MIGHTY IRON
CONSTRUCTION MACHINES AT WORK
www.mightyiron.com
strategisONE


# Big Challenge, Deep Tunnel

CONVENTION CENTER RUNOFF PUTS ENGINEERS TO THE TEST

# Chicago Digs Deep

## DEEP-TUNNEL SYSTEM TO SIPHON STORM RUNOFF FROM CONVENTION CENTER TO LAKE MICHIGAN


**By JOE HANNEMAN / Photos by CHRIS DUZYNSKI**

CHICAGO — One of the world's largest convention centers is undergoing an $850 million expansion, but one of the most impressive things about the McCormick Place West project is the massive underground system being built to handle storm water runoff from the 27-acre site.

Construction had already started on the McCormick Place expansion in 2004 when the city of Chicago decided it no longer wanted a system that would direct all the clean storm runoff to water treatment plants, but to nearby Lake Michigan instead.

Reliable Contracting & Equipment Co. of Chicago was already well along in installing sewers, water, site drainage and telecommunications when the decision was made to empty the site drainage into a deep tunnel.

Even as Reliable and its Volvo EC460B excavator dug and installed piping on the site, engineers were busy designing a 12.5-foot-diameter deep tunnel to direct millions of gallons of clean storm water from the site out to Lake Michigan.

*(continues)*

strategis ONE


*The massive 27-acre expansion of McCormick Place posed significant challenges on how to control storm runoff and keep it from the overburdened sewer system.*

"We really needed to have a decision early on," said Gary Schalmo, president of Mc4 West Constructors LLC, the design-build group for McCormick Place West. "It was either tunnel or storm detention. Once the decision was made to make the tunnel we needed to make sure we stuck with it. Once the decision was made there was no turning back."

A big design change like this could have the potential to cause long delays or budget overruns, but neither happened in this case. Chicago Mayor Richard M. Daley lent strong support, part of his water agenda to reduce pressure on city treatment plants by keeping clean water out of the sewer system.

"It was a huge political accomplishment to get through the Illinois EPA, the Illinois Department of Natural Resources, the (Army) Corps of Engineers, the Greater Chicago Metropolitan Water Reclamation District and the Lake Michigan Federation all to agree to allow this tunnel," said Keith Klodzen, an engineer with Mc4 West LLC. "So that happened remarkably fast."

### *Chicago's history of flood woes*

The kind of big thinking that inspired the deep-tunnel system for McCormick Place West has plenty of precedent in Chicago. Built on essentially swampland and now developed with buildings, parks and parking lots, Chicago has often had troubles with flooding. In 1997, heavy rains backed up the combined sewers, flooding thousands of basements and causing more than $30 million in damage.

This is the city that reversed the flow of the Chicago River in 1900 from east to west. That project was designed to keep effluent out of Lake Michigan and prevent a repeat of the poisoning of the city's water intake — which caused waves of cholera and typhoid deaths in the 1880s and 1890s. It was the first river to flow away from its mouth.

Chicago is also in the midst of the 40-year Tunnel and Reservoir Plan ("Deep Tunnel") to store billions of gallons of storm runoff and prevent flooding and sewer overflow into Lake Michigan and area rivers.

Chicago is one of 750 communities in the United States with combined sanitary/storm sewer systems. In Cook County, Ill., alone, there are 51 communities with combined sewers. When heavy rainfall occurs, storm water can flood the system, causing overflows into the city's canal system or even into Lake Michigan. This type of overflow—which spills into U.S. waterways at an estimated volume of 850 billion gallons a year — can contain a wide range of pathogens and threaten the health of those who use the waterways.

Unveiled in 2003, the city of Chicago's water agenda has taken a multi-prong approach to preventing overflow from reaching area waterways like the long-polluted Chicago River. One strategy is to spend more than $50 million a year upgrading and cleaning the 4,400 miles of city sewer lines. The second is the Deep Tunnel, began in the 1970s to carve 109 miles of underground storage to capture billions of gallons of combined sewer overflow during heavy rains. That system will be complete by 2017.

Recently, residents have been encouraged to disconnect downspouts from the sewer system, and more than 200,000 restrictor valves were installed in street catch basins to control storm flow into the system. The city is also encouraging construction of rooftop gardens to capture rain runoff.

"By expanding our use of green infrastructure, Chicago can demonstrate the common-sense approach of managing storm water before it reaches the sewer system," Daley said when unveiling his water agenda.

The plan is to have McCormick Place West achieve LEED® certification from the U.S. Green Building Council. The Leadership in Energy & Environmental Design (LEED) rating system recognizes sustainable site planning, safeguarding water, water efficiency, energy efficiency and renewable energy, conservation of materials and indoor environmental quality. In 2004, Mayor Daley announced all new public buildings in Chicago would be LEED certified.

### *Keeping Chicago competitive*

McCormick Place West is badly needed for Chicago to stay competitive with Las Vegas, Orlando and other cities in attracting and keeping major trade shows. The city has set goals to not only expand its convention space, but also to control costs and combat a reputation as a high-cost venue.

McCormick Place's main exhibit halls consistently run above practical maximum capacity. The expansion will make more convention dates available, create a balance of meeting and exhibit space, attract smaller meetings when the main facilities are booked, and add to the multi-billion-dollar impact conventions have on the city each year.

