

KRWA Assists with Pigging Raw Water Line at Geary RWD 4

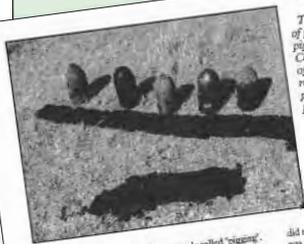
Pipeline pigging refers to the practice of using devices commonly referred to as "Pigs" to perform various cleaning, and maintenance operations for pipelines. In water systems, pigging lines removes mineral deposits and sediment. Pigging water lines has been around for a long time and often can be and needs to be done as waterline maintenance. A buildup of mineral deposits can occur on the inside of transmission and distribution pipelines over time. Regular and routine line flushing can and does help mitigate those problems, but often, efforts beyond flushing are required to remove the deposits to improve water quality. Many factors can determine the need to go beyond flushing to pigging.

Several factors should be researched and considered before embarking on a pipeline pigging project. These include:

- ❖ Are flow rates and pressure adequate to push the pig or swab through the pipeline?
- ❖ Are there any Tee's, elbows, service connections, check valves, etc., which might be a problem where the pig might become stuck?
- ❖ What type of buildup is going to be cleaned? How aggressive of a pig style is needed?
- ❖ How will the pigs be launched and how will they exit? Will the launch and exit points be permanent or temporarily installed?
- ❖ What is the project timeframe? Will service be interrupted to the extent that customers will need to store a supply of water for their use? What about notification of customers about the project is critical!
- ❖ Make sure if water being flushed will have chlorine that it is not entering a stream or nearby creek as de-chlorination may be necessary.

One major cause is the water quality of course. Another issue is flow rates. If a well or line pressure and flow cannot create enough velocity during flushing maintenance to scour debris from the line adequately or the lack of routine line flushing, it can continue to build inside of the line. At which point there will be a time that the buildup could restrict flow or discolored water issues and complaints from customers.

The District's 150,000-gallon elevated water storage tank is located near the district's office.



The main cleaning process is commonly called "pigging". The "pig" are bullet shaped devices made from foam or polyurethane materials. They are coated with different types and configurations of materials, even wire brushes or balls, depending on the need.

The first phase of the project was to clean the 4.5 miles of 4-inch PVC beginning at the chlorination building. This project required three days to complete - largely due to some complications which had not been anticipated. The single most frustrating of these complications was when several pigs got hung up in a pipeline arrangement which was installed by the original contractor. This arrangement consisted of a TEE with several 90's to drop a couple of feet to cross under the highway. Needless to say, this configuration was removed and the pipe reinstalled on a grade to level it in a straight shot. That was a very long day which ended at 1:30 a.m. KRWA's pigs said if they ever find the man who installed that arrangement, they'd need to have the report it really was a ridiculous installation.

"The cost to clean the 12.5 miles of pipeline totaled approximately \$4,000. The largest expense was for backhoe time. The cost of the pigs was only \$387.00. Had this work been contracted out, the cost for pigging alone would have exceeded \$30,000."

There were other problems but these were minor in comparison to the pigging in the TEE arrangement. The KRWA and District continued working on the project to complete the pigging of the entire 12.5 miles of transmission pipeline from the chlorination building to the water tower. After placing the District back in operation, the wells produced 88 gpm at a discharge pressure of 86 psi. Not.

When Marion County RWD No. 1 realized it was not possible to keep their standpipes supplied with all three of their wells operating, it was concluded an obstruction in the pipeline was the cause. Here's an example where a water utility, their engineers and the KRWA worked together to solve the problem - and at a savings of more than \$30,000 for the District.

Pigging lines benefits central Kansas rwd

By C. Michael Butler

Marion RWD No. 1 located in the northwest portion of Marion County serves 230 users and the community of Tampa. The water district was completed in 1972 and consists of three wells, one standpipe and one hundred miles of pipeline. Over the past several years, the district has had problems in keeping up with demand. A couple of times each year were especially critical with the standpipe level dropping some 50 feet and some customers really out of water. All the time, the three wells were pumping continuously.

It was obvious that water production was not able to keep up with the demand. The District elected to hire Schwab-Eaton Engineers. Matheson, to conduct a study of the system to determine the best way to improve production and to verify if production alone was the only system deficiency.

Schwab-Eaton completed a hydraulic analysis of the District through a computer model of the system. A few areas exhibited very high pressure losses due to inadequate (small) water line sizes, but overall the distribution system was in good condition.

