth, TX 76109
817-820-9198

INFRASTRUCTURE ENGINEERING
CIVIL ENGINEERING
One South Wacker #2650
Chicago, IL 60606
312-425-9560

MILHOUSE ENGINEERING
ELECTRICAL ENGINEERING
333 S. Wabash Ave #2901
Chicago, IL 60604
312-618-7185

JACOBS / RYAN ASSOCIATES
LANDSCAPE ARCHITECTURE
1527 N. Sandburg Terrace
Chicago, IL 60610
312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
TECHNOLOGY CONSULTANT
233 S. Wacker Dr. #4400
Chicago, IL 60606
312-202-3300

REGISTRATION

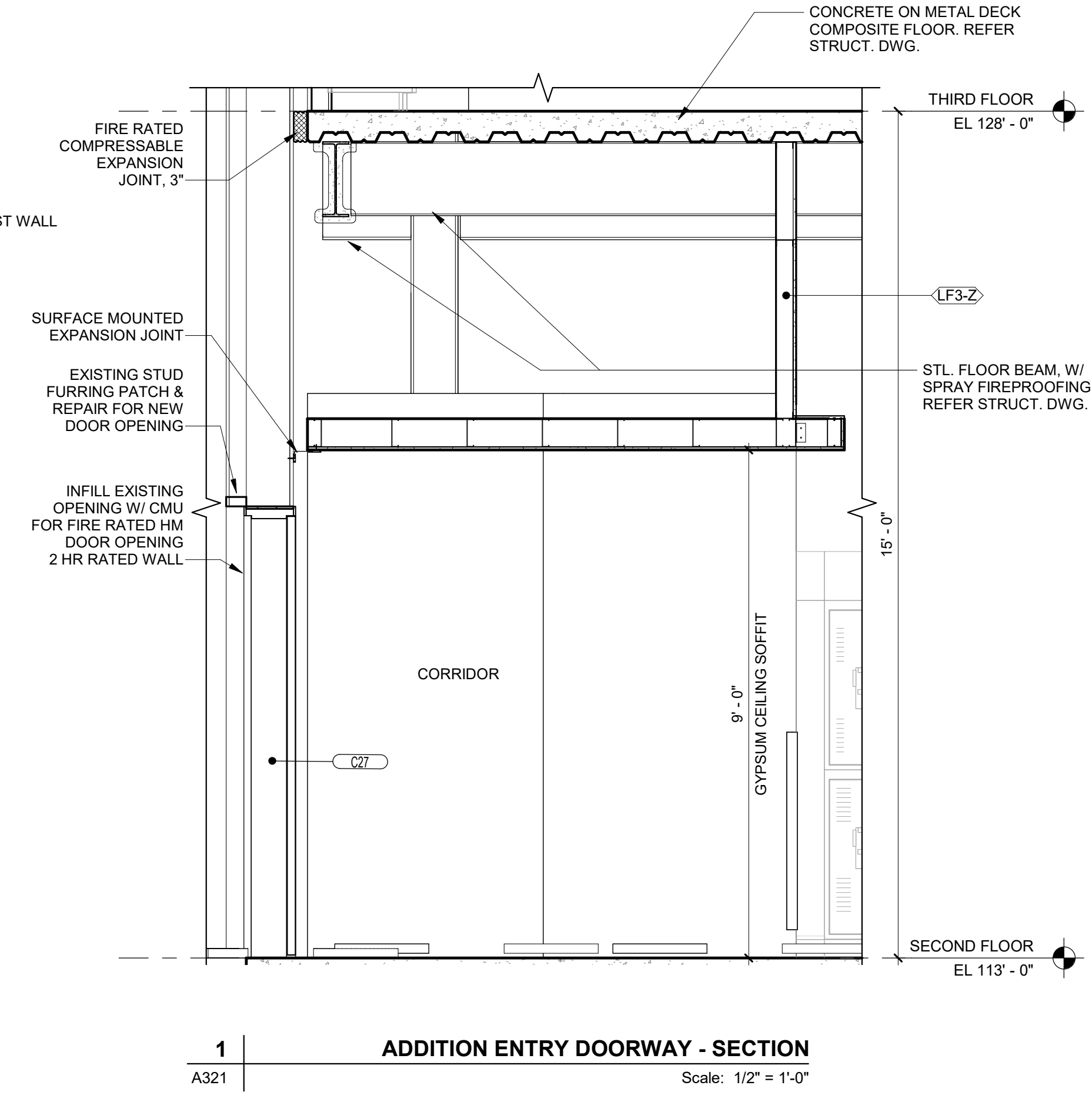
