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March 2018 [mmswmag.com](http://mmswmag.com)

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# HIGH-LEVEL SUPPORT

Award-winning operator evolves  
with water system and becomes  
its greatest asset

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Dan Roller  
Southwest Water Authority  
Dickinson, North Dakota

PRODUCT FOCUS:  
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# INSIDE:

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ON THE COVER: Southwest Water Authority operations specialist Dan Roller was named 2017 Outstanding Water Works Employee of the Year by the North Dakota Rural Water System Association for his dedication to the authority and his reliability as the go-to resource for employees at SWA. (Photography by Kyle Martin)



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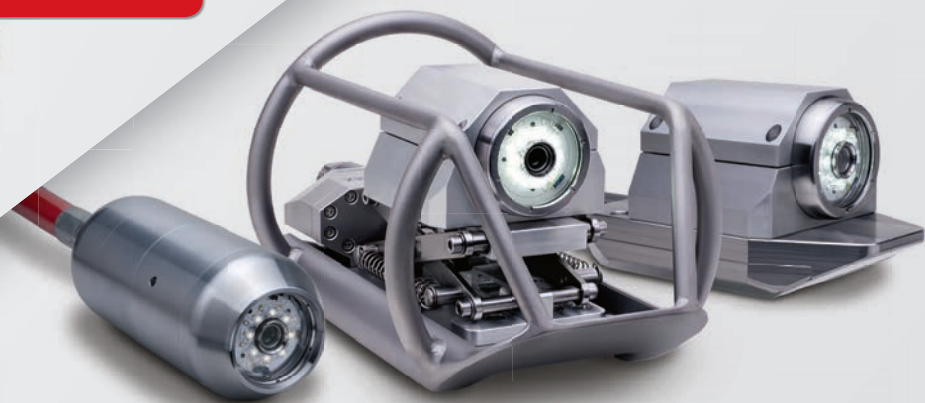
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# BUILD A BETTER STAFF

Outside training opportunities can give your team an advantage in the field

**Y**ou can be a great manager. You can have excellent equipment. You can be proactive and progressive in your approach to system maintenance and improvements. But how do you make sure your staff is capable of carrying out your utility's mission in the field?

I remember my first day working as a mason tender. I'd taken a semester off from college. When my summer job ended, I went to work for a local masonry company. We mostly built basements and poured concrete. My job was relatively simple — mix mud, stack blocks, and puddle concrete. But I'd never done any of it before, and while it was relatively simple, the difference between good and bad tenders was significant.

The masons mostly just expected me to know everything and to do it right — and fast — as soon as I got out of the truck that first day. It's not the most complicated job, but there are nuances. If you've never mixed

**Take the time to develop a culture where learning and developing stronger skills is the norm. That's good for everyone, from new hires to the superintendent and the taxpayers.**

mud, you're not going to know the right consistency. If you've never steered a wheelbarrow of concrete down a 2-by-8-inch plank into a sandy pit to pour footings, you might struggle the first time or two. I dumped one wheelbarrow, once. The hell I caught for it ensured it would never happen again, no matter how deep the pit, narrow the plank, or heavy the load.

I was thrown straight into the mix and was expected to keep up. But I was surrounded by experienced masons who could keep me from doing too much wrong, and as I said, it wasn't a very complicated job. Running water and waste-

water systems is a little different.

Training across utility departments is far from standardized. There aren't apprenticeships. There aren't degrees in sewer cleaning. There are, obviously, operator certification courses, but those don't teach you the ins and outs of running a jet/vac truck or the subtleties of running a camera and coding defects. So what do you do? How do you ensure the people you're sending out to handle calls have the knowledge and skills to properly serve customers and represent your utility? There's no standard answer, but there are some options.

This month's Tech Talk takes a look at Nezat Training and Consulting, one of those options for giving your team a higher level of training. It's a good example of how you can help your crews expand their knowledge base and skill set and ultimately be more productive and efficient.

I was just a grunt in the masonry world, like a third-line grinder on a hockey team that makes up for lesser ability with relentless hard work. It's good to have a few people like that on your team, but you also need to take the time to develop a culture where learning and developing stronger skills is the norm. That's good for everyone, from new hires to the superintendent and the taxpayers.

