



WATERLINE

NEWS AND INFORMATION

FOR PUBLIC WATER SUPPLIERS IN MINNESOTA

Hastings Nitrate Plant Blends into Community



The city of Hastings recently opened its first water treatment plant. The plant, which treats water from two wells that have nitrate, is located in a populated area along a major highway. As a result, aesthetics were a concern in the exterior design. The plant has succeeded in both functions, reducing nitrate and providing a pleasing appearance. See page 4 for the full story.



Governor Mark Dayton proclaimed May 1-7 as Safe Drinking Water Week in Minnesota and posed with Minnesota Department of Health (MDH) Commissioner Ed Ehlinger, Bert Tracy and Carol Blommel Johnson of the Minnesota Section of American Water Works Association, and Ruth Hubbard of Minnesota Rural Water Association. During the week, MDH held a press conference to announce its drinking water annual report at the new water treatment plant in Saint Peter (see story on the plant on page 2). The annual report is on the MDH web site at <http://www.health.state.mn.us/divs/eh/water/com/dwar/report10.html>.

Saint Peter Adds Reverse Osmosis as Part of Expansion and Upgrade

The south-central Minnesota city of Saint Peter came close to being the capital of the state in the 1850s. Before Minnesota achieved statehood, the territorial legislature passed a bill to transfer the capital from St. Paul to Saint Peter. However, a member of the body, a fur trader named Joe Rolette, disappeared with the bill and remained hidden until just before the legislature adjourned, too late for the governor to sign the law.

The capital stayed in St. Paul as Minnesota became a state, but a few years later Saint Peter became home to the state hospital for the insane. Many Minnesotans think Saint Peter got the better end of the deal. For many years, the institution, the Saint Peter Regional Treatment Unit, had its own water supply, but in 2003 the wells serving the treatment center experienced trouble and the treatment center connected to the city's public water supply. In addition, the city has experienced a steady population growth along with the addition of commercial customers as well as three long-term care facilities.

A 2006 water master plan indicated a need to expand the water system's capacity. Saint Peter has been using seven wells, ranging in depth from 130 to 750 feet, that draw water from the Jordan, Franconia-Ironton-Galesville (FIG), and Mt. Simon-Hinckley aquifers. The wells fed two iron-and-manganese treatment plants, the Jefferson plant, built in 1949, and the Saint Julien plant, which was constructed in 1988.

The planned upgrade included the sealing of two multi-aquifer wells and the drilling of four new wells, two into the Mt. Simon-Hinckley aquifer, one into the Jordan, and one into the FIG aquifer. It became clear that, upon evaluation of the water quality from these formations, the utility would need to upgrade its treatment process, as well.



The new Broadway Avenue plant.

Pete Moulton, the water utilities superintendent for Saint Peter Public Works, said that the levels of nitrate found in the well drilled into the Jordan aquifer were double the levels from the two existing Jordan wells. Blending with water from other wells might not be enough to keep the nitrate in the finished water from exceeding the federal limit of 10 parts per million.

An engineering study performed with Bolton & Menk, Inc. of Mankato, Minnesota, also indicated that expanding the existing filtration plants would not be sufficient. Instead, the city

decided to construct a new facility on Broadway Avenue with gravity and membrane (reverse-osmosis) filtration and to modify the Saint Julien plant with the addition of reverse-osmosis treatment. In addition, plans were made to demolish the Jefferson plant. "We found that adding on to the western edge [of the city with the Broadway Avenue plant] gave us the most flexibility," said Moulton.

Kris Swanson, a principal engineer with Bolton & Menk, said that the new wells varied in quality and quantity depending on the aquifer. The two into the Mt. Simon yielded a large amount of water but also iron and manganese, radium (gross alpha), chloride, and sulfate levels. The FIG aquifer, which had a smaller yield, also contained dissolved solids, iron, and manganese. The well in the Jordan aquifer, also with limited yield, was low in iron and manganese but contained the higher level of nitrate.