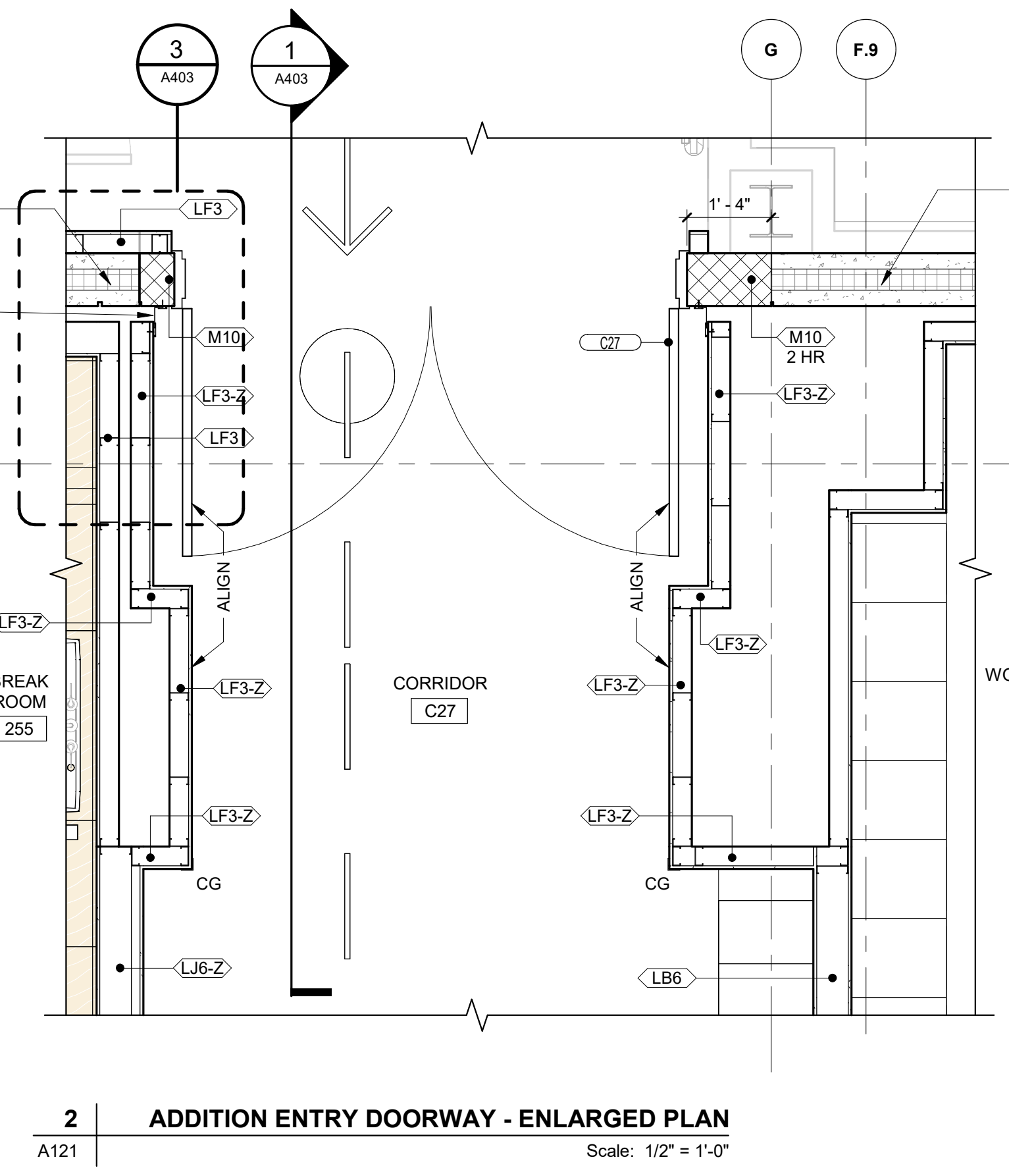
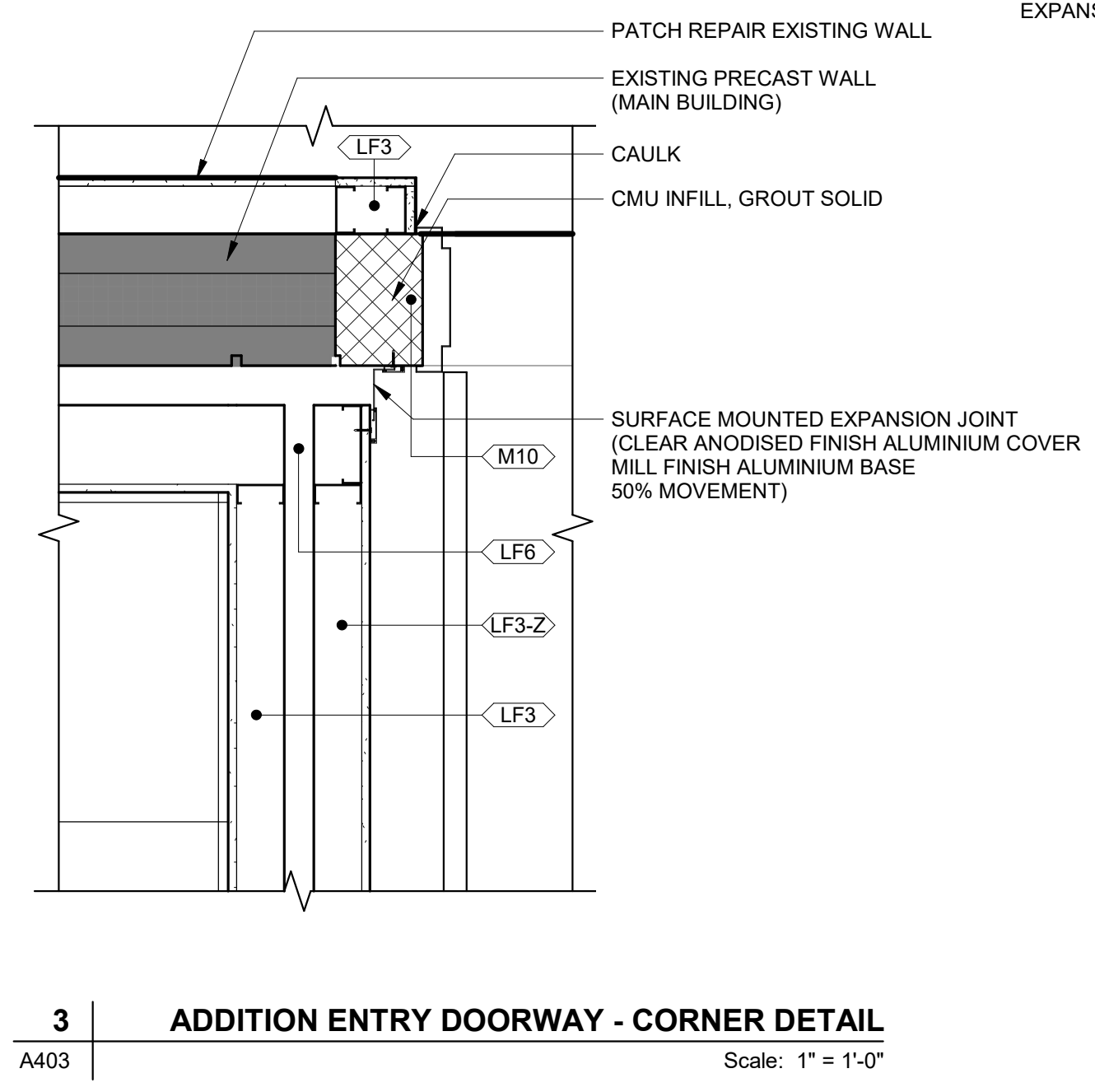
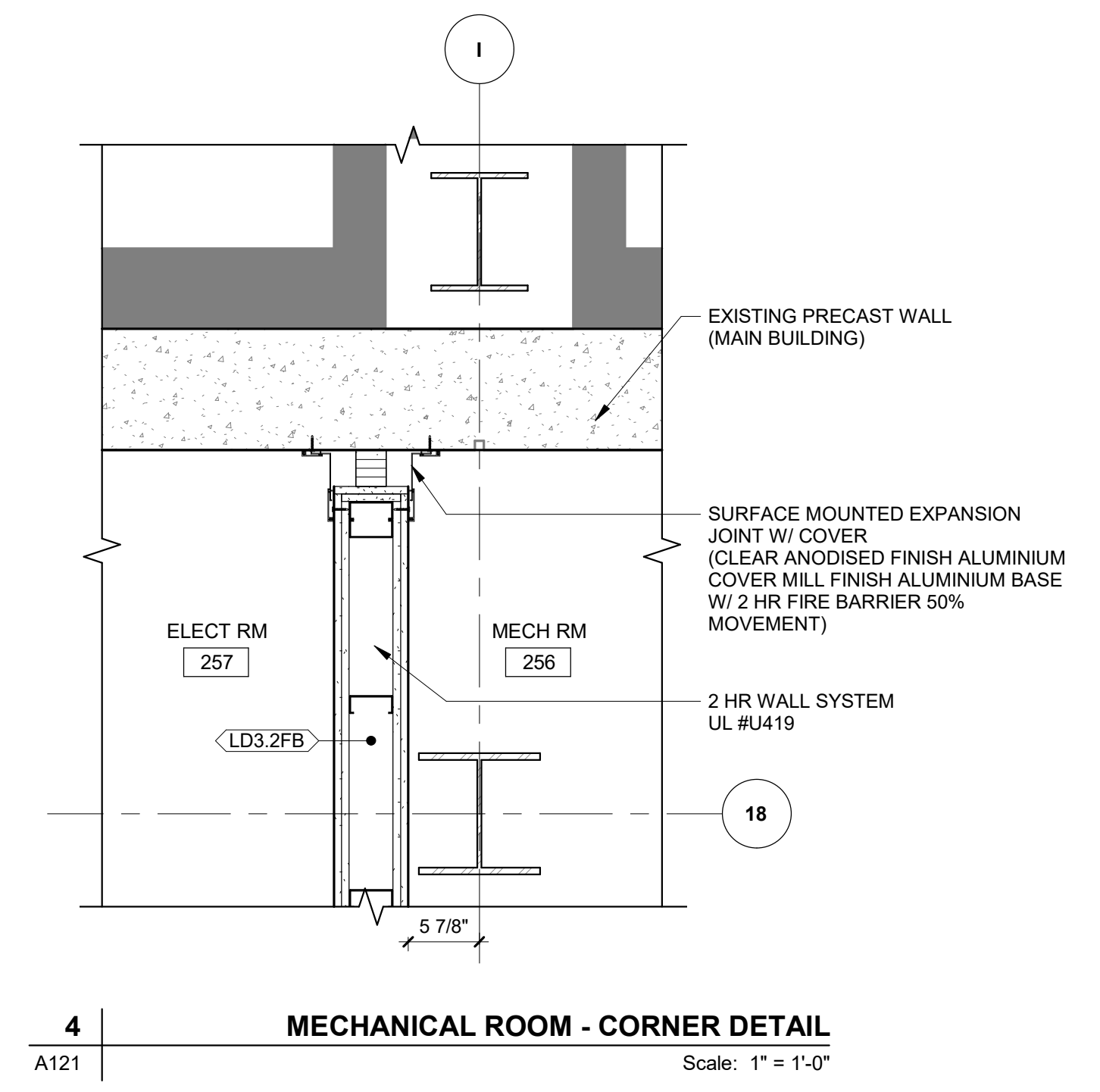
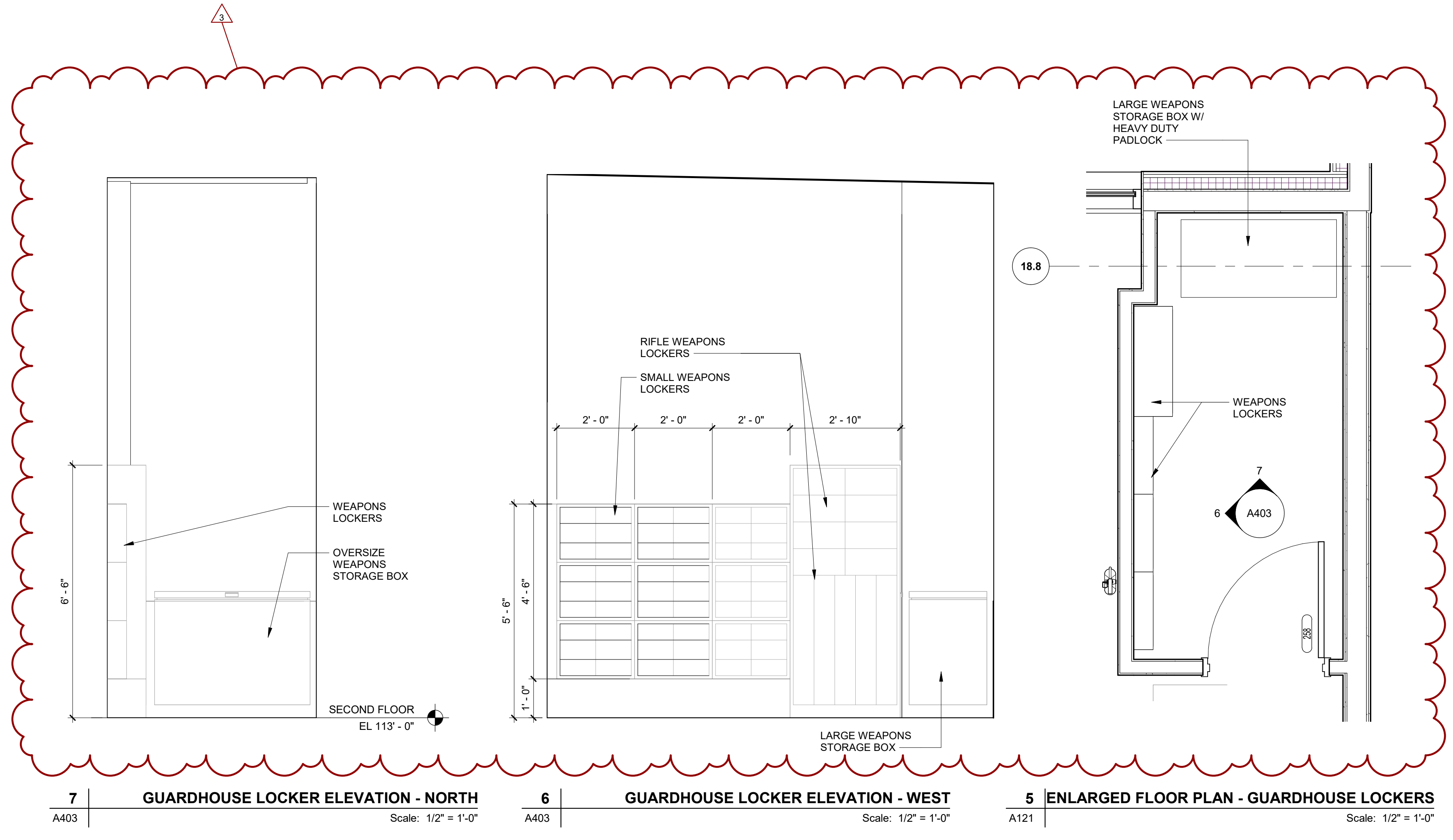
ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
I/R	DATE	DESCRIPTION

