by Bert Zerr

New iron, manganese removal water plant online at Ellis

The city of Ellis, Kan., located along I-70 in Ellis County, is conveniently located midway between Denver, Colorado and Kansas City, Kansas. Aside from being located in beautiful western Kansas, Ellis has a very interesting item of political interest, especially with regard to women in politics. In 1896, the women's "Law and Order Committee" slate won the local election, and the Ellis all-woman council and a lady mayor became one of the first such groups in the United States. Some other facts about people of interest in Ellis include: In the late 1800s, Wyatt Earp and Buffalo Bill Cody were seen often in town; John Henry, train dispatcher with the Union Pacific Railroad in Ellis, invented the electric streetcar in 1882; early residents Walter and Roy Cross developed the "Cross Process," a method of converting kerosene, natural gas, oil or fuel oil into gasoline that was used widely across the U.S.; and, Walter P. Chrysler, who grew up in Ellis and learned about mechanical repair and machinery in the Ellis Union Pacific shop, used this knowledge to found the automotive giant, the Chrysler Corporation.

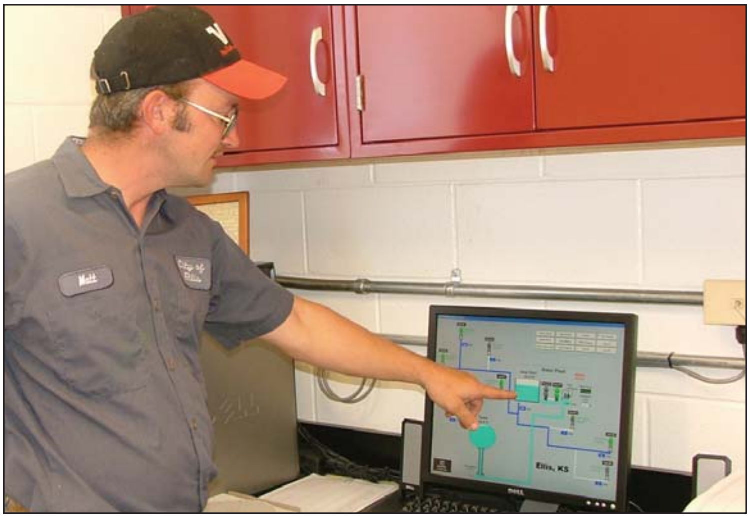
Like most western Kansas cities, the city of Ellis utilizes groundwater as the source of water. This source has served the city well for many years. In recent years however, due to rather poor water quality, especially iron and manganese in some of the wells, city officials made the decision to search for additional wells. While high iron and manganese levels do not violate any Environmental Protection Agency (EPA) maximum contaminant levels, iron and manganese are included in the EPA's secondary maximum contaminant levels. These secondary levels are only guidelines to assist public water systems in managing their drinking water for aesthetic considerations such as taste, odor, and color. These water quality issues caused the city to discontinue using three of the city's eight wells.

During the city's search for new wells, the results of test drilling indicated that new wells

Ellis, Kan. is famous as the boyhood home of Walter P. Chrysler; the home was built in 1889. The Chrysler family occupied this house from 1889 until 1908. In the 1950s, Chrysler Corp. purchased the house and gave it to the city to operate as a museum.

This end view of the pressure filter vessels shows the piping system. The green piping allows raw well water to enter the plant; the light blue piping allows filtered water to leave the filters; the dark blue piping allows treated water to be used to backwash the filters.

could be drilled near Big Creek, in the Big Creek Aquifer. Again, this water contained high iron and manganese. To complicate matters further, the Big Creek Aquifer has been closed to new water rights. Fortunately for the city, the proposed new well locations were within the distance specified by the Division of Water Resources and water rights from the abandoned wells could be transferred to the new well sites. Having located a potential source of groundwater, the city was prepared to move forward with water system improvements consisting of replacing the two abandoned wells, constructing a new water treatment plant (iron and manganese removal plant), and installing new pipeline to route the raw well water to the treatment plant.