However, the computer model did indicate that the well water supply should be producing 88 gpm at an 83 psi discharge pressure at the chlorination building. The cause of the engineer's attention because the District was reporting a water supply of only 68 gpm at 117 psi.

Because engineers and computers are never supposed to make mistakes, I questioned the operator's capability of properly reading instruments. A second reading provided similar results. I also questioned the accuracy of the instruments in the control building. The District reported that they had two pressure gauges which read the same and that the water meter was less than six months old.

At this point, I concluded that the District had a qualified operator and accurate measuring equipment. Our firm was assigned to find the source of the problem and the cure.

I asked the District to take pressure readings at measuring points along the main supply line. I could then compare these to the computer readings. What I found was that the pressures compared favorably even though the measuring locations and elevations were obtained from small scale USGS maps. The only problem was that there were no meters along the first 4.5 miles of pipeline. But at least our side of concern had been reduced to 4.5 miles.

At this time, I felt the problem was either of two things - either a valve was partially closed or there was an obstruction in the line. The valves were all found to be fully opened, therefore we concluded there was some type of obstruction in the pipeline. Flow over, without meter readers to obtain pressure readings along the line, we decided to use a pressure tap. The only alternative to locating the obstruction would be to tap the line and take pressure readings. It was at this time when the District began to seriously question the results of the computer model. Nevertheless, they tapped the line at two points and obtained pressure readings. What the pressure readings revealed was not an obstruction but a rather uniform high pressure drop through the line. According to the drop, the roughness coefficient, or "C" factor, for the 4-inch pipe pipeline was around 80 (new PVC pipe is 150). Was this pipeline only 3 inches in diameter? The conclusion was that there was a mineral deposit in the line. This was somewhat perplexing since a burst-up of minimum size smooth wall PVC pipe is uncommon except on occasion following a complete water treatment process.

Our next suggestion was to cut out a section of pipe for inspection. However, before this request could be made, the pipeline broke near the point where one of the pressure checks had been tapped. When an important build-up was reported in the line, the District thought it was about time to have a face to face check with the engineer. A section of pipe and a long rope (these folks have a sense of humor) were brought to the meeting. Upon inspection of the pipe, it was noted that a fine film of what appeared to be iron and manganese deposit was present. Although the line was that, it was very rough and so such was believed to be the cause of the problem. The cure would be to clean the line.

A pipeline cleaning contractor was contacted. He agreed to clean the line for a "reduced" price of \$8.99 per foot plus ductile expenses and fittings. The price was reduced because he had other work in the area. Remembering that the Kansas Rural Water Association had exhibited at their annual meeting who promoted pigging and cleaning of water lines, a call was made to the Association for help in locating other contractors. As it turned out KRWA offered their assistance to work directly with the District to clean the water line.

THE KANSAS LIFELINE July 1991

KRWA conducted a pigging project

in July 1991 at Marion RWD 1. That project was well-documented to demonstrate the improvement in flow and resulting energy reduction. The article by C. Michael Butler of Schwab - Eaton, P.A., Manhattan, Kan., summarized that project in an article in the July 1991 issue of *The Kansas Lifeline*. By removing excess mineral deposits, the production of water increased by 35 percent. The head pressure was reduced by 24 percent on the 4.5 miles of transmission line from the wells to the chlorination building. I encourage readers to check the article "Pigging Pipelines" at this link: <https://tinyurl.com/y5jj6v2z>.



This photo shows the start of "dirty water" (high content manganese and iron deposits) during pigging of a pipeline on another project KRWA conducted.



This photo shows the buildup from iron deposits in a 3-inch PVC line. This pipe is from a smaller city in northeast Kansas where KRWA staff assisted with pigging.

The reason for pigging a raw water line as in Geary RWD 4, was to improve water quality, maintain flow and improve media life and filter performance and function. By regularly flushing and then as needed, pigging the raw waterline, the district hopes to improve and prolong the life of the plant media and reduce treatment costs. Customers are also sure to appreciate improved water quality. The district's well water is high in iron and manganese. The district's main well produces approximately 500 gpm. An 8-inch pipeline of about 5,300 feet transports water from the well to the

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About the district

Rural Water District No. 4, Geary County, began providing water service to about 50 customers in 1976. Additional land was incorporated into the district in 1981. The district's south boundary is the Republican River. The north boundary is the Geary/Riley county line. Fort Riley borders the district to the east and Milford Lake is on the western border. In 2021, the District has 400 patrons and also sells water to two locations for the Corp of Engineers, Milford State Park, Acorn Resort and also to the city of Milford.