Regardless of how you train new employees or help your experienced operators stay up to date with new technology, there's always room for improvement. The more opportunities they're given to learn and grow, the more valuable they'll be.

Enjoy this month's issue. ♦




**FROM THE EDITOR**


*Luke Laggis*

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## FIGHTING POLLUTION

### City Uses Multi-Faceted Approach to Keep Pollutants Out of Waterways

Sources of waterway pollution can take many different forms, and in recent years, the San Jose Environmental Services Department in California has been attempting to target each one in an effort to clean up waterways in the Santa Clara Valley. The department and its various stormwater management practices were featured in the February issue. In this online exclusive, learn more about other methods the department is using to reduce waterway pollution. [mswmag.com/featured](http://mswmag.com/featured)

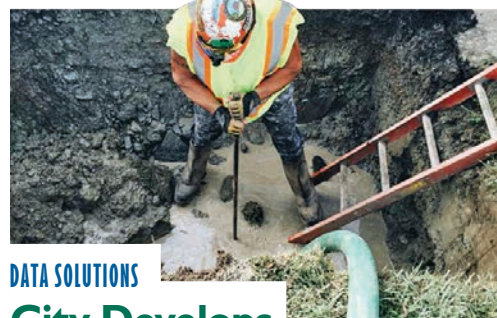


## MAINTENANCE MATTERS

### 8 Tips on Caring for a Tracked Excavator

Although there are many trenchless technologies that can be used these days to take care of underground infrastructure projects, sometimes your utility still needs a more traditional excavation approach. But just because tracked excavators are a familiar sight out in the field doesn't mean maintenance is any less important. Keep these tips in mind to keep your excavator running and productive.

[mswmag.com/featured](http://mswmag.com/featured)



## DATA SOLUTIONS

### City Develops Predictive Modeling for Water Main Breaks

Syracuse, New York, once dealt with 332 water main breaks annually on average in its 550-mile distribution system to the tune of \$1 million. But the city is gradually reversing that trend and trying to take a more proactive approach to the problem, backed by a data algorithm developed with the help of a University of Chicago program. Learn more in this online exclusive. [mswmag.com/featured](http://mswmag.com/featured)

## OVERHEARD ONLINE

“Investing in infrastructure shouldn't focus only on conventional and costly capital projects to expand gray infrastructure. Our analysis proves that lower-cost efficiency programs produce strong economic benefits and should be prioritized by policymakers.”

— *Study Estimates Water Efficiency Could Boost Economy by Billions of Dollars* [mswmag.com/featured](http://mswmag.com/featured)



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# HIGH-LEVEL SUPPORT

Award-winning operator evolves with water system and becomes its greatest asset

*By Jared Raney*

Few operators have been around as long as the system they serve, but Dan Roller is pretty close.

The veteran employee's knowledge and insight into the workings of a system he helped build from the ground up over the past 24 years are some of the Southwest Water Authority's biggest assets.

Roller was named 2017 Outstanding Water Works Employee of the Year by the North Dakota Rural Water System Association for his dedication to the authority and his reliability as the go-to resource for employees at the Southwest Water Authority.

"Dan is an outstanding employee. He has represented Southwest Water Authority in the state of North Dakota so well," says Mary Massad, CEO of the Southwest Water Authority. "He has unique abilities that he's able to bring forth to the authority. ... Southwest Water Authority is just very fortunate to have Dan."

## A broad role

Roller oversees many of the SCADA and telemetry operations for the Southwest Water Authority, in addition to being the de facto resident expert on all equipment and technology. As Massad says in her nomination letter, "Dan's official title at SWA is operations specialist, but with his technical and mechanical expertise, he is so much more."