"We were trying to balance all those parameters," said Swanson in explaining why the city decided to go with reverse osmosis. "Otherwise, we're trying to balance the blending of wells with a number of different constituents and flow that aren't easy to match."

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The soon-to-be demolished Jefferson Avenue plant is on the left. On the right is the new building, housing the reverse-osmosis filters, at the Saint Julien plant.

As was the case with the Jefferson and Saint Julien plants, water from the wells goes into separate plants and is blended in the distribution system. Approximately 85 percent of the water goes through the reverse-osmosis membranes. “The water quality will be the same regardless of which wells they’re using,” said Swanson, adding that in the past, the utility couldn’t blend the water without affecting the quality if it took a well out of service for repair or basic maintenance.

The gravity-filtration stage at the Broadway Avenue plant has a capacity of 2,100 gallons per minute (gpm) and consists of four concrete filter cells, each with a surface area of 225 square feet and each containing a 15-inch layer of anthracite filter media on top of a 15-inch layer of manganese greensand filter media.

The reverse-osmosis stage consists of spiral-wound thin film composite membranes contained within pressure vessels arranged on three skids. Two of the skids receive 925 gpm of gravity-filtered water from a clearwell and produce a treated permeate water flow of 650 gpm. The third skid receives 550 gallons per minute of concentrate water from the other two skids and produces a permeate water flow of 275 gpm. The total membrane permeate water flow of 1,575 is blended with the remaining 250 gpm of gravity-filtered water that was not pumped to the membrane system, resulting in a total finished water flow rate of 1,825 gallons per minute. Swanson said that the third skid, which recovers some of the rejected water, reduces the overall rejected water stream from 25 to 15 percent.

The reverse-osmosis system at the Saint Julien plant, which is in a building constructed adjacent to the existing plant, operates in a similar fashion. Two of the skids each produce 435 gallons of permeate water per minute, and the third skid produces 190 gallons of water per minute. The total 1,060 gallons of water per minute is blended with 150 gallons per minute of gravity-filtered water.

The Broadway Avenue plant also has a two-cell concrete clearwell totaling 290,000 gallons, a concrete backwash reclaim tank with three separate sections sized to contain 60,000 gallons, a 267,000 gallon wire-wound, pre-stressed concrete standpipe for the lower-system finished water storage, a 1,000 kilowatt diesel generator, and chemical-feed systems for gas chlorine, potassium permanganate, hydrofluorosilic acid, polyphosphate, antiscalant, sodium bisulfate, sulfuric acid, and sodium hydroxide.

The modifications to the Saint Julien plant included the replacement of some of the piping and the installation of chemical-feed systems similar to those at the Broadway Avenue plant in addition to a two-cell clearwell totaling more than 155,000 gallons.

The transmission and connection of water main for the city’s two pressure system consist of 95 lineal feet of 6-inch, 90 lineal feet of 8-inch, and 3,490 lineal feet of 12-inch ductile iron main.

Reverse osmosis was selected to deal with nitrate as well as radium, the two primary concerns, but a side benefit is that it also produces softer water. However, that was not good news to those who sell water conditioning equipment, and one dealer expressed his objections to the city and state, arguing that it was more efficient for residents to install



Above: Pete Moulton and Kris Swanson outside the new Broadway Avenue plant. Below: Inside the plant are three skids of reverse-osmosis vessels.



and maintain their own softening systems than to have soft water produced by the city.

Moulton points out that the enhanced treatment was needed to deal with more than hardness. “We can’t produce water that doesn’t meet safe drinking water standards,” he said, adding, “We’d seen our city grow steadily by maintaining and upgrading our water and wastewater infrastructure. We get calls from industries asking if we are going to continue to be able to support them. Our answer is ‘Yes.’ This helps to entice business.”

Swanson added that issues with chloride made reverse osmosis an attractive option since residents with home softeners add salt, which could become a problem if chloride limits on wastewater discharge are adopted in the future. Swanson said that Saint Peter is being “pro-active, a good steward, and is protecting the Minnesota River.”