PROJECT NUMBER
PBC: #07215 AECOM: 60710711

SHEET TITLE
ENLARGED FLOOR PLANS & ELEVATIONS

SHEET NUMBER
A403



DOOR SCHEDULE																								
DOOR NO.	ROOM			DOOR PANEL					DOOR FRAME			DETAIL			FIRE RATING	STC RATING REQUEST ED	STC RATING	HW SET	LOCKSET FUNCTION	SECURITY	DOOR CLOSER	NOTES		
	NAME	NUMBER	TYPE	GLAZING	MATERIAL	WIDTH	HEIGHT	THICKNESS	TYPE	MATERIAL	HEAD	JAMB	SILL											
SECOND FLOOR																								
255	BREAK ROOM	255	F	GL1	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681 / 1/A681	-	-	-	6.00	CLASSROOM	THUMBTURN CYL	Yes					
256	MECH RM	256	F U/E		HM	5'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	44	44	AC2.01	STOREROOM	CR	Yes					
257	ELECT RM	257	F U/E		HM	5'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	90 MIN	-	-	AC3.01	STOREROOM	CR	Yes	EXIT DEVICE				
258	GUARDHOUSE	258	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	43	43	AC2.02	STOREROOM	CR	Yes					
259	CLASSROOM	259	F	GL2	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	43	43	2.01	CLASSROOM SECURITY	THUMBTURN CYL	Yes	EXIT DEVICE				
260	CLASSROOM	260	F	GL2	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	43	43	2.01	CLASSROOM SECURITY	THUMBTURN CYL	Yes	EXIT DEVICE				
261	CLASSROOM - SKILLS	261	F	GL2	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	43	43	2.01	CLASSROOM SECURITY	THUMBTURN CYL	Yes	EXIT DEVICE				
262A	CLASSROOM - SKILLS	262A	F	GL1	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	44	43	8.01	CLASSROOM SECURITY		Yes					
262B	SCENARIO TRAINING	262B	F	GL1	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	8.00	CLASSROOM SECURITY		Yes					
262C-1	STORAGE	262C	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	E1.01	STOREROOM		Yes	ELECTROMAGNETIC HOLD				
262C-2	STORAGE	262C	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	E1.01	STOREROOM		Yes	ELECTROMAGNETIC HOLD				
263	CLASSROOM (SIM LAB)	263	F	GL1	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	44	43	8.03	CLASSROOM SECURITY		Yes					
263A	CONTROL ROOM	263A	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	AC2.07	STOREROOM	CR / LATCHBOLT	Yes					
263B	SIMULATION CENTER LARGE ROOM	263B	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	7.01	PASSAGE		Yes					
264	IT EQUIPMENT ROOM	264	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	-	-	44	44	AC2.03	STOREROOM	CR	Yes			
265-1	SIM CENTER - BAR	265	F	GL1	HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	44	44	AC2.08	CLASSROOM SECURITY	CR / LATCHBOLT	Yes					
265-2	SIM CENTER - BAR	265	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	44	44	7.02	PASSAGE		Yes					
265A-1	SIM CENTER - ALLEY	265A	F		HM	3'-0"	7'-0"	1.34"	01	HM	6/A681	2/A681	-	44	44	7.04	PASSAGE		Yes					
265A-2	SIM CENTER - ALLEY	265A	F		HM	3'-0"	8'-0"	1.34"	02	HM	6/A681	2/A681	-	44	44	7.02	PASSAGE		Yes					
266	SIM CENTER - LIVING RM	266	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	44	44	AC2.08	CLASSROOM SECURITY	CR / LATCHBOLT	Yes					
266A	SIM - POWDER RM	266A	F		HM	2'-6"	7'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	7.00	PASSAGE		Yes	PROVIDE HINGE PIN OR FLOOR STOP WHERE WALL STOP WONT WORK				
267	STORAGE	267	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	1.00	STOREROOM		Yes					
268	EAST VESTIBULE	268	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	AC3.02	STOREROOM	CR	Yes	EXIT DEVICE / ALWAYS LOCKED / ALARM				
268A	PHASE II UNISEX RESTRM	268A	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	4.00	PRIVACY		Yes	OCCUPANCY INDICATOR				
268B	PHASE II UNISEX RESTRM	268B	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	4.00	PRIVACY		Yes	OCCUPANCY INDICATOR				
269	STORAGE	269	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	1.00	STOREROOM		Yes					
270	CLASSROOM	270	N	GL1	HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	43	43	8.03	CLASSROOM SECURITY		Yes					
270A	MODULAR AMBULANCE	270A	N	GL1	HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	1.00	STOREROOM		Yes					
271	UNISEX RESTROOM	271	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	4.00	PRIVACY		Yes	OCCUPANCY INDICATOR				
272	MENS	272	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	3.00	PASSAGE		Yes	PUSH / PULL				