*(continued)*

**Southwest Water Authority operations specialist Dan Roller surveys a new customer service location east of Dickinson, North Dakota. The data will be imported into a Trimble Geographical Information System. (Photography by Kyle Martin)**

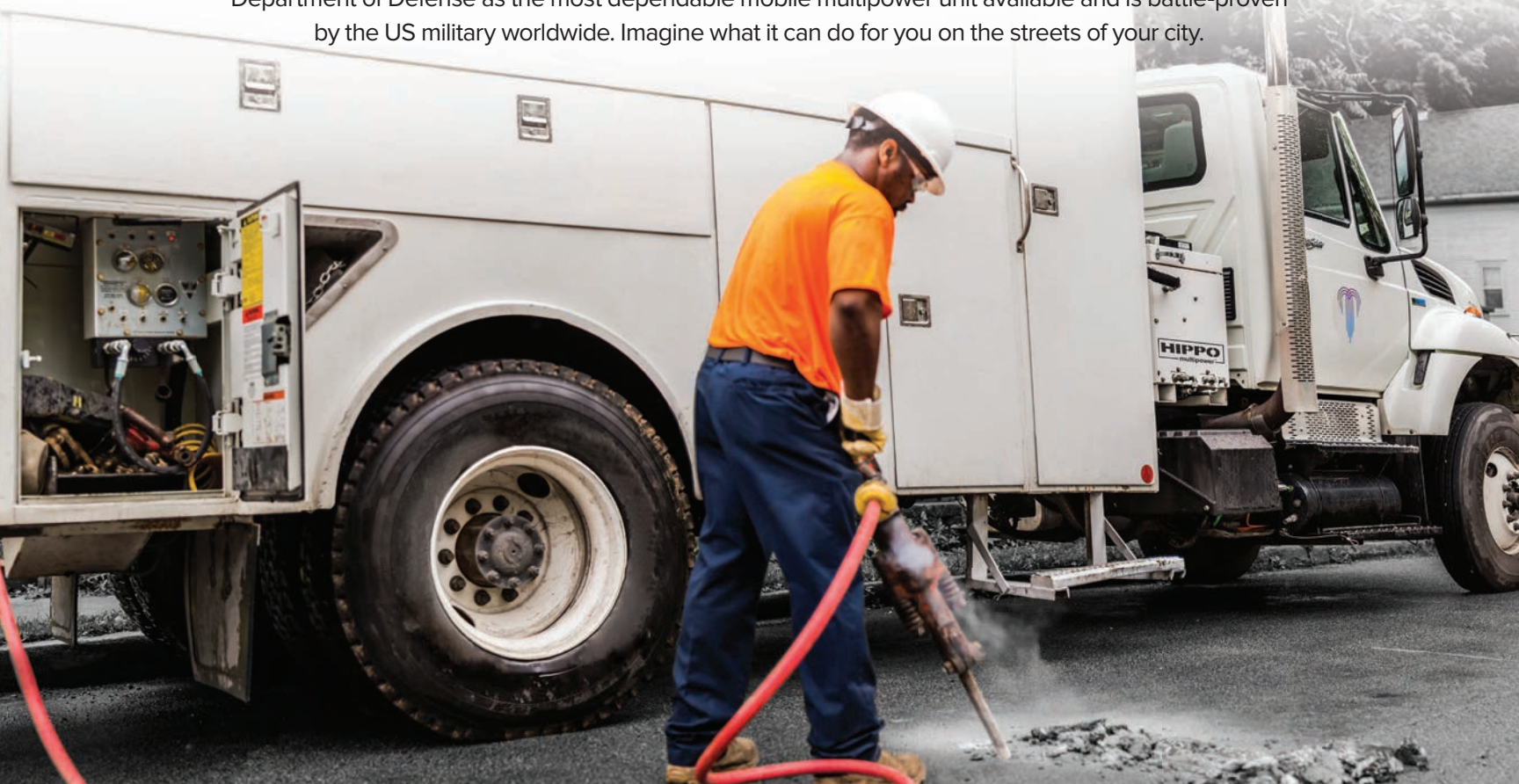




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**Dan Roller inspects the installation of new meters at the Ray Christensen Pump Station.**

**“If he doesn’t have the answer, doesn’t know the answer, he will find it. He will go read about it. He will look at the O&M manuals. He’ll contact whoever needs to be contacted. He follows through with things very well. He’s very reliable.”**

**Mary Massad**

Having been around since nearly the beginning has given him a level of insight that few at the utility possess. He was there when the SCADA system — as well as most of the equipment at the Southwest Water Authority — was put in place. He was around when the engineers were installing the system, able to ask questions directly and even offer input from the operators’ perspective.

