

In the flow

New Technology For A New Era

Water Works Park, the site of the Detroit System's oldest water treatment plant, is now home to its newest.



Mayor Kwame M. Kilpatrick and Mary E. Blackmon, President of the Board of Water Commissioners, at the WWP II ribbon cutting ceremony.

On October 23, Detroit Mayor Kwame M. Kilpatrick cut the ceremonial ribbon at Water Works Park unveiling the beautifully renovated historic property and its new, \$240 million treatment plant, Water Works Park II (WWP II). The fully-automated plant is the largest facility in the U.S. to use ozone as a primary disinfectant.

The Detroit Water and Sewerage Department's (DWSD) new plant began operating in August making Detroit one of the few cities in the United States to have six water treatment plants. The plant's ozone-treated water was blended with the more conventional, chlorinated water produced by the original plant until WWP II took over all treatment responsibilities in December. The new plant is capable of treating 240 million gallons a day (MGD), with room for expansion to 320 MGD.

Used widely in western Europe, ozonation has only recently taken hold in the U.S., with approximately 10 U.S. cities receiving ozonated water, according to the American Water Works Association. Ozone is a more powerful oxidant than

chlorine, and one of its greatest benefits is its ability to kill organisms that have been extremely resistant to chlorine disinfection - such as Giardia, E. Coli and Cryptosporidium, which can cause serious illness and death. It kills instantaneously on contact by rupturing the cell wall of the micro-organism. The only by-product of ozone is oxygen, and it doesn't impart any taste, odor or color to the water. It only improves the taste, smell and appearance.

Since, ozone is an unstable, short-lived form of oxygen, it can't be stored and is manufactured on site at WWP II. Three generators produce up to 1,500 pounds per day from pure oxygen. Once water has been treated with ozone it is fed through filter beds filled with four-feet of crushed anthracite coal. This removes any particles that may be suspended in the water; it's called polishing the water. Any unused ozone is dispersed into the atmosphere as oxygen, a benefit to the environment. Ozone reduces the amount of chlorine needed, though it does not eliminate the need for chlorination.

"Water Work Park II is a perfect example of DWSD's commitment to preserving the city's rich past, while moving forward to provide unequalled services to southeast Michigan residents," said DWSD Director Victor M. Mercado. "This plant represents the state-of-the-art in water treatment. We've taken the best of what's being done across the country and applied it here."

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In This Issue

Detroit's Newest Water Plant	1
Blackout 2003	2
Timeline of Events	4

DWSD's Backup Generators	5
Moment in History	6

Blackout 2003: Assessment Moves Forward

At 4:11 p.m. on Thursday, August 14, 2003, the largest power outage in North American history occurred. Southeast Michigan, much of the Midwest, the northeast United States, and portions of Canada shut down.

The event was unprecedented and overwhelming. Water and wastewater treatment facilities were at a standstill. Communication was lost. However, thanks to deliberate and comprehensive emergency planning initiated years ago, the Detroit Water and Sewerage Department (DWSD) was able to react swiftly. Within one hour of the power outage, DWSD's emergency back-up generators were powering the first of two water treatment plants, Springwells and Southwest, to be brought back on line with emergency generation. The Wastewater Treatment Plant (WWTP) was operating normally by noon Friday, and all five of the Department's water treatment plants were operating by Friday evening. Now, DWSD is working with employees, local communities and others to learn from the experience and take action to improve readiness.

The Emergency

At 4:00 p.m. on August 14th, the DWSD water system was pumping at a rate of over one billion gallons to supply water to customers in over 1,000 square miles in southeast Michigan. By 4:11 p.m. power was lost to all water and wastewater facilities - five water treatment plants stopped pumping, pumping stations stopped distributing water and wastewater, and the largest single-site wastewater treatment plant in the United States ceased operations. A widespread communication failure followed. The magnitude of the blackout was unknown.

Within 20 minutes of the disaster, DWSD's Emergency Response Plan was activated.

Generators Play Key Role

In many ways, DWSD customers were fortunate. Steps to prepare for Y2K significantly increased DWSD's preparedness for other crisis events. Especially notable was the 1999

installation of generators capable of providing power to pump approximately 400 million gallons a day (MGD). Within an hour of the outage the Springwells Water Treatment Plant's backup generators were in operation and the plant was pumping at partial production.

Communication Proved Challenging

When the power went down, the outage was total. Contact via hard-wired and cell phones, faxes, and digital senders was lost for a time. This became critical, as DWSD was unable to contact customer communities to assess their systems conditions, and coordinate restoration efforts for 126 communities served by DWSD. Reacting swiftly, DWSD's emergency response planning came into play, providing a media relations plan that immediately went to work with local broadcast media, radio and TV to get out crucial information, particularly the system-wide Boil Water Advisory issued at 7:15 p.m., August 14th.