273	WOMENS	273	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	3.00	PASSAGE		Yes	PUSH / PULL				
274	UNISEX RESTROOM	274	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	4.00	PRIVACY		Yes	OCCUPANCY INDICATOR				
275	JAN CL	275	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	1.02	STOREROOM		Yes					
276	WATER HTR RM	276	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	90 MIN	44	44	AC2.02	STOREROOM	CR	Yes					
277	DATA	277	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	90 MIN	-	-	AC2.00	STOREROOM	CR	Yes					
278	ELECT	278	F U/E		HM	5'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	90 MIN	-	-	AC3.01	STOREROOM	CR	Yes	EXIT DEVICE				
279	STAFF WORKSTATIONS	279	AL2	GL1	AL/GL	6'-0"	8'-0"	1.34"	04	AL	7/A682	3/A682	1/A682	-	-	AC4.00	STOREROOM	CR / THUMBTURN CYL	No	CONCEALED CLOSER				
279A	COPY	279A	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	05	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
279B	CHIEF	279B	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
279C	STAFF WORKSTATIONS	279C	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
279D	STAFF WORKSTATIONS	279D	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
279E	RECORDS AND TESTING	279E	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
C27	CORRIDOR	C27	F2		HM	8'-0"	8'-0"	1.34"	01	HM	-	-	-	-	-	E1.00	PASSAGE	MGH	Yes	ELECTROMAGNETIC HOLD; PUSH BARS INTEGRATED INTO DOOR PANEL				
C28	CORRIDOR	C28	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	-	-	-	AC2.09	CLASSROOM SECURITY	CR	Yes					
E-257	ELECT RM	257	F		HM	3'-0"	8'-0"	1.34"	01	HM	11/A681	14/A683	13/A683	-	-	AC3.03			Yes	PROVIDE DOOR SWEEP WITH THICK NEOPRENE SEAL AND DRIP CAP				
E-258	GUARDHOUSE	258	N		HM	3'-0"	8'-0"	1.34"	01	HM	-	-	-	-	-	AC2.04			Yes	LEVEL-3 BALLISTIC DOORS WITH BALLISTIC GLAZING; PROVIDE DOOR SWEEP WITH THICK NEOPRENE SEAL AND DRIP CAP				
E-268	EAST VESTIBULE	268	F		HM	3'-0"	7'-6"	1.34"	01	HM	11/A681	10/A681	-	-	-	2.03	AL-CLASSROOM SECURITY		Yes	EXIT DEVICE / ALWAYS LOCKED; PROVIDE DOOR SWEEP WITH THICK NEOPRENE SEAL AND DRIP CAP				
E-270A	MODULAR AMBULANCE	270A	F		HM	10'-0"	12'-6"	1.34"	01	HM	10/A682	9/A682	8/A682	-	-	26	b/o		Yes	OVERHEAD DOOR, REF TO SPEC 083323				
E-C27	CORRIDOR	C27	F		HM	6'-0"	8'-0"	1.34"	01	HM	11/A681	10/A681	9/A681	-	-	E2.00	PASSAGE	CR	Yes	EXIT DEVICE / EXIT ONLY; ALARM WITH DISABLE KEY; PROVIDE DOOR SWEEP WITH THICK NEOPRENE SEAL AND DRIP CAP				
E-ST 10	STAIR 10	ST 10-1	F		HM	6'-0"	7'-6"	1.34"	01	HM	11/A681	14/A683	13/A683	-	-	AC1.00	STOREROOM		Yes	EXIT DEVICE / FIREMAN ACCESS FROM OUTSIDE; PROVIDE DOOR SWEEP WITH THICK NEOPRENE SEAL AND DRIP CAP				
E-ST 11	STAIR 11	ST 11-1	F		HM	3'-0"	8'-0"	1.34"	01	HM	11/A681	14/A683	13/A683	-	34	34	E2.01	AL-CLASSROOM SECURITY		Yes	EXIT DEVICE / EXIT ONLY WITH ALARM; PROVIDE DOOR SWEEP WITH THICK NEOPRENE SEAL AND DRIP CAP			
ST 10-1	STAIR 10	ST 10-1	F		HM	6'-0"	8'-0"	1.34"	01	HM	8/A681	5/A681	-	-	34	34	2.00	PASSAGE		Yes	EXIT DEVICE			
ST 11-1	STAIR 11	ST 11-1	N		HM	3'-0"	8'-0"	1.34"	01	HM	8/A681	5/A681	-	-	90 MIN	34	34	2.04	PASSAGE		Yes	EXIT DEVICE		
THIRD FLOOR																								
355-1	TRAINING STAFF	355	F	GL1	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681 / 3/A681	1/A681	-	-	-	AC2.05	STOREROOM	CR	Yes				
355-2	TRAINING STAFF	355	F	GL1	WD	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681 / 3/A681	1/A681	-	-	-	AC2.05	STOREROOM	CR	Yes				
355A	TRAINING STAFF	355	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
355B	STAFF OFFICER	355B	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
355C	TRAINING STAFF	355	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
355D	STAFF OFFICER	355D	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	06	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
355E	STAFF MTG RM	355E	AL1	GL1	AL/GL	3'-0"	8'-0"	1.34"	07	AL	6/A681	3/A682	1/A682	-	-	3.01	OFFICE / ENTRY	THUMBTURN CYL	No					
356	STORAGE	356	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	-	-	1.00	STOREROOM		Yes					
357	MECH	357	F U/E		HM	5'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	90 MIN	44	44	AC2.01	STOREROOM	CR	Yes					
358	ELECT RM	358	F		HM	3'-0"	8'-0"	1.34"	01	HM	6/A681	2/A681	45 MIN	-	-	AC2.05	STOREROOM	CR	Yes					
359	TRAINING CLASSRM 1																							