It makes him an invaluable asset for the rest of the employees — even the managers.

Roller has also taken over the onerous task of regulation paperwork. “I think the biggest thing that scares people with the water industry is the regulations,” Roller says. “They don’t want to be

responsible for that. But somebody has to deal with that stuff.

“I do a lot of things for them. There’s a lot of pieces to this puzzle, and people don’t realize how many pieces there are until you’re sitting in a position where you have people coming to you for help; you’ve got new equipment coming in that you’ve gotta learn. There’s so many aspects, and I don’t think people really understand how much there is to moving water,” Roller says. “They just think you open the faucet and it moves, but there’s a lot more to moving water than I ever anticipated, ever thought when I started.”

*(continued)*



**PROFILE:**  
Dan Roller,  
Southwest Water Authority

**POSITION:**  
Water distribution  
operations specialist

**BACKGROUND:**  
2 years as a diesel mechanic  
at farm implement store; 8 years as rig  
operator in oilfields; 8 years working  
for an electrician

**CERTIFICATION:**  
Grade III water distribution operator

**AWARDS:**  
2017 Outstanding Water Works  
Employee of the year, North Dakota  
Rural Water System Association





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**“He’s really grown; he’s stepped into his position. He always steps up to the plate. I think he has grown with our project just as our project has grown.”**

**Mary Massad**

### **Mechanical man**

The Southwest Water Authority took over maintenance and operation of the Southwest Pipeline Project in 1996. At that time, Roller was a maintenance worker with the State Water Commission, which was in charge of the project before the Southwest Water Authority took over.

It didn’t take long for Roller to work his way up the ladder, reaching top certification as a Grade III water distribution operator in 2003.

**Roller checks the Micro-Comm radio communications on a pump station SCADA panel in the station’s pump control room.**

“After I was a Grade I, they kind of start throwing you just a little more responsibility,” Roller says. “My manager would send me to training classes and ask me to report back on specific things. That’s kind of how I ended up with taking care of regulation paperwork; it just fell in my hands.”

Before coming into the water industry, Roller ran the gamut of service industry work, from oil drilling to electrical work and even farm equipment maintenance. It’s that wide variety of experience in all things mechanical that has allowed Roller to succeed at the Southwest Water Authority.

“His varied and wide knowledge gives him

the ability to understand what’s going on and come up with ideas, and to troubleshoot,” Massad says. “He’s the go-to person for — say a valve’s not operating right or the city’s system isn’t working right — everything about the system, whether it be mechanical or electrical.”

### **Go-to resource**

“I grew up with all this stuff; I know a lot about different areas, so basically I’m in a high level of support for other people,” Roller says. “I have a good feel for how our stuff operates and can do some electrical troubleshooting on our side.”

Even with new equipment, Roller becomes

## **OLD DOG, NEW TRICKS**

Dan Roller isn’t just an excellent resource for the Southwest Water Authority, he has also pushed to improve the system through his 24 years there — for example, the implementation of automatic satellite-read water meters.

Roller pushed for and took the lead on the program, which allows the authority to get daily reads throughout the system.

“I was quite influential in our automatic meter reading system, which we’re still in the growth process of,” Roller says.

Roller saw automatic meter reading as a money-saving and efficiency-increasing measure, and he personally researched other utilities and programs using the technology — going above and beyond his official responsibilities to help out.

It’s one of the many reasons he was named 2017 Outstanding Water Works Employee of the Year by the North Dakota Rural Water System Association.

“If anybody comes to me, I will do whatever I can do to help, whether it’s in the office, out in the field, doing things beyond my duties,” Roller says. “I haven’t really ever said no to anybody.”





**Roller reviews blueprints at his office at Southwest Water Authority in Dickinson.**

the resource because he is willing to sit and learn the system, whether it's by talking to installers or simply reading the manual. Add that to a knack for passing that knowledge on, and you've got an award-winning employee.

"His strengths are knowledge of our system, his ability to understand how it works, and his ability for explaining it and troubleshooting our system — explaining it to employees, to the public," Massad says. "He's able to figure things out and works well with others.

