



## New Nitrate Removal Plant in Use at Haviland

**T**he city of Haviland is located in Kiowa County between the city of Pratt about twenty miles to the east and Greensburg about ten miles to the west. U.S. Highway 54/400 is the major highway serving Haviland in the southcentral/southwest part of Kansas. Haviland was founded by a group of Quakers originally from Indiana and was named after Laura Haviland, who was responsible for starting many schools for indigent children and being a leader of the Underground Railroad. While she never lived in Haviland, her accomplishments in life were responsible for this name choice. With a population of about 700, the city is home to Barclay College with an enrollment of about 200 students.

The first well in the city was dug in 1886. It was a hand-dug well located in the center of town. A year later, another hand-dug well, thirty-six inches in diameter was needed when the first well had to be filled in when the railroad came to town. Finally in 1925, after using the dug well and many windmills (the city was known as the “City of Windmills” because of having more windmills relative to its population than any other city in Kansas), a new city water system was installed.

The municipal water system served the city very well for many years. Like many cities in Kansas

This is a photo of the existing 50,000-gallon elevated storage tank; the water treatment building is adjacent to the tank.



Four ion-exchange tanks are used to remove nitrate.

This photo shows the solution pump used to inject sodium hypochlorite into the system after treatment for nitrate removal. A second solution pump is available as back-up.



with well water, the only additional treatment needed was chlorination. For the most part, the city has been very fortunate in that water quality is actually very good with Hardness around 200 milligrams per liter (mg/L). Sulfate, iron and manganese are very low also. The only water quality problem is elevated nitrate. The nitrate level remained below the maximum contaminant level (MCL) of 10 mg/L until about 2005. Nitrate levels from 2005 until the present have ranged from 10 to 16 mg/L. With these nitrate levels, it was obvious the city would

need to make improvements, either locating water with lower nitrate levels or by providing treatment.

Much of the agricultural land in the Haviland area is irrigated and as such, additional water rights for new wells were virtually impossible to obtain. This left treatment as the only option. The city decided, on its own, to install point-of-use (POU) treatment for their customers. However, Mayor Robert Ellis stated that The Kansas Department of Health and Environment (KDHE) was not in agreement with this option and after several meetings

and hearings, the city agreed with the consent order requiring them to install a treatment plant. Mayor Ellis further stated that KDHE's reason for not allowing the POU (RO units) devices was that POU treatment is approved only for very small systems and that Haviland, with a college and rest home, did not fit that definition. The obvious choice left for the city to consider was to install a central treatment plant.

The engineering firm of Evans-Bierly-Hutchinson and Associates (EBH) was retained to review treatment options to bring the city into

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compliance with the nitrate standard. The option proposed and ultimately chosen was an ion-exchange treatment plant. Actually, the improvements became a project that extended beyond water treatment and included other improvements.

### Anion Exchange Treatment Plant from Krudico Advanced Water Treatment Systems

The nitrate removal treatment plant, which was placed into operation in late spring 2016, consists of four pressured vessels with nitrate selective anion exchange resin. The process utilizes sodium chloride to regenerate the resin. During the treatment process, there is



Pake McCorley, plant operator, points to the online nitrate monitoring display unit showing a treated water nitrate concentration of 4.9 mg/L.



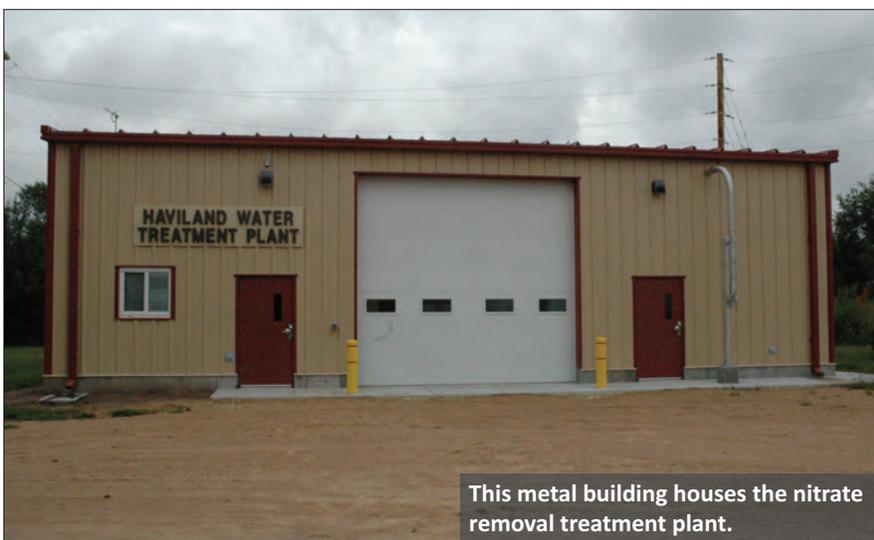
This is a photo of the plastic lined two-cell lagoon system used to store backwash water.

