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- Pipe Scales and Corrosion
- Water Modeling Shasta Dam
- Q&A With Brenda Lennox
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Visit us at www.mnawwa.org
Message from the Chair

What We Don’t Know

As I write this article, four other MN Section leaders and I are a few days from attending our AWWA Regional Meeting of Section Officers (RMSO). Annually, volunteers from the various sections get together at RMSOs to learn what is new at AWWA and to learn what our peers are doing in our neighboring sections. Our region, Region III, includes 10 other sections in the Midwest and Ontario, Canada. RMSOs, along with the Membership Summit, Young Professionals Summit, Annual Conference and Exposition (ACE), and the Summer Leadership Workshop, all give section leaders the opportunity to bring back ideas on how we can improve our sections. When MN section leaders network with volunteers and staff at other sections and with staff at AWWA, everyone in the MN section benefits.

Before we go to these trainings we mostly have a handle on “what we know” and “what we know we don’t know.” But we don’t have a handle on “what we don’t know we don’t know.” If we are lucky, we get the opportunity to search out and know a little more about “what we know we don’t know,” and, by meeting the right person or hearing the right conversation, we can turn “what we don’t know we don’t know” into “what we know” or what “we know we don’t know.”

I feel fortunate when I get to attend AWWA events and share the MN Section’s experience and knowledge with other AWWA Sections and “Pay it Forward.” When I am not at AWWA events I’ve found an easy way to share what I know with others and learn from others in our industry; it is by using Twitter. Before I became active on Twitter, I didn’t know about a lot of the great resources available in the water industry. If you aren’t on Twitter yet, I’d highly recommend you create a profile and make @MinnesotaAWWA the first feed you follow. Our section’s Twitter feed does a great job of bringing, in my opinion, the right amount and frequency of pertinent, relevant water industry posts. That is thanks to our section volunteers, like Pat Shea and others, who coordinate and promote our social media feeds.

Here’s a quick read on Twitter basics www.momthisthowsitworks.com. This site will get you up to speed with how @ and # symbols work, and how to post only to who you want. Even after being on Twitter for two years, I learned a few things from this site that I didn’t know I didn’t know.

Water related Twitter feeds I recommend: @help4smallwater, @EPAwater, @mnawwayp, @awwaace, @MNRuralWater, @waterforpeople, @mnhr, @mnhealth, @mn pca, @yestotap, @A4WE, @freshwatersoc, @urbanturfmn.

Other feeds I recommend: @lifehacker, @99piorg, @Freakonomics.

So check out Twitter. And if you like, follow me at @davejbrown. •
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Recently the city of Saint Peter held a community meeting to commemorate the 20-year anniversary of the F-3 tornado that hit Saint Peter. While many would say, “That sure seemed like a long time ago,” to me it seemed like yesterday. 1998 was a year of transition; the city had plans to add a new housing subdivision and were looking to upgrade the wastewater treatment facility. The future looked bright. A few in the community were opposed to the growth of Saint Peter. Many didn’t want change – they were happy with the brick and wood of Saint Peter. Little did they know that on March 29, 1998 they would be forced to change.

In the days after the tornado, Saint Peter was faced with rebuilding. Damage claims surpassed $235 million dollars with over 200 homes destroyed and over 1,200 homes receiving substantial damage. Many homes that were destroyed were in the older part of town, the core of Saint Peter. While much history was lost, other issues surfaced. What about the age of our water and sewer system serving these areas? Would that be adequate to serve new homes? What glue was needed to make Saint Peter whole again?

City staff strategized about short- and long-term implications of the disaster, and those of us who were tasked with making decisions about water and sewer lines did so knowing that many homeowners wanted to rebuild and stay in our community. Our goal became to make it possible to our customers to rebuild while improving our system to a higher level of sustainability. The rebuilding began and a higher standard was discussed with homeowners, and the city implemented “utility standards” for new construction – a crucial decision by the City Council in 1998, which would set the table for growth and development in Saint Peter for the next 20-years. The glue was set.

“Change” is something we do frequently in the water industry. Leaders come and go, organizations change, and the Minnesota Section relies heavily on the expertise of our membership, just like Saint Peter did during a time of crisis. Section volunteers have been the key to our success; communication with existing and potential members about the benefits of membership is one reason why we have been able to meet with member demands. Our organization has been blessed to have generous leaders and volunteers, but there is a concern that the new generations just don’t do things the way we have done things in the past – which may just be a good thing.

Organizations like the Minnesota Section and the city of Saint Peter are a lot alike. Someone or some group has to be willing to take a chance and provide direction for the betterment of the community. In retrospect, Saint Peter flourished after the tornado. I was glad to be a part of what happened here, but we never could have done it without a willingness to change. Have a great summer!

Bricks, Wood, and Glue

Pete Moulton

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The People You Meet

I hit a quarter-century at the Minnesota Department of Health (MDH) at the beginning of this year, and my involvement with American Water Works Association and the Minnesota Section started soon after. I was in St. Cloud to see the construction on their new water plant, and Gerry Mahon let me know I should join AWWA. He also told me to be sure and put his name as the sponsor on the application. He also told me to be sure and put his name as the sponsor on the application. Mahon let me know I should join AWWA.

I have been involved like this in that I’ve enjoyed all of it.

When you’re with organizations for a long time, you get to know a lot of people. Around MDH, some of the folks from when I started are still here, including Brian Noma, Bob Smude, Carol Kephart, Brenda Eschenbacher, Lih-in Rezania, Paul Halvorson, John Blomme, Mike Luhrsen, and Jerry Smith. There are those who have left, such as Dick Clark, Doug Mandy, and Gary Englund.

There are those who have come along and are still here and those who have come along and are gone. One of those folks is Mark Sloan, and there is more on him further into this issue of Breeze. I got to know Mark when he was an operator. He came to us at MDH in 2004 as our certification officer, and I now know you all got to know him in that role. What a friendly, helpful guy he was. And fun, too. I always referred to him as “The Sloan”, and he called me “The Stew”. We had a good time ribbing Mark about being a brown-noser, sitting up front at meetings if high-ranking officials were presiding while the rest of us tried to hide in the back. He went along with it and encouraged it, even getting us to compete with him for the brown-noser title, which meant we started sitting up front with him.