"If he doesn't have the answer, doesn't know the answer, he will find it. He will go read about it. He will look at the O&M manuals. He'll contact whoever needs to be contacted. He follows through with things very well. He's very reliable."

With retirement looming for Roller, those assets make him even more valuable to the authority as the time comes to pass knowledge down to the next generation.

"There's a method to it," Roller says. "I have my way of doing things; other guys have their way. It's whatever works best for you, and all I can do is teach you what I do and why it works for me. And if that doesn't work for you, then you can deviate from that, as long as the end result is the same — that's all you're looking for."

### Creating a legacy

As the most veteran employee for the Southwest Water Authority, with more years of service than even Massad, Roller is more than just a great employee — he's a legacy.

"He's really grown; he's stepped into his position. He always steps up to the plate. I think he has grown with our project just as our project has grown," Massad says.

**"I have my way of doing things; other guys have their way. It's whatever works best for you, and all I can do is teach you what I do and why it works for me. And if that doesn't work for you, then you can deviate from that, as long as the end result is the same — that's all you're looking for."**

**Dan Roller**

Not the kind of guy to brag about himself, Roller never expected the award — but as far as the Southwest Water Authority is concerned, it is well deserved.

"It's kind of nice that people realize how much you are doing for them and award you for it,"

Roller says. "Kind of a shock, I guess. ... It meant evidently everybody's watching what I'm doing, and they appreciate it. It makes you feel good that somebody recognizes you for the things you're doing." ♦



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# LIKE A WELL-OILED MACHINE

At WD-40, a unique corporate culture promoting learning and the freedom to fail yields off-the-chart levels of employee engagement

By Ken Wysocky

**We invite readers** to offer ideas for this regular column, designed to help municipal and utility managers deal with day-to-day people issues like motivation, team building, recognition and interpersonal relationships. Feel free to share your secrets for building and maintaining a cohesive, productive team. Or ask a question about a specific issue on which you would like advice. Call editor Luke Laggis at 800-257-7222, or email [editor@mswmag.com](mailto:editor@mswmag.com).

It's estimated that roughly 70 percent of American workers go to work every day and feel disengaged and dispassionate about their jobs. That's not the case at San Diego-based WD-40 — and it never will be if Garry Ridge, chief executive officer, has anything to say about it.

At WD-40, a whopping 93 percent of employees say they're engaged at work, according to the latest annual employee survey (the company has been polling employees for the last 19 years). Moreover, nearly 100 percent of employees feel their opinions and values are a good fit for the WD-40

culture, and 96 percent respect their coaches, which is what managers are known as at the company.

How did this business — known globally for its 65-year-old signature product, WD-40 penetrating oil — become such an outlier? By focusing on forging a corporate culture centered on what Ridge calls the four P's: people, purpose, passion and products. The primary emphasis? People and purpose, Ridge says.

"People want to have a purpose in life and a purpose to what they do," he explains.

**"My philosophy about leadership isn't about being in charge. Leadership is about taking care of the people in your charge. It's sad that so many leaders suck the souls out of organizations simply by not allowing people to be their best."**

**Garry Ridge**

"Our job as leaders is to create an environment where our tribe members wake up each day and feel inspired about going to work ... and return home at the end of the day fulfilled by the work they've done. They want to feel like they learned something new and contributed to something bigger than themselves. If you can create this world, they'll take care of your customers and, in turn, take care of your stakeholders.

"My philosophy about leadership isn't about being in charge," he adds. "Leadership is about taking care of the people in your charge. It's sad that so many leaders suck the souls out of organizations simply by not allowing people to be their best."

A conversation with Ridge, filled with references to purpose and corporate values and tribes, makes him sound like a guru from some sort of workplace utopia. But if it all seems too good to be true, guess again; there's serious data that clearly documents the success of his approach, which he started to implement a few years after he became CEO of WD-40 in 1997.

Since 2000, WD-40's market capitalization has grown from about \$305 million to more than \$1.6 billion, which Ridge says is a testament to the power of engaged employees. (For the record, WD-40 was originally developed as a rust-prevention solvent for the aerospace industry. The WD is an acronym for water displacement, and the 40 reflects how many tries it took company engineers to develop the product, first used to protect the outer skin of Atlas missiles from corrosion.)