an exchange of chloride for nitrate as the resin accepts the nitrate and releases chloride into the treated water. The captured nitrate ions are eventually removed from the resin during the brine/rinse cycle. The concentrated nitrate wastewater flows to a two-cell lined wastewater lagoon system installed as a part of this project.

Mayor Ellis noted that while average water use is about 96,600 gallons per day (GPD), the plant is capable is

**Two solution pumps were provided to inject sodium hypochlorite into the line prior to the distribution system.**

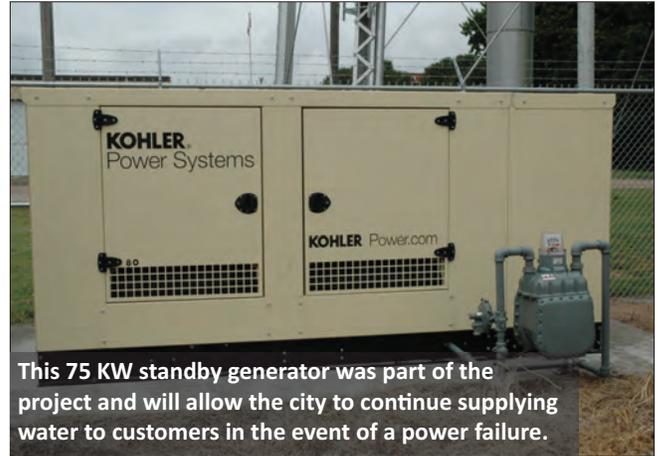
producing 137,742 GPD. In September 2016 about 80 percent of the flow is being treated, blending back 20 percent raw well water to produce water with about 5 mg/L nitrate. All water is disinfected at the end of the treatment process. Two solution pumps were provided to inject sodium hypochlorite into the line prior to the distribution



This metal building houses the nitrate removal treatment plant.



This is one of the wells that was rehabilitated utilizing Monitor pitless unit construction. The work was done by Sargent Drilling, Neb.



This 75 KW standby generator was part of the project and will allow the city to continue supplying water to customers in the event of a power failure.

system. APAC, Hutchinson, Kan. was the general contractor on this project.

### Additional system improvements

This project included rehabilitation of the three wells which included the installation of new pumps. Also, new 6-inch PVC C-900 pipe was installed along with eight new fire hydrants and six new valves. The new valves eliminate the previous practice of disrupting service to the entire town by shutting off the valve at the base of the elevated storage tank when repairs are needed. Finally, a 75 KW natural gas-fired standby generator was provided to power one well and the treatment plant during power outages. Sargent Drilling, Kearney, Neb. was the contractor responsible for rehabilitating the wells.

### Cost of the improvements

The overall cost of the improvements was \$2.435 million. Funding was through the USDA Rural Development with a grant of \$0.879 million and a loan for the remaining \$1.556 million.

The city implemented the following graduated increase in rates to prepare for this project: January 1, 2015: \$22.00 for the first 2,000 gallons; \$2.00 per 1,000 for the next 10,000 and \$2.25 per 1,000 for all usage above 12,000 gallons.

January 1, 2016: \$26.00 for the first 2,000 gallons; \$3.00 per 1,000 for the next 10,000 and \$3.25 per 1,000 for all usage above 12,000 gallons.

Final rate increase will be on January 1, 2017: \$30.00 for the first 2,000 gallons; \$4.00 per 1,000 for the next 10,000 and \$4.25 per 1,000 for all usage above 12,000 gallons.

Water rates prior to rate increases were as follows: \$11.90 for 2,000 gallons; \$1.00 per thousand from 2,001 to 10,000 gallons and \$1.25 per thousand above 10,000 gallons.

Obviously, Haviland customers are already noticing a significant increase in their monthly water bill but will be

noticing it even more when the last increase goes into effect. The cost for 5,000 gallons of water will be \$42.00, up from the original cost of \$14.90 prior to this project.

*Bert Zerr is currently a consultant with KRWA. He has been with KRWA since 2005. Prior to that, Bert was a District Engineer with the KDHE in the Salina District Office for 32 years.*



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