Mark had some health issues in the last few years and then broke his leg, requiring him to retire on disability. And then he died. Dang, stuff happens and this was a reminder of it.

Others leave too, without such finality, and you will also see in the People section that Jim Sadler is retiring. Boy, we always loved having the “Bulldog” around at the conferences, keeping things running smoothly. He was involved in the industry and Minnesota section in so many ways, and we are happy that he still plans to hang around some, even as he and Gail travel the country with their family, which now consists of heifers and steers.

All this reminds me to always appreciate the people we come across and remember that neither they nor we will be around forever. •
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Social Media
Pat Shea reports that in January Minnesota AWWA reached 31,788 people on Facebook and had 1,075 of them engage in some manner (like, comment, share). The section also had 52 new likes to the page. On Twitter, the section had 19,300 impressions for the month, with 241 profile visits, 9 mentions, and 12 new followers.

Secretary-Treasurer Audit
An audit occurs with each change of the secretary-treasurer. Last September Anna “A. J.” Schliep succeeded Ben Feldman as secretary-treasurer, and the audit process is underway.

Memo of Understanding
The board approved a memo of understanding between Minnesota AWWA and the Minnesota Department of Health (MDH) regarding joint-training. The section and MDH have been involved in jointly organizing district water operator schools for more than 25 years and have worked to update the relationship with this memo.

Educational Workgroups
Bo Johnston, chair of the Education Development Committee of the Training and Education Council, reported on the educational workgroups within the committee. They include the Operation Certification Training Workgroup, chaired by Jeanette Boothe. This workgroup was created at the 2016 annual section conference and includes, as members, Rick Wahlen, Bert Tracy, George Kraynick, Jon Eaton, Keith Redmond, and Eric Volk. The workgroup is creating a program to replace the training that was done in past years by John Thorn, who is approaching retirement. The section wants to have an option developed to continue on this work.

Another workgroup is the Drinking Water Institute for Educators, which held its 18th Institute for Teachers in August in Lakeville. As a follow-up to the three-day workshop, the teachers met again on a Saturday in late October at St. Paul Regional Water Services. The 2018 Drinking Water Institute will be held August 6-8 at Rochester Public Utilities.

Conference Council
Conference Chair Rob Isabel reported that contracts with the Duluth Entertainment and Convention Center (DECC) and room blocks with hotels are all set for the 2018 Minnesota AWWA Conference September 18-21. The council is discussing ways to shorten the Thursday night Member Appreciation Dinner to make it more appealing to younger members and operators. Roger Scharf, chair of the council’s Program Committee, has lined up explorer Will Steger to be the keynote speaker.

Recap of 101st Annual Conference
The conference, held in Duluth September 12-15, had an estimated 617 registrants, including 95 exhibitors. A preliminary financial tally shows approximately $114,000 in revenues and $66,000 in expenses for a profit of $48,000. Keynote speaker Erik Therwanger was well received; he was rated 5 out of 5 by 82 percent of the poll respondents. Feedback on the Thursday evening dinner indicates that many think it is too long and not appealing to the next generation of water professionals. The board will discuss ways to modify the event to appeal to young professionals while maintaining the section’s traditions. The Friday morning session, which included state auditor Rebecca Otto, was well attended, and the program committee was commended for its efforts to improve this program. The program committee has already been meeting to plan the 2018 conference, which will be September 18-21 in Duluth.

Conference Council chair Rob Isabel moved that the section automatically increase conference registration fees on an annual basis to account for inflation and increased in cost to hold the conference. The proposal was to increase the fees based or the prior year’s Consumer Price Index or 3 percent, whichever is less.
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The Science Technology Engineering Math (STEM) Committee has been busy. The focus is that we are the ambassadors of the water industry, a philosophy that includes being a role model; showing enthusiasm relating to all areas of the industry, generating conversations regarding the industry with young, middle-aged, and older people.

Our infrastructure assets are aging, as is another previous asset – our staff. As members of the Minnesota Section, we are all ambassadors of the industry. The STEM committee believes it is our mission to recruit, develop, and retain people from all backgrounds and diversity to provide safe and reliable utility services to our customers.

The STEM committee developed material for cities, other government agencies, consulting firms, and vendors to share with potential recruits. The material includes information regarding job descriptions, career benefits, useful web links, and hands-on exercises.

The material can be distributed when given the opportunity to perform outreach services at such events as city open houses, remodeling fairs, community concerts, fun run/walks, and farmer’s markets.

Along with printed material, the committee purchased STEM items that can be given to attendees. There are three STEM banners and signs to be incorporated into your display. These items are all free to the Minnesota AWWA members.

Additionally, the STEM committee is developing a web page that will include testimonials from industry professionals. Short videos and photos of Minnesota AWWA members will promote the water industry.

All of the developed material is available to MN AWWA members. There are 10 pilot agencies that will be testing the material. If interested in participating with the testing or would like materials, please contact me, Carol Kaszynski, ckaszynski@bloomingtonmn.gov, 952-563-4848.
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From the Waterline, newsletter of the Minnesota Department of Health

People

Jim “Bulldog” Sadler

Jim “Bulldog” Sadler retired March 30 after 42 years with the city of Maple Grove. After graduating from Osseo High School in 1970, Jim worked in construction and then joined the Maple Grove street department in November 1976. Five months later he moved to utilities, and he became utilities superintendent in 1998.

Jim has been an active member of American Water Works Association (AWWA) for more than 25 years. He has served as a district trustee and chair of Minnesota AWWA, which also presented Jim with the Leonard N. Thompson Award for his service to the water industry.

*Bulldog* (a nickname acquired through AWWA) is well remembered for his performance under hypnosis at the Minnesota Section conference in Rochester in 1998 when he repeatedly stood and yelled, “Quit peeing in the pool!”

In addition to keeping water safe, Jim raised horses until 2008 when he switched to cattle. He shows cattle across the country. In January 2012, one of his heifers, Dynamite Kisser, took first in her class at the National Western Stock Show in Denver. Jim will now be able to devote more time to his cattle along with his wife, Gail, who is on the board of the Minnesota State Fair.

Jim says he will continue to be around at AWWA events and will stay connected with his friends and colleagues in the industry.