"There's a direct correlation between value created and employee engagement," Ridge points out. "I don't think making a commitment to making people better every day is a bunch of hooey. It's part of our employee development program. We talk to our people at least every 90 days about how to get an A, and I don't mean a mark on their paper.

"Part of getting an A is helping them become better stewards of our values and living those values every day," he says.

In addition, corporate values must discourage micromanaging and instead give employees the freedom to make decisions on their own. This is especially critical for WD-40, a far-flung global company. How do employees make the right decisions? It's easy if they make those decisions based on the corporate values, Ridge says.

"These values aren't something framed and hung in the lobbies of our buildings around the world," he notes. "They're embedded in the conversations we have with our tribe members on a daily, weekly and monthly basis. Our values set our people free."

A central tenet of the WD-40 culture is creating a learning environment. And within that environment, failure doesn't exist in the company's vocabulary. "We don't make mistakes here; we have learning moments," Ridge explains. "We're a learning organization that encourages people to share what's working and what's not working in an open, honest and freedom-based way."

This is important because in too many organizations, employees are afraid to make a mistake for fear that they'll be punished. This results in

*(continued)*





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employees trying to hide failures for as long as possible. The end result? A lost opportunity for a teachable moment that can benefit many other employees. And the problem continues to fester until it becomes a much bigger issue that's more difficult to resolve than if it would've been revealed earlier on in the process, Ridge notes.

There is a learning curve for employees to adapt to this new culture. "It was hard," he concedes. "But leadership is hard work. There are too many people out there who want to lead but don't want to do the work."

Another central facet of Ridge's leadership principles is based on three simple words: I don't know. And the ability to stop and say those words requires what he calls "conscious incompetence" — a willingness to admit you don't have all the answers. "When you say, 'I don't know,' then you get the benefit of answers from all the people who know more about something that you do," he explains.

Ridge calls himself the chief of a tribe. Some leaders like to call their organizations teams, but he prefers tribes because he feels it's more suited to businesses. "I prefer to call our employees a tribe because people want to belong to something, and a tribe is something people belong to," he says. "Teams are something people play on situationally to win a game. But business is much more than a series of games — it's about building a company over time."

Can the same principles that built such a positive culture at WD-40 be applied to other workplaces, such as the water and sewer utilities? "Absolutely," Ridge says. "Isn't the core principle of life about helping people become better than they are today? So many leaders out there are all about themselves. But we're here to serve people — that's what servant leadership is all about." ♦



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General Manager Brad Mason and the Rocky View Water Co-op serve about 2,300 residents in rural Alberta, Canada, northwest of Calgary. (Photography by Mike Ridewood)

# MEASURE BY MEASURE

Alberta's Rocky View Water Co-op takes a metered approach to solving water loss problems

By Peter Kenter

**T**he Rocky View Water Co-op was losing a massive volume of water. Accurate metering was as problematic as leaking pipes.

The co-op was founded to serve a dozen residents and agricultural customers in a rural area just northwest of Calgary, Alberta. But it suffered growing pains. An initial water audit in 2014 estimated system water loss at more than 41 percent. To restore distribution system integrity, the co-op has discovered that accurately measuring non-revenue water is half the battle.

The co-op was formed under the Alberta Rural Utilities Act in 1992. As the province's largest water co-op, it serves 2,300 members. A not for profit, the utility operates under the direction of an elected board. Members of the co-op must

make a one-time purchase of a Class A share, entitling them to vote, and at least 10,000 Class B shares representing one capacity unit — 6 gallons per minute at a minimum pressure of 40 psi. Water used is billed at a metered rate.

## Better accounting

The co-op first began to address water loss in 2013, dividing total water consumption figures by distribution totals and ballparked water losses at 39 percent. The first water audit in 2014 looked worse, with nonrevenue water calculated at 41.5 percent. In early 2015, the co-op installed flow-meters to create five district-metered areas, or DMAs, but the data was still not conclusive. The utility had also begun a proactive program to replace

**“We had two leaks in 2017 representing water loss of more than 8 gallons per second. One was located inside a week and the other in a day. In the past, they might have taken three weeks or longer to locate.”**

**Brad Mason**

all of the water meters on a five-year schedule to more accurately assess consumption.