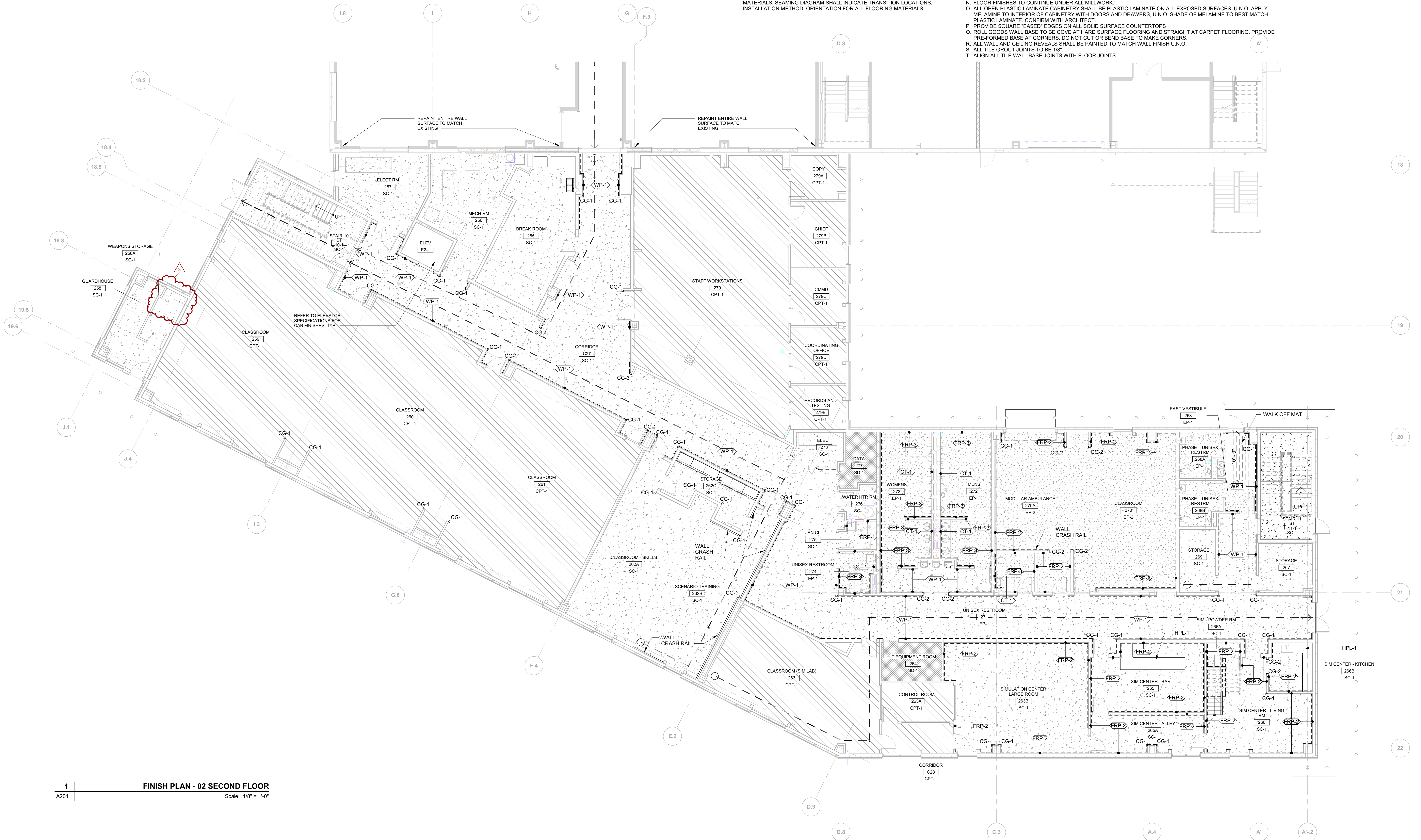
FINISH FLOOR PLAN LEGEND

FLOOR MATERIAL OR FINISH		ANNOTATIONS	
	CARPET (CPT-1)		ALIGN SYMBOL
	RUBBER TILE (RT-1) RUBBER TILE (RT-2)		FLOOR MATERIAL TRANSITION
	RESILIENT FLOORING (RF-1)		WALL FINISH TYPE REFER TO FINISH SCHEDULE
	SEALED CONCRETE (SC-1)		EXTENT OF WALL FINISH
	EPOXY (EP-1) EPOXY (EP-2)		MATERIAL DIRECTION
	STATIC DISSIPATIVE TILE (SD-1)		

GENERAL NOTES - FINISHES

- GENERAL**
- WALL AND CEILING FINISH REQUIREMENTS, CLASS A FLAME SPREAD INDEX OF 0-25, SMOKE DEVELOPED INDEX 0-450.
 - FLOOR FINISH REQUIREMENTS, CLASS I CRITICAL RADIANT FLUX 0.45 WATTS PER SQUARE CENTIMETER OR GREATER.
 - SEE FINISH PLAN, ELEVATIONS, REFLECTED CEILING PLAN AND DETAILS FOR CLARIFICATION OF EXTENT OF FINISH MATERIALS.
 - NO PAINTING OR INTERIOR FINISHING SHALL BE DONE UNDER CONDITIONS WHICH WILL JEOPARDIZE THE QUALITY OR APPEARANCE OF SUCH WORK. ALL WORKMANSHIP WHICH IS JUDGED LESS THAN FIRST QUALITY BY THE ARCHITECT WILL BE REJECTED.
 - REMOVE ALL WALL MOUNTED FIXTURES, ELECTRICAL DEVICES ETC. PRIOR TO PAINTING VERTICAL SURFACES. REINSTALL AFTER PAINTING IS COMPLETE.
 - INTERIOR GYP. BOARD SURFACES SHALL BE WIPED WITH A DAMP CLOTH JUST PRIOR TO APPLICATION OF THE FIRST COAT OF PAINT IN ORDER TO LAY FLAT ANY NAP WHICH MAY HAVE FORMED IN SANDING PROCESS.
 - EXAMINE ALL FINISH SURFACES AFTER COMPLETION OF WORK AND PROCEED WITH "TOUCH-UP" AS REQUIRED.
 - COORDINATE FINISH OF ALL ELECTRICAL, DATA AND AV DEVICES LOCATED ON WALLS WHICH FINISH IS DESIGNATED OTHER THAN P1 WITH ARCHITECT.
 - ALL CRACKS, HOLES, IMPERFECTIONS IN EXISTING WALLS, PARTITIONS OR GYP BOARD SHALL BE FILLED WITH PATCHING PLASTER AND SMOOTHED OFF TO MATCH ADJOINING SURFACES TRANSITION FLOOR MATERIALS UNDER CENTERLINE OF DOORS/OPENINGS UNLESS NOTED OTHERWISE.