Mark Sloan

Former Minnesota Department of Health water operator certification officer Mark Sloan died March 9. He was 58. Mark came to MDH in 2004 with 13 years’ experience as a water operator. He had worked on general maintenance on distribution systems, operated a lime-softening water treatment plant, and served as the utility supervisor for water and sewer operations for the city of Richfield. He also worked for G. M. E. Consulting Engineers. He also had experience in construction inspection and materials testing.

Mark was a familiar face at water operator schools and was respected and well liked by water operators and his co-workers at the health department. He retired in March 2017.

Water Poster Contest 2018

Sarvagna Vempati, a second-grader at Basswood Elementary, submitted the winning poster in the elementary school category in the annual water poster contest sponsored by H2O for Life and the Minnesota Department of Health, which provide bottle-filling stations to the schools of the winning entries. The theme of the contest was “Keep It Out…of Your Water Spout” with an emphasis on reducing exposure to lead and other contaminants. Other winners were Caden Blix of Ordean East Middle School in the middle school category and Krystal Xiong of Hmong College Prep Academy among high schoolers. More posters from the contest can be seen at www.health.state.mn.us/divs/eh/water/poster.html.

We Are Water MN Visits the Capitol

We Are Water MN was on display at the Minnesota state capitol from January 10 to March 11 before moving on to the Hjemkomst Center in Moorhead. The traveling display explores the connections between the humanities and water through an exhibit, public events, and educator resources. We Are Water MN is a partnership involving a number of state agencies, including the Minnesota Department of Health, to bring together personal stories, historical materials, and scientific information. In 2018-2019, the exhibit will be on display in Minneapolis, Bemidji, Crookston, Fond du Lac/Cloquet, Austin, Northfield, Grand Rapids, and Mille Lacs/Onamia. Go to mnhum.org/water for more information.
Industry News

From the Waterline, newsletter of the Minnesota Department of Health

Summit Brewing Company: It Starts With the Water

Though not a brewmaster himself, Tom Thomasser has “brew in his blood.” He is a fifth-generation member of a brewing family that includes a great grandfather who was a master brewer in Austria. Thomasser is now the chief operations officer of Summit Brewing Company in St. Paul, which began in 1986 in a reconditioned transmission shop on University Avenue between Minn. Hwy. 280 and Vandalia Avenue. Thomasser joined the company as it was moving to its current location, off West Seventh Street near I-35E, and was involved in the construction of the new facility and purchase of all equipment. Thus, Thomasser was well qualified to provide a tour of the plant to a group of water operators April 4, and he emphasized water as a primary ingredient in their process.

In 2017, Summit Brewing took in 19.5 million gallons from St. Paul Regional Water Services. It has a sand-and-gravel and carbon filter to remove chlorine from the water. In addition, it makes some adjustments during certain parts of the year for taste and odor. Thomasser said they also do some “tweaking” to the process water in individual recipes. “We try to make the water similar to what it would have been in its home world,” he said, explaining, for example, that their Dakota Soul label is a Czech-style Pilsner. The brewery may harden or acidify the water to mimic the qualities of the water in the Czech Republic.

Summit also has to treat the effluent, sometimes neutralizing the pH and keeping tabs on the temperature of the water as it discharges it. In addition to water as an ingredient for its beers, the brewery relies on water for sanitation, especially in the filtration process. The water may be heated to as much as 180 degrees in its brew kettles and then cooled before reaching the fermentation vessels.
Water Quality Incident?
Contact the State Duty Officer

Water operators and superintendents are reminded that they should call the state duty officer at 800-422-0798 in the event of any type of water quality incident. This includes both intentional (break-in or vandalism) and unintentional (contamination, chemical overfeed) events. In addition to the duty officer, personnel should contact law enforcement if the incident was intentional. MDH has the phone numbers and more information on its website at www.health.state.mn.us/divs/eh/water/factsheet/emergency/response.pdf.

2018 Drinking Water Institute August 6-8

The 2018 WaterWorks! Drinking Water Institute for Educators will be held from August 6–8 in Rochester.

Each year, Minnesota science teachers attend the three-day event, learning about drinking water and ways to develop inquiry-based activities that can be incorporated into their existing science curriculum. The program is free to teachers, who receive college credit for their participation.

WaterWorks! is sponsored by the Minnesota Department of Health and Minnesota American Water Works Association.

More information is available at www.health.state.mn.us/water/institute/index.htm.

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Austin Utilities in Austin, Minnesota, opened a new municipal service center in July 2016, just to the north of a new well and above-ground storage facility. Well 12, which went on-line in 2013, was the city’s first new well since 1977. It was constructed after Hormel Corporation, manufacture of Spam and other cured meats, approached Austin Utilities about obtaining all of its water from Austin.

The utility determined it could handle the increased demand, approximately 3.5 million gallons per day, with a high-capacity well and 2-million storage tank along with a mile of 16-inch pipe to get the water into its distribution system. Hormel had been receiving some city water but, after connecting to the municipal supply, was able to seal its own wells. The utility bonded for the construction of the well, tank, and pipes and will benefit from the increased revenues by the sale of its water to Hormel. Austin has eight wells, ranging in depth from 110 to 1,075 feet, that draw from the Prairie du Chien-Jordan, Spillville, and St. Peter aquifers.

The water is treated with chlorine, fluoride, and a polyphosphate. In late 2017 Austin began demolishing its downtown power plant which contained the original municipal wells. Austin Utilities will be working with staff from the Minnesota Department of Health to make sure all the abandoned wells are sealed.

Invisible Heroes Videos Highlight Drinking Water Providers

The Minnesota Department of Health has produced a series of Invisible Heroes videos, profiling water systems in Fairmont, St. Cloud, St. Martin, Worthington, New Brighton, and Oakdale. Each of these systems has overcome challenges to continue to provide safe drinking water to its residents. The videos are available on the MDH web site: Invisible Heroes Videos: www.health.state.mn.us/divs/eh/water/videos.html.
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Purpose and Summary
Lead and copper in drinking water distribution systems are federally regulated by the Environmental Protection Agency (EPA) through the Lead and Copper Rule (LCR). Corrosion mechanisms that release lead and copper have received increased scrutiny in recent years, which has led to the development of numerous guidance documents. This article summarizes the current state of knowledge for corrosion mechanisms and control and the potential regulatory changes relevant to water systems in Minnesota. Key points include:

- Water systems can limit corrosion by controlling water quality to promote formation of effective passivating scale layers and to manage biogrowth.
- Water quality parameters pH, alkalinity, chloride, sulfate, and chlorine residual/type are important factors that affect formation and stability of passivation layers, while Langier Saturation Index (LSI) alone is not an effective predictor of corrosion control.
- Consistent chemical composition and maintenance of chlorine residual throughout the distribution system are important for effective corrosion control.
- In Minnesota, the Minnesota Department of Health (MDH) sets the LCR monitoring schedules and reviews the results to determine system compliance with the LCR. MDH is available to provide technical assistance about corrosion control measures and regulatory changes.