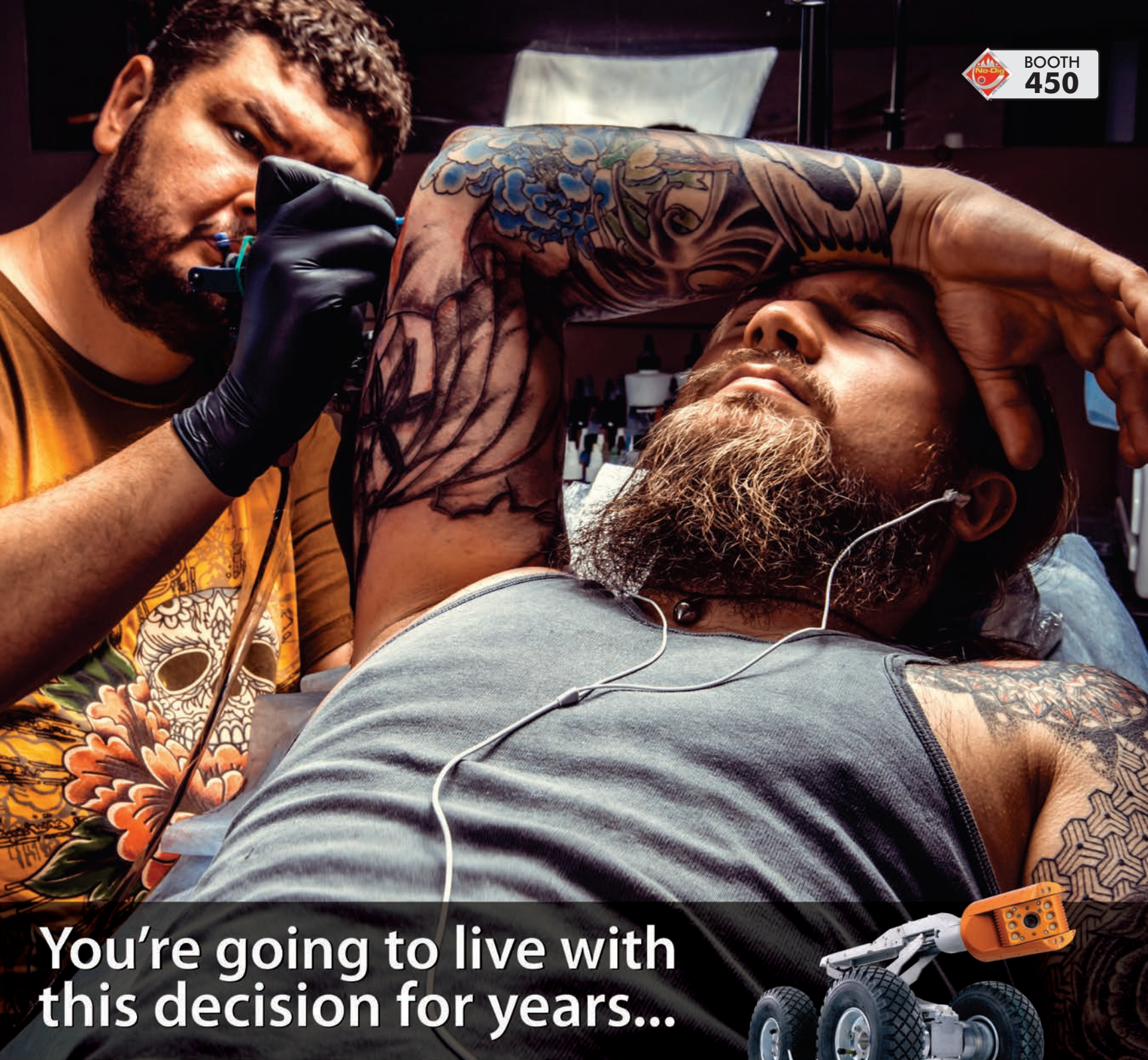
“Everyone was doing the best job they could,” says Brad Mason, general manager, who joined the utility in mid-2015. “However, the board was in transition from a working board to a policy-driven board. When I arrived, part of my goal was

*(continued)*





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Rocky View Water Co-op operator Corey Bureau tests lab turbidity at 0.07 NTU.

