

# Bringing Rainwater Harvesting to the Lakefront



Figure 1 The beach houses at 41st Street Beach and Osterman Beach are situated on Chicago's North and South sides. The project team successfully sought a variance to the Chicago Code to bring rainwater harvesting technology to the city's lakeshore.

On warm summer days in Chicago, locals and tourists can be spotted playing with water. Children splash in spray pools that decorate the city's neighborhoods, while families in Millennium Park wait for the faces of Crown Fountain to spill water over the crowd. Travel a little south to Grant Park, and the historic Buckingham Fountain is using water to create a sky-high spectacle.

Two beach houses along Lake Michigan's shoreline (see Figure 1) developed by the Public Building Commission of Chicago (PBC) use water for a different purpose: to flush toilets and urinals. Rainwater harvesting technology is front and center at these traditional brick buildings, which are teaching the general public some valuable lessons.

Using harvested rainwater indoors in Chicago posed some challenges. At the time of construction, rainwater harvesting for the use of flushing toilets and urinals was not allowed by Chicago's building code. A special review by the Department of Building's Committee on Standards and Tests and the Illinois Department of Public Health (IDPH) was necessary, and many stakeholders were involved in the approval process. The

rewards of a team working together to move a project and code forward are apparent when beachgoers pause to read the signage and appreciate water conservation in action.

## A SUSTAINABLE PROTOTYPE

Rewind to 1998, when Chicago architectural firm Muller + Muller Ltd. designed a functional prototype that would service the beach and lakefront trail with public restrooms, a lifeguard station, and a concession area. When the Chicago Park District later requested to build two additional prototypes and pursue LEED certification, Muller + Muller enhanced the original prototype's sustainable features and showcased rainwater harvesting technology. These seasonal facilities use a lot of water, and since Chicago gets about 36 inches of rain per year, rainwater harvesting seemed like a good idea.

The new prototypes did even more to reduce energy and water consumption. In addition to the rainwater harvesting, they included natural ventilation, eliminating the need for heating and cooling, and tubular skylights to bring natural daylight to public

## Project Team

**Owner:** Public Building Commission on behalf of the Chicago Park District

**Architect:** Muller + Muller Ltd.

**MEP Engineer:** Primera Engineers Ltd.

**Civil Engineer:** Infrastructure Engineering

**General Contractor:** Pacific Construction Services

**Landscape Architect:** Daniel Weinbach & Partners

**Structural Engineer:** GRAEF

**Rainwater Harvesting Manufacturer:** Water Harvesting Solutions (Wahaso)

## Project Stats

- » 2,200 square feet per building
- » Eight lavatories
- » One outdoor shower
- » One indoor shower
- » Three drinking fountains
- » One mop sink
- » One hand sink
- » Three-compartment sink
- » 11 flush valve water closets
- » Four flush valve urinals

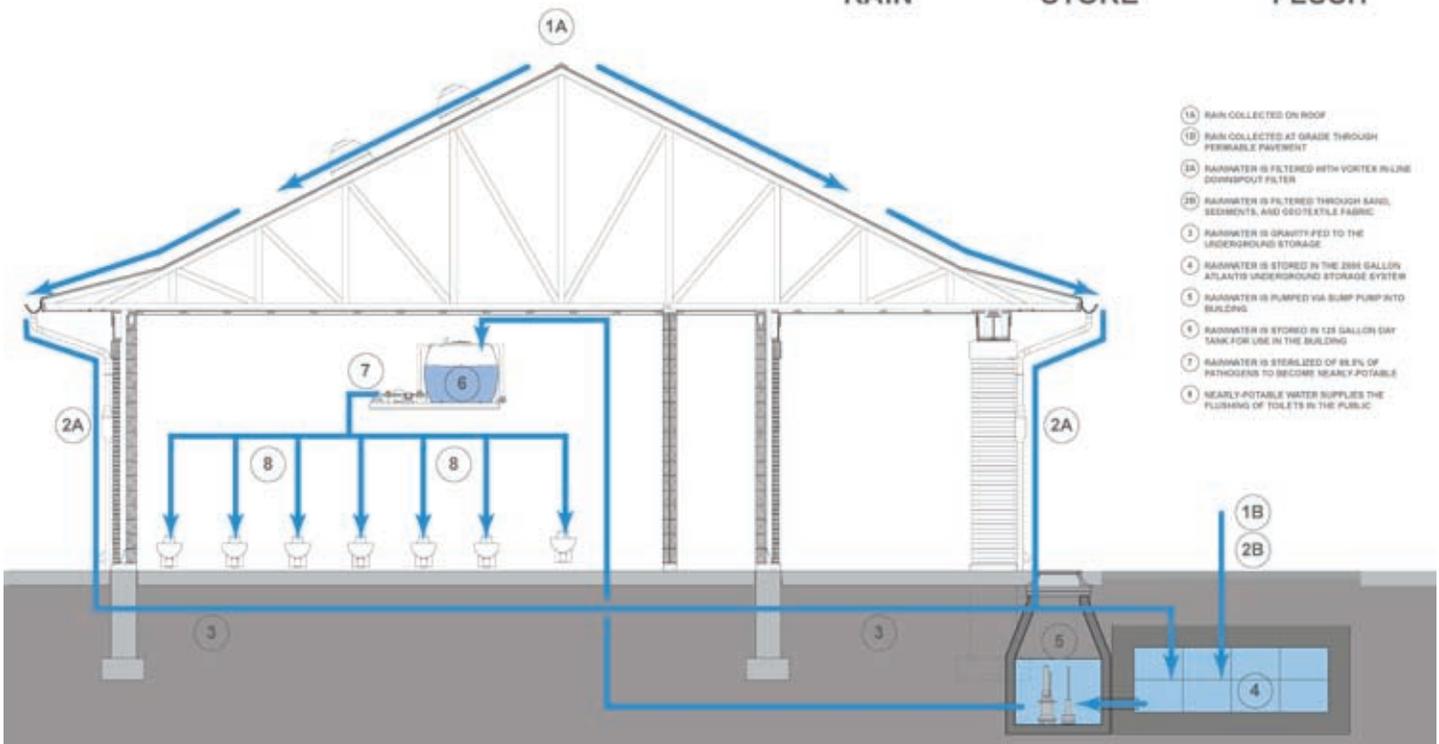
spaces and eliminate the need for artificial lighting. Low maintenance, robust materials, and automated controls keep operational costs minimal and allow the Chicago Park District to get more value out of the buildings.