Corrosion Overview and Mechanisms
Internal corrosion of drinking water distribution systems is a complex and dynamic process that depends on water chemistry, distribution system materials of construction, and microbial activity. In the most general terms, corrosion refers to an electrochemical reaction between a metal surface and bulk water, where metal is transferred from the surface into the water. Internal corrosion can degrade both distribution system infrastructure and drinking water quality. Corrosion of distribution system materials can lead to off-color water events or the release of lead and copper into drinking water. Most sources of lead and copper in delivered water originate from premise plumbing located on private property.

The primary mechanism of corrosion is an electrochemical reaction between a metal surface and water, where the metal becomes oxidized and can dissolve into the water. Once dissolved, the metal ion can remain dissolved in the water or react with other constituents in the water to form solids that can deposit on the inside of pipes. For example, when iron pipes corrode, they can lead to red-water events or to build-up of iron scale layers and tubercles that restrict flow. These interior scale layers can also accumulate other metals (e.g., manganese, lead, copper, arsenic, radium, etc.), which can be released back into the bulk water if the scale layers are disturbed. Scale layers are highly heterogeneous and reflect the history of different processes occurring at the pipe surface over its lifetime.

Another significant mechanism of lead and copper release is microbiologically induced corrosion, which occurs when biological activity increases the release of metal into the water. Biological activity can lead to acidic microenvironments near metal surfaces that increase corrosion rates and/or dissolve existing scale attached to those surfaces. Microorganisms can form biofilms on interior pipe surfaces and become interspersed with metal scale layers.

Additional corrosion mechanisms include galvanic corrosion and erosion corrosion. Galvanic corrosion is a less significant corrosion mechanism and results from electrochemical interaction between dissimilar metals (for example, copper pipe with lead solder and brass fittings).

Developing Passivation Layers
A key component of effective corrosion control is developing a protective, “passivating” layer on metal surfaces to provide a physical barrier between the metal surface and bulk water. By limiting contact between the metal surface and water, multiple corrosion mechanisms are inhibited. An effective passivating layer has several characteristics: low solubility, uniform coverage on the metal surface, low porosity, and strong integrity under variable hydraulic conditions.

Some effective passivating layers develop naturally without chemical addition if the water quality conditions are amenable. For example, lead pipes can form stable scales of lead oxide (PbO₂) or lead carbonate complexes (e.g., PbCO₃, Pb₃(PO₄)₂(OH)₂). Likewise, malachite (Cu₂CO₃(OH)₂) and cupric hydroxide (Cu(OH)₂) passivating layers develop on copper pipe over time under favorable water quality conditions.

The addition of orthophosphate or silicates can be used to promote the formation of insoluble passivating layers, such as lead-phosphate complexes (e.g., Pb₃(PO₄)₂, Pb₅(PO₄)₆). Addition of orthophosphate has been shown to inhibit corrosion of lead, copper, and iron, but its effectiveness depends on several water quality conditions, such as pH and oxidation-reduction potential (ORP). Orthophosphate addition enables formation of stable lead scales near neutral pH and without high oxidant conditions and are typically most effective in the pH range from 7.4 to 7.8. Some water systems use a blend of orthophosphate and polyphosphate to meet multiple treatment objectives, and it is important to note that polyphosphates play a different role in finished water stabilization. Polyphosphate can sequester iron, manganese, and...
other metals to limit unwanted deposition; however, it does not limit, and may in fact increase, lead and copper corrosion through increased solubility [4, 2].

Not all scale formation helps to control lead and copper release in distribution systems. Multiple studies and best practices advise that calcium carbonate (CaCO₃) does not protect against uniform corrosion [2, 1] because the material is too porous to provide a good barrier. Therefore, metrics related to calcium carbonate formation (i.e., Langier saturation index, calcium carbonate precipitation potential, Ryznar index, etc.) are not predictive of corrosion control effectiveness. In fact, calcium carbonate precipitation can interfere with other passivation measures, such as orthophosphate addition [2].

Water Quality Parameters that Impact Corrosion and Scale Formation

Since effective corrosion control relies on developing a stable passivation layer on metal surfaces, bulk water chemistry and biostability play key roles. Biostability is the propensity of a water to support biological activity and depends on assimilable organic carbon, nutrient concentrations, and disinfectant residuals. Water pH ORP, as well as concentrations of alkalinity, hardness, dissolved inorganic carbon, natural organic matter (NOM), and ammonia all affect corrosion rates, passivation layer formation, and layer stability. [1, 8, 2]. Water pH and alkalinity within the distribution system affect lead and copper metal solubility and buffering capacity. Buffer capacity is important for stabilizing pH despite the presence of destabilizing chemical and biological processes in distribution systems. Natural organic matter (NOM) impacts metal solubility and can serve as a food source for microbial processes leading to biofilm growth and MIC. Many water quality parameters and their impact on corrosion are interrelated. For example, without adequate biostability, ammonia in distributed water can support growth of nitifying bacteria, which can reduce water pH if buffering capacity is insufficient [1]. This interconnection makes it difficult to relate changes in a single water quality parameter to a change in corrosivity.

Chemical addition at water treatment plants, including coagulants and disinfectants, affects the corrosivity of finished water in distribution systems. Disinfectant type and residual throughout the distribution system governs the oxidation-reduction potential of water, which in turn affects the speciation of lead, copper, and other metals and their ability to form passivating scale layers. Changing disinfectant (e.g., free chlorine to chloramine) or dose may disrupt passivation layers and require a change in corrosion control approach. Higher doses of chlorine can promote lead oxide scale formation, but this passivating layer may not be stable using chloramines as a secondary disinfectant [6, 2]. Maintaining disinfectant residuals manages biological growth and inhibits microbial-induced corrosion. Disinfection is a balancing act, as increasing the disinfection dose may not be feasible due to increased potential for disinfection byproduct formation [8].