Boil Water Advisory

Despite DWSD's quick response, the extended interruption in service in various parts of the service area meant that state regulations required water quality conditions be tested for impurities. The Michigan Department of Environmental Quality requires that two tests be conducted 24 hours apart after full system-wide service has been restored in such conditions.

Service Resored

In portions of the service area, many of DWSD's customers never saw significant pressure changes or loss of service. Customers living in various communities - Woodhaven, Dearborn, Detroit, Southfield, Farmington, Warren and Bloomfield Township - reported that they continued having water service even though they were without electrical power. Thanks to sound planning, exemplary dedication from DWSD's 3,000 employees, and the unprecedented cooperation from throughout the region, the rest of the DWSD's service area was quickly brought back online. By Thursday night, just six hours

(continued on page 3)

"The Mission of the Detroit Water and Sewerage Department is to exceed our customers' expectations through the innovative treatment and transmission of water and wastewater, and the provision of services that promote healthy communities and economic growth."

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after the blackout occurred, DWSD was pumping water at a rate of 424 MGD. By 3:00 p.m. on Friday, the Wastewater Treatment Plant was fully restored to normal operations. By noon Saturday, the water system was pumping at normal levels, once again distributing millions of gallons of water throughout the region. The Boil Water Advisory was lifted on Monday, August 18th at a 3:00 p.m. press conference broadcast live from Water Works Park.

Assessment: Looking Forward

With good planning comes experience. Following the blackout, the DWSD team set to work examining the event, how the system functioned, where things went wrong, how the communications chain worked - or didn't work, and so on. The evaluation and plans for improvement continue.

In October, DWSD met with wholesale customer representatives and participated in an assessment and review of the August events. Attendees had the opportunity to share their blackout experiences. Some communities weathered the crisis by tapping wells and other backup systems. Others, were frustrated by their total reliance on DWSD. While few shared the same experiences, most seemed grateful for the dry August weather. Rain-generated storm flow could have inundated Detroit's and other idled wastewater treatment plants within the region, costing millions in cleanup.

Participants contributed suggestions to avoid a repetition of problems experienced in August, in the event another catastrophic power loss should occur. Among the recommendations submitted by customers were:

- Development of a regional emergency communication plan,
- Faster system switching to backup generator power,
- Added water storage capacity, and
- Development of a regional plan to ensure adequate fire protection.

DWSD is currently analyzing these recommendations and will continue to participate in future assessment meetings.



Richard Hughes

Artist's rendering of Downtown Detroit during the blackout

Timeline of Events

THURSDAY- August 14

- 4:00 p.m.** DWSD system pumping at rate of 1,028 million gallons a day (MGD).
- 4:11 p.m.** Power is lost to all DWSD facilities causing shutdown. Widespread telephone, fax and internet communication system failures.
- 4:30 p.m.** DWSD activates its emergency response plan. All water and wastewater treatment facilities placed under the highest security.
- 5:00 p.m.** Emergency generators activated at the Springwells Water Treatment Plant (WTP).
- 5:30 p.m.** Wastewater Treatment Plant (WWTP) Emergency Operations Center activated.
- 6:00 p.m.** Southwest WTP returns to partial operational capacity with startup of generators.
- 7:00 p.m.** Lake Huron WTP begins partial production thanks to restored electrical power feed from DTE Energy.
- 7:15 p.m.** DWSD issues a system-wide Boil Water Advisory. Live on-air news coverage with Channels 2, 4, 7 and WJR and WWJ radio.
- 8:00 p.m.** DWSD begins water sampling at various city and suburban system locations.
- 10:00 p.m.** Water system pumping at 424 MGD and slowly increasing water pressure so as not to damage either DWSD or local infrastructure.

FRIDAY- August 15

- Midnight:** DWSD maintains pumpage at levels above 400 MGD with increases added throughout the night.
- 8:00 a.m.** Power feed to WWTP returns to normal. Because it is dry weather, DWSD avoids the need to discharge combined sewer overflow into Detroit and Rouge Rivers using its in-system storage capabilities.
- 12:00 p.m.** WWTP returns to normal primary and secondary treatment operations
- 3:45 p.m.** The Northeast WTP starts high lift pumping with

restored energy from DTE Energy.