The total project cost was \$18.8 million with some of the money coming through below-market loans through the drinking water revolving fund in addition to some grant money through the American Recovery and Reinvestment Act.

Construction on the Broadway Avenue plant began in September of 2009 and was completed in March of 2011. The Jefferson plant kept operating during this period, and the Saint Julien plant was also continued while the building to house the reverse-osmosis equipment was being constructed.

The project has increased the utility’s total capacity from 2 million to 3.3 million gallons per day to serve its 11,000 residents, which include students and staff at Gustavus Adolphus College. “Our design criteria was to meet our water needs to 2030,” said Moulton in explaining why they chose the system they did. “This gave us the most flexibility and one of the best water qualities in the state.”

Hastings Removes Nitrate with New Plant

Tucked beneath bluffs and rolling hills amid the Mississippi, St. Croix, and Vermillion rivers, Hastings is a city with a rich heritage that includes being home to the first documented baseball team in Minnesota. The team was actually in Nininger City, now a part of Hastings, a planned community with the goal of becoming an “ultimate utopia” by Ignatius Donnelly, a lawyer, farmer, statesman, orator, and author who became one of the leading figures in Minnesota’s early years. Regardless of how completely Donnelly’s dream developed, Hastings has emerged into a thriving community of 22,000, with many residents who commute daily to the nearby Twin Cities and others who work in the immediate area.

For much of its history, Hastings served its citizens water straight from city wells, the only treatment being the addition of fluoride. That changed in recent years because of growing concerns about rising levels of nitrate in two municipal wells. “We didn’t feel very comfortable with that,” said Hastings public works superintendent John Zgoda. In 2006 the city began working with Kurt Johnson, an engineer then with TKDA, Inc. in St. Paul (and now with Bonestroo in Roseville) on a feasibility study to treat for nitrate removal.

Hastings draws its water from wells in the Jordan aquifer. Their water is exceptionally low in iron and manganese and doesn’t require treatment. However, nitrate in two wells, numbers 3 and 5, has been increasing and spiking at times toward the maximum contaminant level (MCL) of 10 parts per million (ppm). “We have seen a steady rise in nitrate levels in several of the city wells over a decade or longer,” said Johnson. “It became obvious that it was time for the city to act to ensure they maintained compliance with the nitrate MCL.”



Johnson explained some of the challenges of the region. “The geology available to develop wells within the city is very difficult. The Jordan [aquifer] has an eroded valley running through most of the city, and a major fault limits the use of the aquifer on the west side of the city. The Vermillion River water finds its way into the Shakopee [formation with the Prairie duChien aquifer], which is cracked and fissured and carries

agricultural runoff, which is likely the source of the nitrate as it recharges the Jordan groundwater in the city.”

Johnson said they considered several options, including reverse osmosis, but rejected that. “Finding water is an issue,” Johnson said. “Membranes aren’t the greatest with a lot of spent water discharge.” Instead, they opted for anion-exchange treatment system with a new plant to treat the water from wells 3 and 5.

Tonka Equipment Company of Plymouth, Minnesota, supplied the system, which includes anion-exchange vessels, valves, facepiping, instrumentation, brinemaker, brine delivery components, a control system, and a softening system for brine make-up water to prevent calcium precipitation.

“The plant uses four anion-exchange vessels,” explained Tonka vice president Todd Butz, “each rated to treat up to 400 gpm [gallons per minute]. A portion of the 2,400 gpm total plant flow is treated through the units while the balance is bypassed around the anion exchange vessels and blended with the treated water to produce finished water with nitrate concentration consistently below the MCL.”

“It’s like we’re softening, but we’re not,” said Zgoda. “We’re using salt regeneration to get rid of the nitrate. It’s a different ion for nitrate removal than for softening. We’re

Continued on next page



Left: Mark Peine and John Zgoda of Hastings by Well No. 5. Right: Todd Butz by the four anion-exchange filters.

doing a salt-brine solution to regenerate the vessels for the nitrate removal.”