The water supply is provided from three wells. Two lower producing wells are on standby. The district's newer well can produce up to 500 gpm. The source is an alluvial aquifer located below the dam at Milford Lake. The water has high amounts of iron and manganese. Untreated water is pumped to the filter plant where treatment is through the use of an oxidation (chlorine) filter that helps to remove most of the iron and manganese.

District Manager/Operator Clifford White first became involved with the project as a board member in 1987. With changes within the district, White says that the board saw a need for to employ someone vs. contracting service for operations. Clifford was hired as Manager/Operator since 2000. He attained a Class VI water operator certification in 2002.

The district recently completed construction of an addition to the filter plant. The expansion includes a shop, equipment room and a restroom. The district has moved all equipment including management out of the main filter room so as to protect from the corrosiveness. White says that the district has had to continuously replace and repair equipment because of being in close proximity to the chlorination.

Also part of the current project was to replace the media in the filters due to fouling from the iron and manganese. Another aspect was the pigging of the 8-inch transmission line from the wells to the filter plant to remove mineral deposits from the pipe.

The district's plant site also has a 50,000-gallon storage tank that holds water until resupply is called for the by district's 150,000-gallon elevated tank. The system operations are controlled by a SCADA system.

Inside RWD 4 water treatment plant,



Anxiety reigns supreme! It can be stressful waiting for a pig to make it to the exit point.

treatment plant. The plant is about 200 feet in elevation above the wellhead.

Geary RWD 4 Operator/Manager Cliff White contacted KRWA for assistance with the project. I met with Cliff and discussed planning for the project. The district wanted to install permanent launching and receiving ports so that pigging of the line could become regular maintenance to improve filter media life and efficiency.

After meeting with Cliff and reviewing the proposed project, we wanted to be sure to cover any issues for the path the swab would take. We tried to confirm any services, Tee's or any changes in route that could create a problem in disrupting the pig's path and causing it to get stuck. We installed the pits and ports to allow for the launching and exiting of the pigs.

On the day we worked on the project, we first connected the riser and pipe at the exit pit to direct water away from the area and to ensure no damage would be caused because water flowing from the discharge point. Given the length of the pipeline to be pigged and knowing the flow rate and pipe size, we calculated the time required for the foam pig to travel the distance from the well to the treatment plant. We estimated it would take about 27 minutes to reach the plant exit point.

Almost exactly 27 minutes from the start of the pumping, a lot of discolored water began to arrive. But there was a problem. There was no foam pig! We continued to flush water for another hour. Still, there was no pig coming from the exit port. There was no loss of pumping capacity. So, where could that swab be?

There were only a couple of possibilities. I learned later that the district had installed a check valve at the midway point of the line at the top of a small hill. Usually, a soft swab type pig would have passed such a swing check. This valve, however, had a center pivot with two halves. The



Preparing for a pigging project requires having a port to launch and an exit point. KRWA staff member Greg Metz is shown here tightening MJ connections to hold the piping together. Straps were added as an extra measure.

district excavated the valve and opened the pipeline at that location. Sure enough, the swab was stuck in the one side of the check valve.

Pigging waterlines can be a very rewarding project. KRWA has seen all sorts of methods and manners how projects have been approached. In extreme cases, one city connected a fire truck to the waterline to force the pigs through cast pipelines that were very clogged with mineral deposits. In another town, the city mayor decided that using a high capacity air



The photo shows the foam swab (pig) after it was retrieved from a check valve. It was caught in the system for several weeks.

compressor would help propel the pigs better. Yes, it did – including launching one nearly over the top of a two-story home. In another case, a system did not close side valves and swabs went through pipes of lower integrity and ended up with plugged kitchen faucets and washing machines. The message on that is to know the system and shut off the sideline valves.

I know several systems have installed permanent launch and exit ports on pipelines so that pigging can be readily accomplished. That's a good idea if the water quality has treatable amounts of iron and manganese.

KRWA staff are prepared to help any community or RWD that may be interested in reviewing the need for or options to clean sections of pipeline. For those systems that have known water quality issues that contribute to excessive

mineral buildup, the acceptance that regular pigging of some lines may need to happen is a first step to ensuring better water quality and more satisfied customers.

Greg Metz joined KRWA as a Technical Assistant in July 2009. He previously worked at the city of Washington for 13 years where he was involved in city utilities including the power plant, streets, water and wastewater. He also served as purchasing agent for those utilities.



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