Engineering Controls

Water systems have several options for adjusting finished water quality at the water treatment plant to achieve optimal corrosion control. Chemical addition can be used to adjust pH, alkalinity, and buffer capacity. In general, passivating layers are more stable at higher pH, but the ability to adjust pH depends on the calcium and dissolved inorganic carbon content of the finished water [1]. Corrosion inhibitors (i.e., orthophosphate, silicates) and sequestrants (e.g., polyphosphate) can be used to manage water quality. The EPA Optimal Corrosion Control Technical Recommendations provide a series of flowcharts to identify appropriate chemical addition strategies depending on treated water dissolved inorganic carbon, pH, presence of iron/manganese, and contaminants observed (i.e., lead or copper) [1].

Maintaining consistency in water quality throughout the distribution system is one of the most important tools for managing corrosion. If finished water quality changes due to shifts in source water or treatment processes, the impact on water quality in the distribution system should be evaluated. Care must be taken to implement changes strategically and gradually. Proactive monitoring for key water quality parameters can identify adverse changes in water quality conditions early to allow for corrective measures before lead and copper exceedances. If exceedences occur, regular monitoring of chemical and biological parameters at representative locations throughout the distribution system can help pinpoint underlying causes and remedies.

Introduction to LCR Monitoring in Minnesota

The LCR requires systems to monitor drinking water at customer taps. If lead concentrations exceed an action level of 15 parts per billion or copper concentrations exceed an action level of 1.3 parts per million in more than 10 percent of customer taps sampled, the system must undertake a number of additional actions. This could include conducting a corrosion control study, implementing corrosion control treatment, conducting additional monitoring, and performing public education. Systems that have installed corrosion control treatment in response to an action level exceedance are typically required to collect water quality parameters from sites in the distribution system. MDH reviews these results looking for stable, consistent distribution water quality.

Finding and maintaining a pool of monitoring sites that meet EPA selection criteria is important for selecting representative sample sites. Systems should maintain their inventory of lead service lines and review existing sampling sites, and document their efforts to find sampling site volunteers and rationale for changes in sample sites. The highest priority sampling sites, called “Tier 1” sites, are single-family structures that contain either (a) lead pipes or a lead service line (including full or partial lead service line, or lead gooseneck), or (b) copper pipes with lead solder installed between 1982 and 1986.

The number and frequency of samples a system must collect for lead and copper monitoring is based on the system’s population and compliance history. Required monitoring frequency ranges from six months to three years, depending on system age and whether recent changes have been made.

MDH encourages all systems considering changes to treatment operations or source water to review proposed changes with MDH beforehand to implement any needed monitoring changes occur in a timely manner and minimize unintended consequences. If two water systems are planning an interconnection, both systems should
consider corrosion control needs and water quality stability, and clearly delineate which system will provide any needed corrosion control treatment.

**Regulatory Updates Relevant to Minnesota**

EPA has been considering significant changes to the LCR and announced a “War on Lead” in January 2018. EPA has been gathering information from states, water systems, AWWA, ASDWA, and other stakeholders about potential changes to the LCR. You can read more about some of the proposed ideas here: [www.epa.gov/dwstandardsregulations/lead-and-copper-rule-long-term-revisions](http://www.epa.gov/dwstandardsregulations/lead-and-copper-rule-long-term-revisions).

Based on legislation passed during the 2017 Minnesota Legislative Session, public and charter school districts are required to have a lead sampling plan and to begin monitoring by July 1, 2018. Schools are required to make test results publicly available. Water systems may want to collaborate with schools to communicate a consistent message regarding the source of lead in any results the schools may find.

**Conclusions**

In summary, water systems should manage their water quality to maintain consistent chemistry and support development of effective passivating scale layers within their distribution systems. Recent publications, including the references listed below, provide more in-depth information and decision-making resources for water systems operators and engineers.

**References**


The phrase “water, water, everywhere …” may resonate with you – if, like me, you call Minnesota your home. It’s the “Land of 10,000 Lakes.” In this region, we are lucky to have adequate freshwater supplies to meet our population’s needs. The state has highly productive aquifers that are heavily relied on by municipalities in the Twin Cities metropolitan area, and there are large surface water bodies that we are also able use.

This is an entirely different hydrologic context to what I experienced growing up in California. California has always faced water management challenges and will continue to do so. Though California has a Mediterranean climate with a well-defined dry season, it is a climate intrinsically of extremes. The state has dealt with seasonal and multi-year droughts, and the duration and severity of these multi-year droughts will likely increase in coming years. In addition to droughts that have plagued California, the majority of precipitation falls in the northern part of the state, but the majority of water is used in the southern part of the state.

Therefore, California has an extremely complex network of conveyance and storage infrastructure to transport water throughout the state. In 2013, while working for the Stockholm Environment Institute (developers of WEAP, Water Evaluation and Planning software), I began work on a project with Stantec where I learned more about California hydrology and the complex operations that accompany water conveyance throughout the state.

Using the WEAP software, I worked on a team to develop the Sacramento Water Allocation Model (SacWAM) for the State Water Resources Control Board (State Water Board) in California. The State Water Board is the state agency in California that governs water rights, determines water quality standards, and regulates wastewater and stormwater discharges throughout the state. The WEAP software embeds a hydrologic model within a system operations model. The model estimates stream flows throughout the Sacramento Valley, one of the largest and most productive agricultural regions in the United States.

Understanding baseline water availability throughout the Sacramento Valley region allows decision-makers to better allocate surface and groundwater resources, and understand future and alternative management scenarios. For example, SacWAM can be used to estimate the monthly flow regime in a river, or typical storage levels in a lake or reservoir, and it can also be used to simulate future flows in that same surface water body, under various regulatory or climatic scenarios. For instance, our reliance on a certain water body could be sustainable under existing conditions, but if we were to increase the population that relies on that supply source by 20 percent in the next
30 years, what would that then mean for surface water levels? The WEAP software allows us to inform crucial water management questions that will face future generations.