In addition to the treatment plant, Hastings has drilled two new wells while discontinuing two older ones. Well number 1, a multi-aquifer well that went into the Mount Simon aquifer and had a lot of iron, pumped only 300 gpm. Trichloroethylene was found in well 2, causing the city to cap it at the time well 7 went into service. Well 8, drilled to provide additional capacity to meet peak demand, was designed at the same time as the treatment plant.

Hastings now has six wells. Water from wells 4, 6, 7, and 8 is treated with fluoride and mixed with the water from wells 3 and 5, which is treated at the plant.

Hastings has a two-tiered distribution system, an elevated system, which supplies the growing development in the south and west ends of town, and one served by a 1 million gallon ground-storage reservoir by the treatment plant. The ground-storage system provides water to the downtown area.

Prior to the construction of the treatment plant, water from well 5, even though it is next to the ground-storage reservoir, went into the elevated system while well 3, to the east, came into the ground-storage system. Hastings can also bring water from the elevated to the ground-storage system and, since the installation of booster pumps in the 1990s, has been able to go from ground to elevated.

With the construction of the new plant, the ground-storage system is used as the utility’s clearwell, and wells 3 and 5 have been tied into the plant. Zgoda said the wells normally have raw-water levels of 8.8 ppm of nitrate, with the levels reaching between 9 and 9.2 ppm between February and April. Two of the other wells, 6 and 8, have nitrate levels between 7 and 7.8 ppm, and wells 4 and 7 have levels around 4 ppm.

About 60 percent of the water from wells 3 and 5 goes through the nitrate filters; the rest bypasses the filters and is blended with the filtered water. Some of this water goes into the ground-storage system, and three booster pumps



Above: An overhead look at the filters. Below: the booster pumps.



can bring some to the elevated system. Hastings has a 750,000 gallon tower near the Dakota County Government Center, to the west of the plant, and a 1 million gallon tower by an industrial park to the east, off Minn. Hwy. 316.

A challenge the designers faced was related to the site of the plant, on the south side of Minn. Hwy. 55 in a growing residential area. “It’s very, very visible,” said Johnson. “All of a sudden this knob on the top of the hill, which was pretty wide open, became a lot more populated.” Johnson added that the 1950 vintage pumphouse already on the site “presented a dated architecture, and the blue color made it even more conspicuous. It was time for the city to improve the aesthetics of their facilities to complement the new development along the Highway 55 corridor.” The walls on the well house were knocked down and rebuilt as part of the building that houses the treatment equipment. Zgoda says the structure looks so nice that someone once came in because he thought it was a bank.

Hastings is now on quarterly monitoring because the finished water has been over 5 parts per million of nitrate, but Zgoda says, “We’re knocking it down below 5.” The plant went on-line in late 2008 and, after some adjustments were made, it has gone through a complete season. If the nitrate levels remain under 5, the utility may go to annual monitoring. For informational purposes, the city is working with the Minnesota Department of Health to monitor nitrate levels in the raw water as a means of measuring the effectiveness of the treatment.

The bypass/blend allows for the flexibility to adjust the treated/bypassed proportion for future compliance, should the raw-water nitrate level continue to increase. Hastings does not disinfect its water, but Johnson said that provisions were made to add chlorine in the future if desired.

The entire project, including two 12-inch mains between the plant and well 3, was approximately \$3.5 million. No financing was needed as the city paid for the plant through its water fund.

Reminder to All Water Operators

When submitting water samples for analyses, remember to do the following:

- Take coliform samples on the distribution system, not at the wells or entry points.
- Write the Date Collected, Time Collected, and Collector’s Name on the lab form.
- Write the Sample Point on lab forms for bacteriological and fluoride samples.
- Attach the label to each bottle (do not attach labels to the lab form).
- Include lab forms with submitted samples.
- Do not use a rollerball or gel pen; the ink may run.

If you have questions, call the Minnesota Department of Health contact on the back of all sample instruction forms.

