

Water Story

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CROSS COUNTRY

Multiple construction methods are deployed in building a major pipeline to deliver Lake Michigan water to suburbs of Green Bay, Wis.

By Doug Day

Six suburbs of Green Bay, Wis., are looking forward to another Midwest winter, because that's when they expect to have a new, cleaner, and more reliable source of drinking water.



By the end of 2006, a \$106 million pipeline will transport water from Lake Michigan and the lakeshore city of Manitowoc along state and county highways, under picturesque rivers, through solid rock deposits, and up and down the scenic hills of the northeastern Wisconsin countryside to Brown County.

When completed, the pipeline and associated distribution system will

deliver 8 mgd from Manitowoc's microfiltration water plant southeast of Green Bay. It will take about 65 miles of pipeline to cover the 30 miles and deliver the water to six communities, say members of the Central Brown County Water Authority. The communities lie along the north, south, and western borders of Green Bay.

By 2030, it's expected that about 12 million gallons a day will be pumped to customers in the fast-growing suburbs — one city, three villages and two towns. The authority may also build a 10-million-gallon storage reservoir sometime in the future to supplement individual communities' storage capacity.

Seeking supplies

The suburban communities started looking for a new supply of drinking water in 1999. CBCWA Executive Director Dave Vaclavik explains that all the communities currently use wells. "Capacity is becoming an issue," he says. "The water table is dropping, so the quantity of water just isn't available."

The water also doesn't meet current federal drinking water standards. "A number of the wells exceed the radium limits and are under consent degrees to take care of the radium by December," Vaclavik observes.

The authority evaluated buying water from the cities of Green Bay and Manitowoc or building its own pipeline. Eventually, the authority selected Manitowoc's offer as the most economical choice. Construction on the pipeline began in July 2005 and is scheduled for completion by December 2006.

The need for a new drinking water supply came as no surprise. Growth in the suburbs in the 1960s and '70s led to discussion of long-term plans, and the first study was conducted in 1976. Even then, it was clear that the area's aquifer could not support future needs. Another study in 1992 confirmed the first study and recommended using Lake Michigan as the water source. The CBCWA was formed after the state legislature passed a law allowing the formation of joint water authorities in 1998.

In 1999, Manitowoc Public Utilities built a new modular water treatment plant using hollow-fiber microfiltration technology from USFilter Memcor Products. Manitowoc Mayor Kevin Crawford says the city's municipal utility decided on



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the new plant after a cryptosporidium outbreak that killed more than 100 people and sickened 400,000 in Milwaukee in 1993.

“We built additional capacity hoping that a neighboring community would be interested in purchasing water or partnering with us,” Crawford says. While that deal didn’t work out, the city did get a call from CBCWA. “That phone call came in on a Friday and the following Tuesday or Wednesday I was making a presentation to the members of the water authority.”

Making it work

Although Manitowoc was just coming off what had been the largest public works project in the history of the county — an \$80 million, 63-megawatt circulating fluidized bed boiler for its municipal electric utility — Crawford was confident that a deal could be worked out with the water authority.

Manitowoc ended up building two water plants: a 14 mgd pressurized microfiltration plant for its needs, and a 20 mgd vacuum microfiltration plant for use by the CBCWA. When the original unit was completed, Manitowoc had the second largest microfiltration plant in North America, according to Crawford. “When we’re done with the work to provide water to central Brown County, we believe we’ll be the largest microfiltration plant in the Western Hemisphere,” he says. Finished water from the MPU plant will be pumped into the line at 200 psi through a series of four pumps with a firm capacity of 21 mgd:

- Two 8.5 mgd pumps (900 hp with reduced voltage starters)
- One 8.5 mgd pump (900 hp with variable frequency drive)
- One 4.0 mgd pump (450 hp with variable frequency drive)



Meanwhile, the pipeline project was broken into 11 contracts: nine for the actual pipeline and two for related equipment and structures. The finished line will include one booster pumping station, 10 metering and pressure-adjusting stations, a master metering facility, and a pressure-reducing valve vault, along with the many miles of PCCP, ductile iron, and PVC pipe from Northwest Pipe, Price Brothers, and American

Spiral Weld:

- 48-inch pipe – 166,400 lineal feet
- 36-inch pipe – 43,300 lineal feet
- 30-inch pipe – 10,150 lineal feet
- 24-inch pipe – 66,800 lineal feet
- 20-inch pipe – 15,200 lineal feet
- 16-inch pipe – 27,850 lineal feet
- 12-inch pipe – 18,350 lineal feet

Approximate numbers, based on December 2005 preliminary design report from Consoer Townsend Envirodyne Engineering Inc. of Chicago.

River crossings

The CBCWA located nearly all the pipeline in public right-of-way and along state and county utility corridors. Ed Tharp, associate vice president for project design and construction supervisor for Consoer Townsend Envirodyne Engineering Inc. of Chicago (CTE), says 20 private easements were needed, and the authority purchased four small properties of a half acre or less for booster pump and valve stations.