Water management in California is certainly different, given its unique geography, climate, and artificial conveyance system. The types of questions that are being asked in California will inherently be different from other states. That doesn’t mean that there is no role for quantitative tools to be used by planning agencies, cities, and states in the often water-rich Midwest. For example, despite an apparent abundance of freshwater resources in Minnesota, water-supply issues do exist and will likely become more prevalent with population growth in urban centers.

A great example is the historic water resources lawsuit surrounding groundwater appropriation in the Twin Cities related to White Bear Lake in Washington County, Minnesota. Plaintiffs claimed that groundwater used for public water supply in this area was over-appropriated and that a protective lake water elevation for White Bear Lake should be set. This single issue is not an isolated case-study. Already, issues are popping up across Minnesota related to groundwater use and stormwater quality for irrigation – issues that highlight the critical need to understand the intricate relationships water has throughout its lifecycle.

Water is an inherently complex resource to manage – it is often not available when and where we need it, and there are many stakeholders with a variety of needs that must be met. This is likely not the only water resources management decision that Minnesota will face in the next few decades. Long-range planning is crucial to understanding the temporal and spatial availability throughout the Twin Cities metropolitan area. Are we currently using quantitative tools to understand water resources availability? Do we understand what future availability may be, given factors such as climate change and population growth? Quantitative water balance models like WEAP can help us to make informed management decisions.

**About Ailsa McCulloch:** Ailsa McCulloch works in Stantec’s Water Resources group in the Twin Cities office, working closely with municipalities on stormwater design and management issues.

Lake Shasta on the Sacramento River provides water supply for large urban and agricultural centers in California. It was modeled in the Sacramento Valley WEAP program to understand water supply reliability.
Q&A WITH AWWA PRESIDENT
Brenda Lennox

1. Three words that describe your experience (so far) as the President of AWWA.
Humbling, amazing and fulfilling experience to make a difference. (Ok more than three.)

2. To elaborate, is there a specific (good, funny, uplifting) highlight/experience that stands out?
As a visiting officer, I have an opportunity to meet folks from AWWA’s forty-three sections. Even though independently we face local and regional issues, water professionals are often more similar than not. I have found we share the same common value and goal regardless of where we live. We are service oriented professionals that want to give back to our communities. We impact the daily quality of life by providing safe water. This is consistent all over North America.

3. What have you learned about AWWA that you didn’t know before?
I’ve always known that AWWA is a complex organization. I’ve learned that to sustain the largest organization of water supply professionals in the world that was founded in 1881 by engaging the expertise of volunteers is a powerful model. What a network of resources you can build by engaging 51,000 water professionals.

4. What do you foresee for the future of AWWA as an organization?
AWWA will maintain a strong leadership role as we will continue to confront top concerns that face water professionals in innovative ways such as addressing aging infrastructure concerns through WIFIA, fighting nonpoint source pollution through the Farm Bill, and providing input to the USEPA on anticipated revisions to the Lead and Copper Rule.

AWWA continues to address the aging workforce and talent retention concerns through several initiatives, including a guided effort with its 43 Sections to connect veterans and transitioning services members to jobs in the water sector. I had the privilege of meeting with CEO David LaFrance, Katie McCain, Past AWWA President, other Association volunteers and staff in Washington last August along with representatives from Soldier for Life, Marine for Life, Veterans Affairs, the Department of Labor, and Department of Defense to build awareness and strategies that help veterans work in the water sector. This was a great opportunity to focus on one of my goals as President to recruit veterans to our water profession.

As professionals in the water sector retire, our need for talent pools of qualified individuals is increasing. We protect public health and environment 24/7/365. There will always be work in water and many veterans have skill sets that match our needs. Military members have been targeted as a good fit for the sector because of their technical expertise and experience working non-traditional hours in a regulated environment.

These are just a few examples that establish AWWA as a prominent leader.

5. Which section(s) hosted the best happy hours/networking events?
As I engage in section networking events I’ve met folks from many regions and professional backgrounds. What an amazing water family we have. Each section welcomes you with hospitality and graciousness as if you are one of their family. EACH Section is the “best” and I would revisit any one of them in a second!

AWWA past-president Jeanne Bennett-Balley.
6. If you could serve another term as President, would you? Why or why not?
If I could serve another term as President I would welcome the opportunity. Any opportunity to make a difference is worth a sacrifice. While this past year has required a lot of work, and time away from family, the experience has definitely been worth it!

7. You’re an inspiration for women in your industry, what advice would you give to a woman with her sights on becoming the 4th ever female president of AWWA?
One of Walt Disney’s most famous quotes “If you can dream it, you can do it.” I’ve embraced this value in my competitive barrel racing for four decades. It also transitions into your professional career. Do not underestimate your role or the contribution you can make to the water profession. If you have the desire and passion to serve, step up. Volunteer for assignments even if it is outside of your comfort zone. Seek out successful leaders around you to serve as mentors as you navigate your professional journey.

8. Did your role as President help you to finally overcome your fear of public speaking?
Well this is a great question! I will say public speaking is still not the favorite part of my job. However, I’ve had a lot of practice speaking in many different settings over the past year. As with anything, practice (and a lot of preparation!) has helped.

9. Do you plan to continue to grow diversity within AWWA leadership? How so?
As I began my role as President another of my focus areas was diversity and inclusion. As an association, AWWA has been encouraging diversity in various forms for nearly 30 years. Since 2013 the AWWA Strategic Plan includes Fostering Diversity and Inclusion (D & I) as one of AWWA’s core principals. Even with 30 years of focus, we still have opportunity to strengthen our commitment to D & I by embracing it at all levels throughout our organization. I am committed to taking every opportunity to continue to raise awareness of D & I’s importance and encouraging water professionals to embrace it.

As leaders, we must diligently continue to seek out, recognize and honor the knowledge we gain from our differences.

10. What are your plans a day or a week following your presidency? How about a year?
Many of you know that my hobby is barrel racing which is a timed event with a horse. My horses have always been my therapy. My plan for the summer is to spend a lot more time at competitive barrel racing with my husband Jerry and daughter Michele. From there we will see what’s in store.