- 6:30 p.m.** DTE energy feed to Water Works Park restored and high lift pumping started.
- 8:00 p.m.** All five WTP's online. The system is pumping at a rate of 687 MGD. DWSD is producing treated water at yearly average day demand levels

SATURDAY- August 16

- 8:30 a.m.** Power is restored to all 22 DWSD booster pumping stations.
- 12:00 pm.** Water system pumping at normal levels and pressures stabilized.

First round of acceptable bacterial Michigan Department of Environmental Quality testing at multiple sites conducted.

Continuation of coordinated print and broadcast media coverage.

DWSD pumps a total of 765 million gallons for the day.

SUNDAY- August 17

- Second round of bacterial testing performed in Detroit and within first-tier customer communities.
- Continuation of coordinated print and broadcast media coverage.
- DWSD pumps a total of 714 million gallons for the day.

MONDAY- August 18

- 8:00 a.m. - 12:00 pm.** DWSD confirms lab results and coordinates with MDEQ to lift Boil Water Advisory.
- 3:00 p.m.** Boil Water Advisory is lifted.

Boil Advisory vs. Alert

A Boil Water Advisory is strictly a precautionary measure. The advisory is used when conditions suggest that the drinking water may be contaminated and may need to be boiled.

A Boil Water Alert is definite. Through water quality monitoring something unacceptable has definitely been detected in the water. Boiling is necessary to protect the consumer from infection.

DWSD'S Backup Generators

The Detroit Water and Sewerage Department's (DWSD) decision to install backup power generators for potential Y2K events proved fortuitous during the massive power grid failure in August 2003. At an assessment meeting in Novi, wholesale customers said DWSD's decision to install backup power generators was a big plus. However, while crucial to the rapid restoration of water and wastewater service throughout southeast Michigan, a number of unanticipated challenges arose.

When Y2K was on the horizon, experts envisioned a wide range of potential scenarios. As part of the City of Detroit's homeland security plan, DWSD in 1999 spent \$52 million to purchase and locate 45, 2-megawatt generators throughout the system. During the blackout, the generators did what they were designed to do in the manner in which they were designed to do it. Unfortunately, they were not designed to handle a total power failure. Yet, that is exactly what happened in August. The DWSD system was pumping at a rate of 1028 million gallons a day (MGD). The Generators were designed to provide power to keep the water pumping at 400 MGD and water and wastewater pump stations moving both water and sewage throughout the system. If power loss had been limited to one, two, or even three treatment plants, water and wastewater services would have continued uninterrupted, if not quite at full capacity.

As a matter of protecting public health, the Michigan Department of Environmental Quality requires all water systems to have backup redundancy. Each DWSD facility is designed to have multiple power feeds, one from at least two different substations. When the entire power grid failed, it took all of DWSD's facilities down with it. The backup generator system had to be cold started, adding to the time needed to bring DWSD's facilities back on line.

Another unanticipated component of the power failure was the amount of water needed by system users. A Y2K water emergency would have taken place in mid-winter, something quite different from the water-intensive use during the hottest part of a mid-summer afternoon.

What's Being Done

DWSD is reviewing recommendations to upgrade the existing system of back-up generators. The upgrades recommended would provide additional generators to supply more back up power for the water treatment plants, wastewater treatment plant and pumping stations. Upgrades would also include making switching to generator power more efficient to bring the Department's plants and pumping stations back on line in less than five minutes of a complete power loss. This would be soon enough to avoid the need for boil water advisories for most, if not all parts, of the water distribution system.

Will there be a repetition of the collapse of the power grid as happened on August 14th? It is possible, but unlikely. Many feel it will not happen again during our collective lifetimes.

Should we gamble that it won't happen again? Absolutely not. When confronting serious health and safety issues, the Boy Scouts motto, "Be Prepared," is the best policy.

How Much Power

When people think of generators, they think of something big enough to keep the lights and refrigerator running in their homes; something available from the corner hardware store. Not so with the generators used by DWSD. One generator can power everything in several homes.

An upgrade of DWSD's generators could allow full pressure to be restored throughout the system within 10-20 minutes, but to do so would place unnecessary stress on the mains. A measured restoration of pressure prevents such needless damage. The Department would be able to treat 650 MGD of drinking water and process 200 MGD of wastewater.

The reality is really quite easy to understand. Enhanced back-up capabilities cost money. The greater the capability, the greater the cost. How much is needed?




A Moment In History

The brass clock in the customer service center in the Water Board Building reflects a historic moment frozen in time: 4:11 p.m. on Thursday, August 14, 2003. That was the moment when electrical power was lost in a domino effect from the East Coast of the United States, west into portions of Canada, southeast Michigan, and parts of the Midwest U.S. Roughly 50 million people were affected by the unprecedented event.



photo by Paul Gomez



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