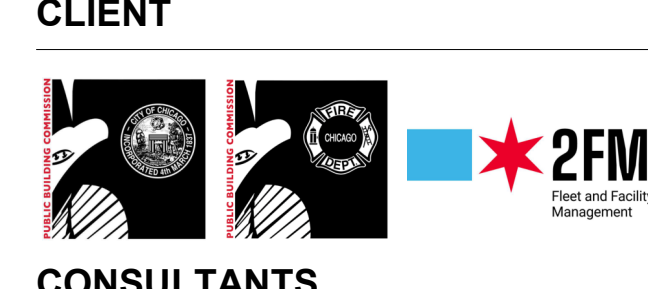
- PROCEDURE**
- THE CONTRACTOR SHALL SUBMIT (2) SAMPLES OF ALL FINISH MATERIALS TO THE ARCHITECT FOR APPROVAL, INCLUDING, BUT NOT LIMITED TO: PAINT, WALL COVERINGS, LAMINATES, FLOORING MATERIALS, ETC. ANY NEW WALL, FLOOR, CEILING OR WINDOW TREATMENTS MUST BE SUBMITTED FOR APPROVAL PRIOR TO ORDERING. FINISHES NOT SUBMITTED IN THE MINIMUM QUANTITY OF (2) SHALL BE REJECTED. SUBMIT SAMPLES TO ARCHITECT PRIOR TO PLACING FULL ORDERS WHERE MATERIALS ARE NOT RETURNABLE.
 - INSTALL ALL FINISH MATERIALS IN ACCORDANCE WITH THE MANUFACTURERS RECOMMENDED SPECIFICATIONS, SURFACE PREPARATION, ADHESIVES AND BACKINGS, INCLUDING WALL COVERINGS, FLOORING MATERIALS, LAMINATES ETC.
 - CONTRACTOR TO BE RESPONSIBLE FOR ALLOWING FOR DELIVERY AND LEAD TIMES FOR ALL FABRICS AND OTHER CUSTOM FINISHES WITHIN THE CONSTRUCTION SCHEDULE. ALL DELIVERY TIMES MUST BE CONFIRMED, AND ANY EXCESSIVE LEAD TIMES MUST BE BROUGHT TO THE ARCHITECT'S ATTENTION IMMEDIATELY TO ALLOW FOR RE-SPECIFICATION IF NECESSARY. SUBMIT FLOORING SEAMING DIAGRAM FOR REVIEW PRIOR TO PURCHASING MATERIALS. SEAMING DIAGRAM SHALL INDICATE TRANSITION LOCATIONS, INSTALLATION METHOD, ORIENTATION FOR ALL FLOORING MATERIALS.
- MATERIALS + FINISHES**
- ALL WALLS AND COLUMN SURFACES TO BE PAINTED PT-1 U.N.O.
 - ALL PAINTED WALLS TO HAVE EGGSHELL FINISH U.N.O.
 - ALL PAINTED CEILING TO HAVE FLAT FINISH.
 - ALL PAINTED WOOD WORK, HOLLOW METAL FRAMES AND DOORS TO HAVE SEMI-GLOSS FINISH.
 - PAINT UNDERCOUNTER SUPPORT BRACKETS TO MATCH WALL COLOR.
 - ALL EXPOSED CEILING AND EXPOSED EQUIPMENT INCLUDING ALL BEAMS, DUCTWORK, CONDUIT, ETC. SHALL BE PAINTED PER SPECIFICATIONS U.N.O. REVIEW ALL MATERIALS TO BE PAINTED AT EXPOSED AREAS AND PROVIDE PROPER PRIMER TO ENSURE PAINT ADHESION.
 - UNDERSIDE OF SOFFITS (WHERE OCCURS) TO RECEIVE A FINISH TO MATCH ADJACENT VERTICAL FINISH, U.N.O.
 - PAINT CEILING ACCESS PANELS WHERE THEY OCCUR TO MATCH ADJACENT CEILING FINISH.
 - PAINT ALL EXPOSED SURFACES U.N.O. INCLUDING HOLLOW METAL DOOR FRAMES, GRILLES, FIRE HOSE OR EXTINGUISHER CABINETS, EXPOSED PIPING, ETC. U.N.O. TO MATCH ADJACENT WALL FINISH. DO NOT PAINT EXTRUDED ALUMINUM FRAMES OR STOREFRONTS. UPON COMPLETION, REMOVE ALL PAINT FROM WHERE IT HAS SPILLED, SPLASHED, OR SPATTERED ON EXPOSED SURFACES.
 - EXISTING DOORS TO REMAIN TO BE PAINTED TO MATCH ADJACENT WALL COLOR.
 - ALL STAINED MATERIALS TO HAVE UNIFORM COLOR.
 - ALL VERTICAL SURFACES U.N.O. SHALL RECEIVE WALL BASE RB-1.
 - SUBMIT TILED GROUT MOCK-UP FOR REVIEW. REFER TO FINISH MATERIAL LEGEND FOR GROUT COLORS REQUIRED.
 - FLOOR FINISHES TO CONTINUE UNDER ALL MILLWORK.
 - ALL OPEN PLASTIC LAMINATE CABINETRY SHALL BE PLASTIC LAMINATE ON ALL EXPOSED SURFACES, U.N.O. APPLY MELAMINE TO INTERIOR OF CABINETRY WITH DOORS AND DRAWERS, U.N.O. SHADE OF MELAMINE TO BEST MATCH PLASTIC LAMINATE. CONFIRM WITH ARCHITECT.
 - PROVIDE SQUARE "EASED" EDGES ON ALL SOLID SURFACE COUNTERTOPS
 - ROLL GOODS WALL BASE TO BE COVE AT HARD SURFACE FLOORING AND STRAIGHT AT CARPET FLOORING. PROVIDE PRE-FORMED BASE AT CORNERS. DO NOT CUT OR BEND BASE TO MAKE CORNERS.
 - ALL WALL AND CEILING REVEALS SHALL BE PAINTED TO MATCH WALL FINISH U.N.O.
 - ALL TILE GROUT JOINTS TO BE 1/8"
 - ALIGN ALL TILE WALL BASE JOINTS WITH FLOOR JOINTS.



1 FINISH PLAN - 02 SECOND FLOOR
 Scale: 1/8" = 1'-0"



PROJECT
 Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS
AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-375-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-9190

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

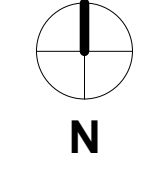
MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

NORTH ARROW



ISSUE/REVISION

NO.	DATE	DESCRIPTION
3	07/12/2024	ADD 01
2	07/05/2024	ISSUED FOR PERMIT
1	06/26/2024	ISSUED FOR BID
I/R	DATE	DESCRIPTION

PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
 SECOND FLOOR - INTERIOR FINISHES PLAN

SHEET NUMBER

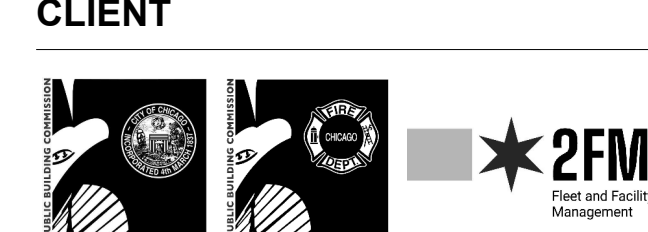
A801

KEYNOTES

- 64 UNDERGROUND CONDUITS, SEE SITE PLAN FOR CONTINUATION.
- 68 IN-GROUND OPEN BOTTOM PULL BOX, 36 X 36" MINIMUM. (TYPICAL).
- 69 IN-GROUND OPEN BOTTOM PULL BOX, 24 X 24" MINIMUM.
- 70 1.25" CONDUIT
- 72 2" CONDUIT
- 75 2" EMT CONDUIT WITH BUSHINGS (TYPICAL).
- 78 2" GRC CONDUIT WITH BUSHINGS (TYPICAL).
- 83 4" PVC CONDUIT WITH BUSHINGS (TYPICAL).
- 85 12" X 12" X 6" PULL BOX WITH COVER.
- 87 18" X 18" X 8" PULL BOX WITH COVER.
- 109 EXPANSION JOINT, PROVIDE EXPANSION FITTINGS FOR ALL CONDUITS THAT CROSS EXPANSION JOINTS AND BUILDING SEPARATIONS (TYPICAL).
- 117 TWO VIDEO INTERCOM STATIONS, DUAL HEIGHT ON BOLLARD