11. Do you have any final thoughts, or anything you’d like to share with the Sections as your AWWA presidency comes to a close?
It has been a privilege to serve with the high caliber of water professionals in AWWA. Many of my colleagues have become lifelong friends. The water profession is a noble career that makes a difference in quality of life for our communities. I did not choose the water profession as a career with intent. Once I landed here I never looked back and have enjoyed a 30+-year career. My message to Sections would be to share your story with young professionals and students. This is a service industry. We make a difference every day in quality of life for our families and communities. Whether you are an operator, customer service professional, engineer, scientist, human resource professions, and the list goes on, the water profession is a great place to be! •
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Skids Designed The Way You Want It
Disasters are opportunities for Rochester, Minnesota. An August 1883 tornado, which left widespread destruction and 26 dead, led to the city’s first hospital, led by Dr. William Worrall Mayo and his sons. This was the beginning of the Mayo Clinic and the first sign of Rochester’s future as a medical center.

Nature tore through the city again nearly a century later – a flood that killed five and caused $60 million in damage. This disaster led to the “Renaissance of Rochester,” pulling the city out of a decade of stagnation and signaling the beginning of an era of unprecedented construction.

One of the city’s primary agencies, Rochester Public Utilities, has been working for years to make sure it does not have another kind of disaster – too little water. Groundwater planning, asset management, source water protection, and pro-active strategies are at the heart of sustainability efforts to ensure that the utility can continue to supply safe drinking water to a city that is growing, residentially and commercially.

**Background and History**

Rochester grew up on the south fork of the Zumbro River, which provided power from its falls but also feeder creeks that were prone to flooding.

With safety a primary concern following the 1883 tornado, the city contracted with a private company, Hodgkins, Moffet, and Clark of Waterville, New York, to operate a water system although fire protection, not drinking water, was the primary motivation.

In 1916 the city purchased the water works company and began adding wells and storage facilities. The 1920s saw the addition of a chlorinator to disinfect the water and a major construction project, which included a 128-foot-high tower near St. Mary’s Hospital that holds 200,000 gallons. The tower, no longer in service but still a landmark for Rochester Public Utilities (RPU), provided adequate pressure to the area surrounding St. Mary’s Hospital and was the beginning of the high-level system still in use today.

**Profile**

Today, Rochester has a population of more than 114,000 and expects annual growth of 1.6 percent for the next 10 years, according to Cary Johnson, RPU manager of maintenance and construction – water operations. In addition, the city is in the early stages of Destination Medical Center, a 20-year economic development initiative that includes expansion of the Mayo Clinic. Water design project coordinator Donn Richardson notes downtown redevelopment and more high-density apartments in the city as another reason for the growth.

The utility has 32 wells (and is adding another in 2018) and pumps approximately 4.7 billion gallons of water per year. (RPU pumped 4.49 million gallons in 2016.) The wells range in depth from 400 to 1,000 feet and draw mainly from the Jordan Aquifer, a sedimentary unit that underlies much of southeastern Minnesota. Other multi-formation aquifers – Prairie du Chien-Jordan, Prairie du Chien-Wonewoc, Jordan-Wonewoc, and Prairie duChien-Mt. Simon – supply water for Rochester.

The wells are interconnected, and the water is treated with chlorine, fluoride, and a polyphosphate for corrosion control at each site. Johnson noted the complexity of the distribution system, which has numerous pressure zones. Nineteen storage facilities hold nearly 17 million gallons of water.

Even though the customer base is growing, the per capita usage is going down says Sidney Jackson, RPU director of core services.

Senior civil engineer Doug Klamerus credits residents and businesses for understanding the need to conserve and use water wisely. “The community is seeing the big picture,” Klamerus said, “I see nothing but support for the conservation program.”

**Sustainability**

Todd Osweiler, environmental and regulatory affairs coordinator, said the announcement about Destination Medical Center, as well as other water concerns in the news, “brought up the question of how much we can keep on pumping.” RPU has partnered with Barr Engineering of Minneapolis, the U. S. Geological Survey, and the Minnesota Department of Natural Resources on groundwater studies and evaluation.
“We became pro-active about sustainability,” said Osweiler. “All this spurred more on sustainability.”

A sustainability evaluation has included input from stakeholders, review of existing data, groundwater modeling to determine the potential impact of future pumping, identification of data gaps that produce uncertainty in modeled predictions, and the development of a monitoring plan.

Osweiler outlined the four components RPU has for conservation and sustainability: leak detection, rate setting, water rebates, and education.

The utility performs a leak detection survey on half the system each year, using resources to find and fix leaks, resulting in water accountability of more than 95 percent.

Rates are set with a multi-tiered structure that rewards low usage. Commercial irrigation is the highest tier grade. “Use more, pay more,” says Klamerus.

RPU encourages residents to replace fixtures with ones that use less water and provides rebates for such purchases. Osweiler says in 2015 that RPU issued nearly 1,600 rebates that have resulted in savings of 8.8 million gallons.

At the heart of the sustainability effort is education. The more people understand all that is involved in producing and maintaining safe water, the more that are willing to do their part in protecting and conserving it.

Tours bring in school children, who are asked for their ideas on protecting water. Rochester has three times hosted the American Water Works Association Drinking Water Institute, a four-day summer program for Minnesota science teachers to learn about water and develop inquiry-based activities to integrate into their existing curriculum.

RPU Plugged In is a monthly publication with information on easy ways to conserve water, how to find leaks in homes, and updates on what utility projects. RPU promotes drinking tap water instead of paying for bottled water by encouraging schools and business to install filling stations for reusable water bottles. The annual water quality report (Consumer Confidence Report) is included in one of the issues each year, and the utility has put coupons in the publication for residents to get a free water bottle.

It also offers a Service Assured Program for a monthly fee, which covers repairs on portions of the water system that belong to a resident, such as the service line.

Asset Management and Enhanced Sampling
RPU employs asset management to budget for future projects. A two-year study now underway will plan for the next 30 to 40 years, examining the life expectancy of current infrastructure and identifying critical assets and their impact on customers. Having a plan to rehabilitate or replace pumps, pipes, and storage facilities allow for controlled maintenance rather than crisis situations.