The rainwater harvesting system captures and filters 100 percent of the rainwater that falls on the roof for use in flushing toilets and urinals in the building. The rainwater is filtered and held in a 2,000-gallon cistern tank and then gets pumped into a 125-gallon tank where it waits to pass through an ultraviolet sterilizer before being used as flush water (see Figure 2).

Estimating annual water usage is difficult for a beach house. By using a modified LEED calculation form, the team estimated annual water usage of 75,000 gallons, and it is

# RAINWATER HARVESTING

CITY OF CHICAGO • CHICAGO PARK DISTRICT



- 1A RAIN COLLECTED ON ROOF
- 1B RAIN COLLECTED AT GRADE THROUGH PERMEABLE PAVEMENT
- 2A RAINWATER IS FILTERED WITH VORTEX IN-LINE DOWNSPOUT FILTER
- 2B RAINWATER IS FILTERED THROUGH SAND, SEDIMENTS, AND GEO-TEXTILE FABRIC
- 3 RAINWATER IS GRAVITY-FED TO THE UNDERGROUND STORAGE
- 4 RAINWATER IS STORED IN THE 2000 GALLON ATLANTIS UNDERGROUND STORAGE SYSTEM
- 5 RAINWATER IS PUMPED VIA BUMP PUMP INTO BUILDING
- 6 RAINWATER IS STORED IN 125 GALLON DAY TANK FOR USE IN THE BUILDING
- 7 RAINWATER IS STERILIZED OF 99.9% OF PATHOGENS TO BECOME NEARLY POTABLE
- 8 NEARLY POTABLE WATER SUPPLIES THE FLUSHING OF TOILETS IN THE PUBLIC

Figure 2 Rainwater harvesting system diagram (Courtesy of Muller + Muller Ltd.)



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expected that 27,000 gallons will be supplied by rainwater, reducing potable water usage by nearly 40 percent. Data is currently being collected by a totaling meter, and actual data will be available after the facilities have been open for more than a year.

All PBC projects are designed to achieve LEED Silver certification from the U.S. Green Building Council. The design team's focus on water conservation earned accolades from the City and the building industry by winning the mayor's Green Works Award and the American Council of Engineering Companies' Illinois Chapter Special Achievement Award for Small Projects in 2010.

### CRACKING THE CODE

One of the biggest challenges faced by the project team was the building code. It was important that the design team (architect, plumbing engineer, civil engineer, and rainwater harvesting manufacturer's engineer) worked together to prepare an extensive presentation that would support the case for earning a variance to the code.

Chicago's building code dates back to 1881, just after the Great Chicago Fire, and Chicago Building Code Section 18-29-602 requires that only potable water be used for all plumbing fixtures. It makes no provision for the use of rainwater for any type of plumbing fixture. As one of the first public projects in Chicago to embark on rainwater harvesting, this project was a test case for both the Chicago Department of Buildings and the Illinois Department of Public Health.

Fortunately, the city and the state were both in the process of reviewing their codes to include water reuse at the time the project was under design. The mayor's office and the PBC saw the value of rainwater harvesting and were eager to work with the design team to obtain a variance. The PBC advised the team to start with a request to the IDPH, since a written draft of guidelines for rainwater harvesting was in existence. The team received a response from IDPH and made some changes and moved on to City Hall.

The Chicago Department of Buildings addresses variance requests to the code

by referring them to the Committee on Standards and Tests. This committee is comprised of building industry technical professionals and city staff who meet monthly to review the suitability of new systems and methods of construction. The design team made an application to the committee in the spring of 2010. At that time, only two buildings in Chicago were using rainwater for flushing toilets. These beach houses would be among the first city-owned buildings to be approved.

Since the approval of this project last year, three additional PBC projects using water harvesting for flushing have gone through the permit process. The latest development in Chicago is the Department of Buildings working with IDPH for guidelines on using rainwater. The IDPH has written guidelines and expects to incorporate them into their regulations in the near future. As of now, all projects wishing to add rainwater harvesting must apply to the Department of Buildings, which pursues joint review with IDPH.

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Fig 4a

### OPENING A LEARNING LESSON TO THE PUBLIC

The general public usually doesn't get a glimpse of sustainable technology in action, according to Nick Perry, project architect at Muller + Muller. By exposing visible tanks and piping and using signage to explain the technology (see Figures 3 and 4), the prototypes transcend functionality and present learning opportunities for anyone who uses the facility.

"Building owners go through a great effort to make their buildings more sustainable," Perry said. "We wanted to take an invisible technology and make it interactive. When people flush, they can hear and see the water splashing in the exposed tank."

Perry also noted, "This is a way to get Chicagoans to think about our water supply and how we are going to preserve it for the future." **PSD**



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Figure 3 The tank and other systems are exposed so end-users can see and hear rainwater harvesting in action as they use the facility.

Figure 4 Educational signage informs and educates the public on the rainwater harvesting system.



Fig 3b



Fig 4b



Fig 3a