Metro School



The Metro District Waterworks Operators School in April included a visit to the St. Anthony Falls Hydraulic Laboratory and Meter Madness. The 2012 Metro School will be in a new location, the Ramada Plaza on Industrial Boulevard in northeast Minneapolis, and will feature a different format with the school starting with an operator breakfast and product show on the opening day.



Proposed Guidance for Fluoride Levels

The U.S. Department of Health and Human Services (HHS) has proposed new guidance which recommends a single national optimal fluoride level of 0.7 parts per million (ppm) for community public water supplies. This would replace an optimal fluoride range of 0.7 to 1.2 ppm, a range used by the state of Minnesota when it developed its fluoridation laws.

To promote public health through the prevention of tooth decay, Minnesota requires municipal water supplies to maintain an average distribution system fluoride concentration of 1.2 ppm while remaining between 0.9 ppm and 1.5 ppm. That requirement remains in effect. The newly proposed HHS optimal level of 0.7 ppm is subject to a 30-day public comment period.

According to Karla Peterson and David Rindal of the Minnesota Department of Health (MDH), once the HHS recommendations are finalized, MDH will investigate changes in policies and/or laws that will continue to promote and protect the dental health of all Minnesotans and will provide updates if the state rules change.

Waterline

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Protecting Community Water Systems

By Dave Schultz
Minnesota Department of Health Engineer

Protecting community water systems may seem overwhelming and expensive. But is it? This past year several Minnesota water system facilities were broken into. Fortunately, no evidence of tampering with water quality was detected. Is this our wakeup call? Are our water systems adequately protected? Water towers, ground storage facilities, and water plants were the targets of intruders.

Following these break-ins I went on a search for low-cost ways to protect water system facilities. What I found was amazing and very low cost. I was so impressed that I installed a security system in my house for \$79.00. Steve Burkland, water superintendent with the city of Milaca, informed me of this low-cost security system that he highly recommends. Everything is included for a COMPLETE wireless security system. You get a wireless security console, six door/window sensors, two security keychain remotes, two motion detectors, a light module, and a main console remote. Best of all, there are no security company sign-up fees.

How the System Works

When the console is triggered, it flashes your facility lights and blares a piercing 95-decibel siren (about as loud as a home stereo on maximum volume). It also activates the voice-dialer system. It calls you first. If you don't answer, it calls three programmable numbers until somebody picks up. When you answer, it plays a pre-recorded message. Press "0" to listen in at your water facility. That way you can determine if there really is an emergency or if it's just a false alarm. If by some slim chance intruders do get into your water facility, they won't get far without setting off the system. Included is a motion detector. Any motion detected will trigger your alarm system. Aside from the blaring alarm and voice dialer system, your system will flash a light.

I know the system I installed was designed for a house. Could it be adapted to be used at your water system?

The U. S. Environmental Protection Agency (EPA) has developed guidance for water system warning systems.

What is a contamination warning system? A contamination warning system provides drinking water utilities with a systematic and comprehensive approach for monitoring and surveillance of the distribution system. Through implementation of the monitoring and surveillance strategies and a comprehensive consequence management plan, utilities can improve their ability to detect intentional or unintentional distribution system contamination. In addition, their increased ability to monitor and understand distribution system water quality may help to optimize operations and improve the overall quality of the product delivered to customers. Monitoring and surveillance components of the contamination warning system include the following:

- On-line water quality monitoring
- Sampling and analysis
- Enhanced security monitoring
- Consumer complaint and public health surveillance

In addition to these monitoring and surveillance components, consequence management is a critical aspect of the overall architecture for a contamination warning system. Consequence management refers to the procedures and protocols for assessing credibility of a contamination incident and implementing response actions.

The EPA has good advice on water system security. I cannot help to think if the water systems that have had security breaches had a security system such as the one I installed at my house, the intruders would have been scared off immediately or, better yet, caught.

Water system security is a serious concern and protecting your system starts with the water system employees.