Water main repairs have historically been dictated by when and where street repairs were being made. Klamerus says a more collaborative approach, which includes the needs of RPU to replace or rehabilitate water infrastructure, is now part the decision-making process for future street repairs. Klamerus said asset management planning is a way to gain a better understanding of the extent of
financial investment needed to maintain our current level of customer service. If more investment is needed than current street repair projects allow, RPU will look at the most financially feasible option between full water main replacements or trenchless rehabilitation technology to maintain the utility’s infrastructure for additional projects.

In addition to planning to avoid dealing with emergencies, asset management is a budgeting tool, a way to avoid radical rate increases.

Beyond sampling for contaminants regulated under the federal Safe Drinking Water Act, RPU has been involved in a general chemistry project, testing under the Unregulated Contaminant Monitoring Rule, and special projects such as a pesticide study in conjunction with the Minnesota Department of Health (MDH) and Minnesota Department of Agriculture.

MDH district engineer Paul Halvorson said, “It is some of the most sampled water in the state.”

“All of our data will help them in the future as they use their models to evaluate groundwater sustainability.”

RPU has 6 water operators and 11 people in the field with GPS in all trucks and iPads with all staff. Two of the trucks have a SCADA interface in them. “What helps me in getting samples in an efficient manner is the operator’s ability to operate the system remotely via SCADA in the truck,” says Halvorson. “With this, the operator can have the required wells running for a while before I get there, so it’s a quality, representative sample.”

As is the case with every water system, the quantity and quality of drinking water is paramount. Reliable service is necessary. Rochester Public Utilities serves a city that has been used to challenges from nature, and it is determined to not allow anything to disrupt the water service to Rochester residents.

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<td><a href="mailto:jami@epuc.net">jami@epuc.net</a></td>
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<td>William Anderl</td>
<td>Minneapolis Water Works</td>
<td><a href="mailto:bandenl@yahoo.com">bandenl@yahoo.com</a></td>
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<td>Todd Anderson</td>
<td>City of Maple Grove</td>
<td><a href="mailto:todd.anderson@ci.maplegrovenn.mn">todd.anderson@ci.maplegrovenn.mn</a></td>
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<td>Scott Anderson</td>
<td>City of Bloomington</td>
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<td>Brett Anderson</td>
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<td><a href="mailto:brett.anderson@minneapolis.gov">brett.anderson@minneapolis.gov</a></td>
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<td>Anita Anderson</td>
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<td>Michael Anderson</td>
<td>Minneapolis Water Services</td>
<td><a href="mailto:mike.anderson@ci.spaun.us">mike.anderson@ci.spaun.us</a></td>
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<td>Minneapolis Department of Health</td>
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<td>Minneapolis Div of Water Trmns &amp; Dist Srvcs</td>
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When making purchasing decisions about products and services in the wastewater industry throughout Minnesota and beyond, please support the companies whose advertising makes the Breeze magazine possible. You will find them quickly with our convenient, easy to use Buyers’ Guide. On the following pages, you will find information that will help you meet your purchasing requirements throughout the year ahead. The initial section of this Guide lists categories of products and services along with the various companies that can provide them to you. The following section provides an alphabetical listing of those companies, as well as the contact information you will need to reach them.

**CATEGORIES**

**Activated Carbon**  
CEI-Carbon Enterprises Inc.

**Acoustic Pipeline**  
**Condition Assessment**  
M.E. Simpson Co., Inc.

**Advanced Metering Infrastructure**  
M.E. Simpson Co., Inc.

**Aeration Blowers**  
Hardy Pro-Air Systems & Service

**AMR Systems and Meters /AMI Solutions**  
Core & Main  
Dakota Supply Group  
Ferguson Waterworks  
HD Supply Waterworks  
Metering & Technology Solutions  
Mid America Meter, Inc.  
Sensus, a Xylem brand

**Anthracite**  
CEI-Carbon Enterprises Inc.

**Backflow Prevention**  
HydroCorp

**Chemical Processing & Feed Systems**  
TGO Technologies

**Coatings, Linings, and Corrosion Control**  
Bolton & Menk, Inc.  
ESS Brothers & Sons Inc.  
General Repair Service

**Communication**  
AE25

**Cross-Connection Control**  
HydroCorp

**Data Collection & Management**  
M.E. Simpson Co, Inc.

**Design-Build Contractor**  
AECOM  
Black & Veatch Corporation  
Brown and Caldwell  
Disinfection/Equipment  
Ferguson Waterworks

**Disinfection/Equipment**  
TGO Technologies

**Electrical Instrumentation/Controls/Generators**  
AE25  
Mid America Meter, Inc.  
Thompson Automation and Specialty Services  
Ziegler Power Systems

**Electrical Safety Services**  
Thompson Automation and Specialty Services

**Engineers/Consultants**  
AE25  
AECOM  
Apex Engineering Group  
Aqua Backflow  
Black & Veatch Corporation  
Bolton & Menk, Inc.

**Environment**

**Environmental Contaminant Treatment Systems**  
TGO Technologies

**Environmental Scientists/Services**  
Aqua Backflow

**Filter Media Remove/Supply & Install**  
CEI-Carbon Enterprises Inc.  
Tonka Water  
Filtration  
CEI-Carbon Enterprises Inc.  
Tonka Water, a U.S. Water Brand  
Vessco, Inc.  
WSB & Associates & Associates

**GIS**  
AE25  
Bolton & Menk, Inc.  
DGR Engineering  
KLJ  
Moore Engineering Inc.  
TKDA  
Witzeth Smith Nolting  
WSB & Associates & Associates

**GPS & Mapping**  
M.E. Simpson Co, Inc.

**Greensand Plus**  
CEI-Carbon Enterprises Inc.

**Land Surveying**  
Bolton & Menk, Inc.  
DGR Engineering  
KLJ  
Witzeth Smith Nolting  
WSB & Associates

**Leak Detection/Correlator Services**  
M.E. Simpson Co., Inc.  
Sensus, a Xylem brand  
Water Conservation Services, Inc.

**Management Consulting**  
Aqua Backflow

**Manhole and Catch Basin Castings**  
ESS Brothers & Sons Inc.  
Ferguson Waterworks

**Master/Production**  
M.E. Simpson Co., Inc.

**Mechanical Seals**  
General Repair Service

**Metallizing**  
General Repair Service
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