"The convention and tourism industry contributes more than $8 billion a year to the local economy and generates more than 128,000 jobs throughout the metropolitan area," Daley said. "If it doesn't remain strong, the economy of the Chicago area and the entire state of Illinois will suffer. We will lose jobs. And we will lose revenue. We can't afford to lose either."

McCormick Place West will add 470,000 square feet of exhibition space, 250,000 square feet of meeting space, with 60 meeting rooms and an impressive 100,000-square-foot ballroom.

### *Storm runoff presents challenges*

The expansive roof and the truck docks will collect millions of gallons of runoff during heavy storms. This posed a big design challenge for facility planners. When the original RFP was published, the plan was for an underground detention system to hold runoff until it could be released into the sanitary sewers.

Utilities construction on the McCormick site was already underway in 2004 when the mayor's administration said it wanted the storm system to empty into Lake Michigan instead of going to sewer treatment plants.

"Being in relatively close proximity to Lake Michigan, there was strong incentive on their part to try and get all of the runoff from this 26-acre roof to Lake Michigan, because that roof has essentially clean runoff," Klodzen said. "That's where the storm-water tunnel came in."

The water-diversion system for the facility is designed to handle runoff from a 100-year flood. But it's not as simple as piping rainwater into Lake Michigan. Runoff from the 3.5-acre truck delivery dock and parking areas must be diverted to the sanitary sewer.

The city's plan called for a tunnel for the clean roof runoff, but the water from the truck docks and parking areas must be subject to a " first flush" where the initial run-off is sent to a water treatment plant.

"After that first flush, all the contaminants have theoretically been washed away and the overflow is then clean and can go to the lake," Klodzen said.

*(continues)*

### *Tunnel to run through bedrock*

Open excavation or even a shallow tunnel would run into old urban fill, building pilings, old terra cotta piping and more.

"Obviously if you're going to dig a tunnel, you want the shortest route possible," Klodzen said. "Well, to go under buildings, the most logical thing then was to go down into the rock. That way we did not have to worry about any interference with the foundations for existing buildings."

The tunnel will run 3,385 feet from the outfall at McCormick Place West to Northerly Island (site of Chicago's former Meigs Field airport). It will run about 150 feet below ground level. STS Consultants of Chicago designed the tunnel for Mc4 West Constructors and will build it utilizing a 12 foot 6 inch Robbins M81218-304 tunnel-boring machine.

"The boring machine makes a huge difference in the capacity of the tunnel, because it creates a much smoother surface," Klodzen said.

To build the deep tunnel, a 22-foot-diameter shaft will be dug on the east end of the tunnel route. Digging will proceed west to another shaft on the McCormick Place West site. The rock and earthen spoil will be used for landscaping on Northerly Island, which

*Utilities excavation kept things moving.*

the city is transforming from its former use as a single-strip airport for private aircraft into a 75-acre park.

The tunnel pipe itself will be unlined. The inlet shaft will be lined with reinforced concrete, while the outlet shaft will be lined with cast-in-place concrete. It will work as an inverted siphon to force storm-water from the convention center to the lake at a maximum flow rate of 500 cubic feet per second.

"It's permanently full of water at the elevation of the lake," Klodzen said. "The head difference between our water coming in and the lake level forces it through to the lake."

Designers had to ensure the outfall at Northerly Island would not cause significant lake currents that could disrupt boat traffic at the narrow opening of Burnham Harbor, Klodzen said.

### *Tunnel required utilities changes*

Engineers decided to add three new pump stations after the tunnel concept was approved. With the first-flush contaminated runoff going to the sewer for treatment, positive pressure was needed to keep the sewers from backing up.

Bob Borello, utilities superin-tendent for Mc4West Constructors, said the tunnel did not require a redesign of the new sewer system being built along Prairie Avenue, the major utility corridor in the area. But some elements that connect into it, such as bottom-elevation inverts, had to be changed.

Borello credits the subcontractor, Reliable Contracting, with keeping

*(continues)*


*Reliable Contracting & Equipment Co. installed site utilities, including storm drainage running to the deep tunnel.*




*The storm drainage system that will link to the deep tunnel includes pump stations that will prevent backflow problems.*

**"It was a major accomplishment. It's a very positive thing, because it takes a huge load off the existing sewer system."**

construction moving smoothly despite the design changes. Reliable kept ahead of the foundation contractor while relocating existing utilities, building a new utility corridor along Prairie Avenue and installing new piping for sanitary, water and drainage.

Reliable also had to dig carefully around existing telecom lines, some of which were housed in fragile, old terra cotta conduit. Excavators also encountered some old urban debris such as brick sewers, railroad ties and more.

"On Cottage Grove, remnants of an old trolley line were still down there," Borello said. "The tracks, the ties, the whole thing. Electric cabling — everything was still in there."

Klodzen said a parking garage adjacent to McCormick Place West also had to be tied into the storm-runoff system. Designers had to replace the planned rooftop detention system in the parking garage and direct flow of runoff into the site's drainage system.

"If we would have allowed all this water that could have overflowed from the garage into our sanitary sewer, the sanitary sewer capacity would have been eaten up by the rainfall," Klodzen said. "We had to make sure we collected it all."

The tunnel has capacity to hold a 100-year-storm runoff from up to 61 acres, Klodzen said. That means it could hold runoff from more of the McCormick Place site, although no decision on that has been made.

"It's a big deal. It was a major accomplishment. It's a very positive thing, because it takes a huge load off the existing sewer system," Klodzen said.

*McCormick Place West's massive roof will generate a big supply of storm runoff.*