Is your water system safe? Do some searching. You will be surprised at the new technology of security systems and low cost of many systems. The time is now to get all water systems protected.

Anna Munson and Larry Cole Join and Rejoin MDH



A pair of engineers will be working with the Minnesota Department of Health (MDH) through November to help with the U. S. Environmental Protection Agency's Infrastructure Needs Survey and the General Water Chemistry Project.

Anna Munson (left) grew up in Watertown, Wisconsin, and worked as a civilian engineer, based in Bremerton, Washington, for the U. S. Navy and as a sales engineer for a small manufacturer's representative company in Eagan, Minnesota. In between those positions, she earned her master's degree in civil engineering at the University of Washington. Before her children were born, Anna and her husband,

Graham, were avid hikers and campers. They still travel and make a couple camping trips a year with their three red-headed children: Eli, 5, Natalie, 3, and Reed, 18 months.

Larry Cole (right, shown receiving the George Warren Fuller Award from Minnesota American Water Works Association in 2005) started working for MDH in 1968 and retired in 2003. He worked out of the Bemidji office and now lives on a small farm near Lake of the Woods and needs to mow about 10 acres of land every week. He does some gardening and also enjoys cross-country skiing and ice fishing. He has been an avid muskie fisherman, and Larry (called "Lars" by his fellow anglers) caught his largest lunker, a 29-pounder, in Cass Lake in 1993. He and his wife, Nancy, are now members of the Borderland Communities Orchestra, based out of Emo, Ontario. Nancy plays the viola and Larry the cello in the orchestra.





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CALENDAR

Minnesota Section, American Water Works Association

*June 8-10, Central Water Operators School, Ruttger's Bay Lake Lodge, Deerwood, Contact Lisa Vollbrecht, 320-255-7225.

*October 6, Southwest Water Operators School, Marshall, Contact Jeff Larson, 507-537-7005.

Information for all district schools, including agendas, is at

<http://www.health.state.mn.us/water/wateroperator/trng/schoolagendas.html>

Minnesota Rural Water Association, Contact Kyle Kedrowski, 800-367-6792

*June 15, Operation & Maintenance, Wahkon

*July 13, Operation & Maintenance, Spring Grove

August 3, Operation & Maintenance, Zumbrota

August 17-18, Operator Equipment Expo, Waconia

September 7, Operation & Maintenance, Warren

*September 14-16, Water Certification Refresher Course, St. Cloud

*September 20, Operation & Maintenance, Park Rapids

October 13, Water and Sewer Rate Setting, St. Cloud

***Includes a water certification exam.**

*October 14, Southeast Water Operators School, Cabela's, Owatonna, Contact Dennis DuChene, 507-384-0559.

*October 19, Central Water Operators School, St. John's University, Collegeville, Contact Lisa Vollbrecht, 320-255-7225.

October 25, Winterizing Your Water System, Bemidji

October 26, Winterizing Your Water System, St. Cloud

November 2, Financing Your Community Projects, St. Cloud

November 15-17, Cross Connection & Backflow Prevention, Location TBA

*November 22, Operation & Maintenance, Clarks Grove

November 30, Operation & Maintenance, Waite Park

*December 7, Operation & Maintenance, Biwabik

*November 29-December 1, Hampton Inn & Suites, Bemidji, Contact Jeanette Boothe, 651-201-4697, or Stew Thornley, 651-201-4655.

***Suburban Utility Superintendents Association School**, October 25, Shoreview, Contact Kevin Chmielewski, 651-490-4611.

MRWA Class D and E Training

Class D

September 14, St. Paul

October 11, Park Rapids

Class E

June 23, Rochester

Note: Class D workshops are eight hours, and Class E workshops are four hours. The morning session of a Class D workshop is the same as a stand-alone four-hour workshop for Class E operators; thus, Class E operators may attend either the stand-alone four-hour workshop or the morning session of the Class D workshop.

For an up-to-date list of events, see the training calendar on the MDH web site:

http://health.state.mn.us/water/wateroperator/trng/wat_op_sched.html