A particularly challenging section has been crossing the small but historic Devil’s River. While only a couple of inches deep, the river bottom provides a rare view of the Niagara Escarpment limestone bedrock, exposed millions of years ago by the movement of two adjoining glaciers. Just upstream is Rock Mill, one of the oldest existing structures in Manitowoc County and listed on the National Registry of Historic Places. There are also historically significant bridge abutments in the area of the pipeline.

Vaclavik said the original idea to tunnel beneath the river was dropped when bids came in at about a million dollars, four times higher than expected. The CBCWA then planned to dig an open trench across the river and cap the trench with colored concrete. That move was opposed by the owners of the property, now a campground and museum, and some supporters. When the Public Service Commission agreed with the concerns of the opponents, the plan was revisited.

Rather than traditional tunneling, the construction contractor suggested using rock boring, which needs less room, uses smaller installation pits and costs less — about \$350,000. “We were able to stay within the road right-of-way and avoid the old bridge abutments,” says Vaclavik. While it caused some delay and some additional cost, he says the new plan preserves the nature of the area: “Everything about this worked out better for us.”

Multiple methods

The rock boring is just one of the excavation methods being used along the route. Along with open trenching, “There’s a fair amount of rock trenching, and we’ve done some traditional jack and bore for a number of the highway crossings,” Vaclavik says. Pretty much, if it exists, we’ve done it on this job.”

Tharp says more than 200 permits and information filings were required. “For one of the nine pipeline contracts, I sent out 28 packages for permits and reviews,” he reports. The permits included:



- State Department of Natural Resources construction and waterway and wetland permits
- Public Service Commission of Wisconsin approvals
- Permits from local municipalities along the route
- Railroad crossing permits
- State Department of Transportation highway crossing and right-of-way permits
- County highway department highway

crossing and right-of-way permits

- U.S. Army Corps of Engineer river crossing approvals

Vaclavik says the project required about 100 permits just for crossing wetlands. “The process was very complex and took longer than we anticipated,” he says. The Wisconsin DNR administrative code requires the pipeline to operate at 35 psi at ground level. The system was designed for 40 psi at the lowest pressure point, which is near the point where it connects with the CBCWA’s local transmission system. That connection point is at 890 feet, the highest point along the route.

Isolated shutdown valves are located every mile, the maximum spacing allowed by DNR rules. The pipeline also has air release valves, air and vacuum valves, and blow-off valves for draining the line, if needed.

Due to elevation changes between Manitowoc and Green Bay, system pressure will vary significantly, sometimes exceeding 200 psi. As demand grows, an additional pumping station will likely be needed, probably around 2020.

Room to grow

Monitoring and control is done through programmable logic controllers and remote telemetry units connected by fiber optics to a CBCWA’s SCADA system to be installed at Manitowoc’s water treatment plant and operated by Manitowoc Public Utilities. All CBCWA members can access the system through a dedicated Internet site.

The water authority owns the water line and some of the capacity at Manitowoc’s treatment plant. Other municipalities that want to use the line in the future will contract with CBCWA. All three villages along the route — Francis Creek, Denmark and Hobart — have paid for installation of tee connections for potential future use.

Mayor Crawford says it is possible for other communities to take advantage of Manitowoc’s investment. The pipeline has been sized to meet the projected maximum daily demand plus 50 percent. The 20 mgd vacuum micro-filtration plant can be expanded simply by adding modular units. Included in the agreement, however, is a limit on providing water to unincorporated areas within Manitowoc County. Crawford says that was done to prevent urban sprawl in the farmland around Manitowoc.

MPU will sell water to the CBCWA at 51 cents per 1,000 gallons in the first year and 81 cents the next year. The Public Service Commission of Wisconsin would review any rate increases after that. CBCWA will charge its members \$2.18 per 1,000 gallons at the outset.

“This is a model for regional cooperation,” says Crawford. The water deal opens economic development opportunities for both counties, especially along Interstate 43, which runs between Manitowoc and Green Bay near the pipeline route. “We’re looking forward to lots of new development along that corridor that will come sooner rather than later because we have this source of clean drinking water,” Crawford says.

After two years on the job, Vaclavik has some advice for others planning similar projects. “Start the permit process early,” he says. “Permitting is very complex on a job of this size.” It is also important to be aware of other underground utilities. “We’ve run into a number of unexpected conflicts with other underground entities,” Vaclavik says. “Some of them have been constructed after we did our locating requests, and some of them just never got located during the process.”

Crawford observes that an important part of the process was building relationships. “We had people who spoke the common language of water at the

table at all times,” he says.

He would have liked a better relationship with the communities that competed with Manitowoc for the water deal. A complete regional network, he says, “Would have been a huge development benefit for all of Northeastern Wisconsin.” He hasn’t closed the books on the idea and still has hopes that such an entity will develop over time. For now, the focus is on getting pipe into the ground and water flowing from Lake Michigan.

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