PROJECT
Emergency Medical Services (EMS) Addition
 701 N. Kilbourn Avenue, Chicago, IL 60651



CONSULTANTS

AECOM
 ARCHITECTURE, STRUCTURAL, MECHANICAL, PLUMBING, FIRE PROTECTION
 303 E. Wacker Dr. #1400
 Chicago, IL 60601
 312-373-7700

ARCHITRAVE LIMITED
 ARCHITECTURE
 211 W. Wacker Dr. #1650
 Chicago, IL 60606
 312-642-2600

ABERCROMBIE PLANNING+DESIGN
 PUBLIC SAFETY DESIGN CONSULTANT
 3508 Overton Park Dr W
 Fort Worth, TX 76109
 817-920-8198

INFRASTRUCTURE ENGINEERING
 CIVIL ENGINEERING
 One South Wacker #2650
 Chicago, IL 60606
 312-425-9560

MILHOUSE ENGINEERING
 ELECTRICAL ENGINEERING
 333 S. Wabash Ave #2901
 Chicago, IL 60604
 312-618-7185

JACOBS / RYAN ASSOCIATES
 LANDSCAPE ARCHITECTURE
 1527 N. Sandburg Terrace
 Chicago, IL 60610
 312-664-3217

LEVEL-1 GLOBAL SOLUTIONS
 TECHNOLOGY CONSULTANT
 233 S. Wacker Dr. #4400
 Chicago, IL 60606
 312-202-3300

REGISTRATION

ISSUE/REVISION

NO.	DATE	DESCRIPTION
6	07/12/2024	ADD 01
5	07/05/2024	ISSUED FOR PERMIT
4	06/26/2024	ISSUED FOR BID
I/R		

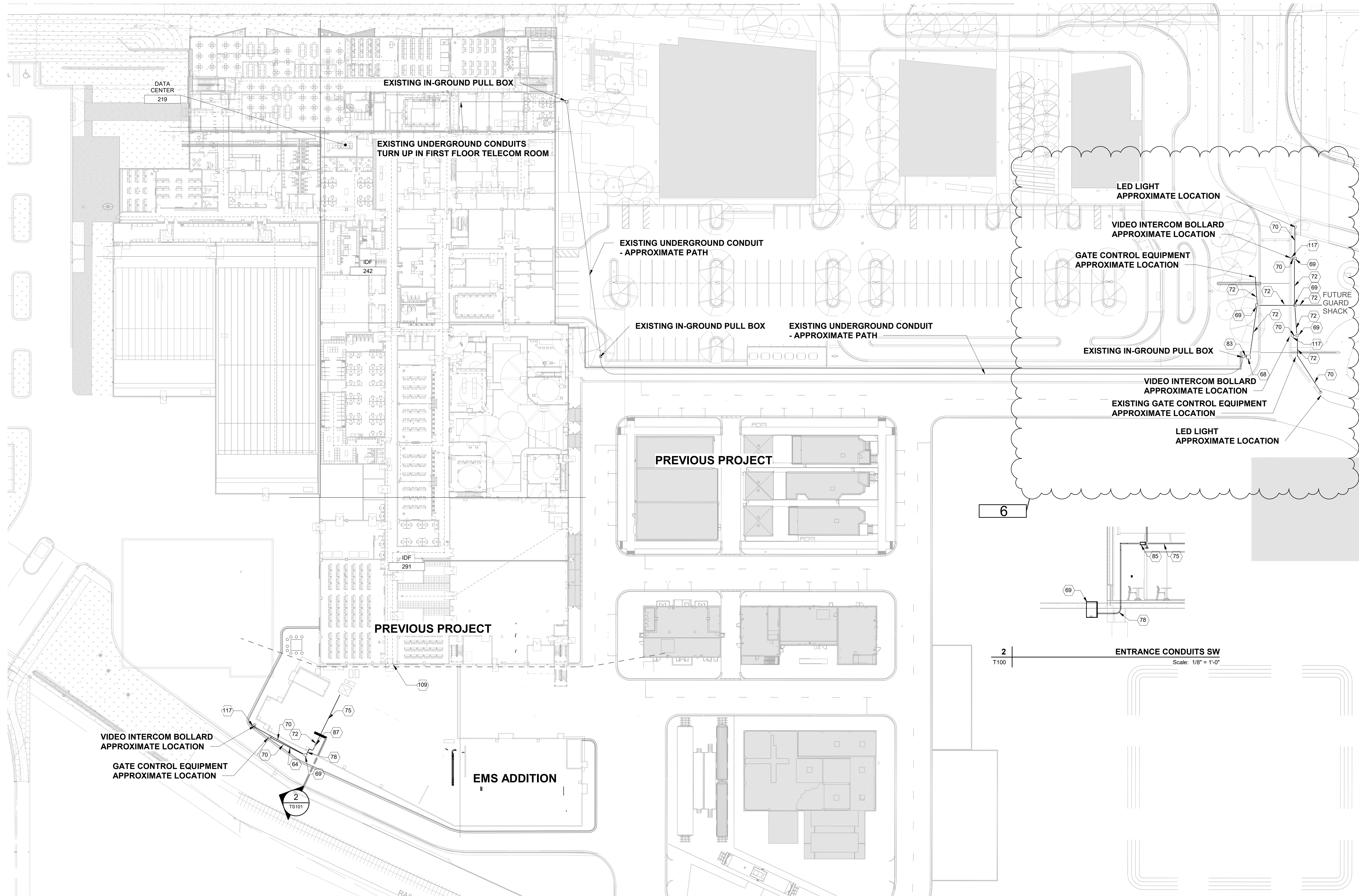
PROJECT NUMBER
 PBC: #07215 AECOM: 60710711

SHEET TITLE
 TECHNOLOGY SITE PLAN

SHEET NUMBER

TS101

This drawing has been prepared for the use of AECOM's client and may not be used, reproduced or disseminated by third parties, except as agreed by AECOM and its client as required by law or for use by governmental reviewing agencies. AECOM accepts no responsibility, and denies any liability whatsoever, to any party that modifies this drawing without AECOM's express written consent. Do not scale this document. All measurements must be obtained from the stated dimensions.



1 | **TECHNOLOGY SITE PLAN**
 Scale: 1/32" = 1'-0"

2 | **ENTRANCE CONDUITS SW**
 Scale: 1/8" = 1'-0"