Left: *Plant Operator Matt Windholz checks the status of operations. Ellis now has an integrated telemetry and SCADA system which allows operators to be more efficient.*

Above: *This onsite generator is capable of providing sufficient power for the entire plant. The generator was needed in May 2008 when a tornado knocked out power to the water plant. The generator operated for a 40-hour period before electrical power was restored.*

Pilot plant shows results

Layne Christensen, equipment supplier, and Wilson & Company, consulting engineer, were contacted to assist the city with the project. The first step was to construct a pilot plant at one of the new well sites. The pilot plant was not only to determine treatment needs but also to allow residents to observe both treatment technology and results. Also, during the preliminary design process, the city held several meetings open to the public. During these meetings the general public was allowed input regarding well locations, contamination issues, treatment alternatives, funding options, water rate impacts, time requirements, and design selection. Ultimately the decision was made to proceed with a project.

With the addition of two new wells in this project, the city now has eight wells that pump to a new Layne 1.5 million gallon per day (MGD) pressure filtration

Taken from the mezzanine section of the water plant, this is an overhead view of the Layne Ox pressure filter layout.

This is a view of the pumping system in the plant. The two pumps on the right are high service pumps that deliver water from the clearwell to the distribution system. The pump on the left is the backwash pump.

plant to remove iron and manganese. The filtration plant utilizes six Layne Ox vessels, each containing manganese dioxide media. Pre-chlorination facilities are provided to allow chlorine to be injected into the line ahead of the vessels to oxidize the iron and manganese, thereby allowing the precipitated minerals to be filtered out. Filtered water flows into a 0.250 MG clearwell. Post-chlorination facilities are provided to add chlorine to the treated water as needed. Two high service pumps deliver treated water to the distribution system.

Also included in the project was a 360 KW generator powered by a diesel-fired engine. Operation of the generator is exercised every Wednesday; it can power the entire plant. In fact, Matt Windholz, plant operator, stated the generator performed very well when it was called into service in May 2008, running for a 40-hour period when power was interrupted as a result of a tornado.

These booster pumps are for pre- and post-chlorination. Pre-chlorination is used to oxidize the iron and manganese and post-chlorination is used to maintain the desired chlorine residual in the distribution system.

This connection allows raw water to bypass the plant. The green pipe on the left is the raw well water line to the filters. The light blue line is the filtered water line (treated water) from filters. The valve between the two lines is normally closed but can be opened if there is ever a need to bypass the plant.

Design-build vs. design-bid-build

Rather than using the customary design-bid-build process, the city chose to utilize the design-build project delivery system. Wilson & Company, Inc. was the designer, Layne Christensen was the major equipment supplier, and Walters-Morgan Construction, Inc. was the main contractor. The advantages given for using this process include reducing the amount of construction time by approximately 10 percent and the total project time by nearly 25 percent. Also, the city-contractor-engineer team is allowed to incorporate changes in the project during construction to save on construction cost. Last, this process allowed the city to ensure the contractor used local labor and materials, when possible. In fact, Walters-Morgan Construction purchased most materials through local businesses. Also, all of the electrical work on the project, including telemetry and SCADA systems, was completed using Don's Electric, an electrician and systems integrator located in Ellis. The pre-fabricated metal building was supplied and erected by Art Schoenthaler, a dealer and contractor also located in Ellis. Stan Honas Masonry, a contractor in Ellis, completed all of the masonry work for the interior rooms. Werth Plumbing of Hays completed all of the plumbing lines and fixtures for the treatment facility.

The cost of this project was $5,500,000. The city chose to use bonds to fund the project. The city increased the monthly minimum water meter change by $26.13 for each meter size. For example, minimum monthly charge for a 5/8-inch meter and 3/4-inch meter is $32.13; a 1-inch meter is $36.50; a 1 1/2-inch meter and 2-inch meter are $44.43; meters larger than 2-inch are $56.63. In addition to the monthly minimum, users are charged $3.25 per 1,000 gallons of water used.

"The reason the city decided to increase the minimum meter charge was they needed to assure an adequate cash flow. Increasing the rates based on water usage, especially since the city's water conservation plan is still in place might result in a decrease in cash flow," Assistant City Clerk Charlene Weber explained. "City residents are very happy with the quality of the treated water and city officials were pleased with the design-build process."

The guaranteed maximum price approach required strict budget control techniques, allowing the city "budget control" resulting in cost savings of approximately 10 percent over the initial project budget. Also, the city was very pleased that local resources were used. It is believed strong local support and the hiring of local contractors occurred because city government chose to use the design-build process over the more traditional design-bid-build process. Additionally, customers were pleased with the funding through revenue and general obligation bonds paid for in part through local sales taxes and through minimum meter charges. The end result is a state of the art water treatment plant sufficient to handle the needs of a growing community.