**“The worst of the older meters were underreporting water use by 20 to 30 percent. The worst case was 78 percent and one customer had no meter at all for seven years.”**

**Brad Mason**

to bring focus and direction to the co-op, and one of those focuses was reducing water loss.”

In the fall of 2015, Mason proposed that the board adopt the American Water Works Association’s free M36 Water Audits and Loss Control Programs, including its Water Audit Software package.

“We sold it to the board as a recognized approach to water audits, applying accounting principles to water consumption,” Mason says. “As a policy-driven decision, it allowed us to say what we were going to do and how we were going to do it and where we could get the best bang for our buck, instead of throwing darts at the dart board.”

The co-op’s first M36 water audit was completed in late 2015. “It was disheartening because we calculated our water losses at 60 percent,” Mason says. “We realized that it wasn’t necessarily real water loss, but the result of our data getting better and leaks that were worse than we had thought.”

Rocky View Water Co-op wasn’t simply counting on the audit to solve its water loss problems. It concurrently launched an accelerated multi-pronged effort involving effective asset management, more effective system metering and monitoring, and rapid repair and replacement of defective infrastructure.

### Assessing assets

While the co-op’s nondistribution assets were already part of the accounting system, distribution



**PROFILE:**  
Rocky View Water Co-op Ltd., Calgary, Alberta

**YEAR ESTABLISHED:**  
1992

**CUSTOMERS:**  
3,000 population, 2,300 members, 1,400 connections

**SERVICE AREA:**  
40 square miles

**DEPARTMENT STAFF:**  
6

**CURRENT INFRASTRUCTURE:**  
Water — 155 miles

**ANNUAL OPERATING BUDGET:**  
\$2.29 million operating/  
\$1.81 million capital

**ASSOCIATIONS:**  
American Water Works Association,  
Alberta Water and Wastewater Operators Association, Western Canada Water

**WEBSITE:**  
[www.rvwater.ca](http://www.rvwater.ca)

Lead operator George Grosariu searches for water system leaks with a Sewerin AquaTest acoustic listening device.

assets were not. The utility purchased NEXGEN Asset Management Software to record all distribution assets and estimate their value. That task is about two-thirds complete. All system assets are currently mapped and accounted for and are being assigned GPS coordinates using a Leica Geosystems GR Zeno 20 data management system with HxIP.

“Our next step will be Esri mapping to be able to identify those lengths of pipe that experience

the greatest number of leaks,” Mason says.

The distribution system is relatively young at 15 to 25 years old. One third of the system is bell-and-spigot PVC pipe. The newest pipe is fused HDPE. Pipe ranges from 2 to 8 inches in diameter, although most measure from 4 to 6. Pipe is buried about 8 feet deep.

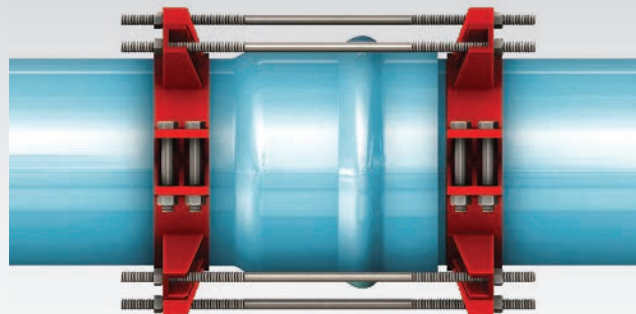
“I would rate the overall pipe condition a C,” Mason says. “The bell-and-spigot pipe has a high leakage rate, and the oldest pipe was installed

*(continued)*





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The Rocky View Water Co-op staff includes (from left) lead operator George Grosariu, Office Manager Brandy Jarvis, Operations Manager Lawrence Michetti, General Manager Brad Mason and operator Corey Bureau.

## FIVE TIPS FOR USING THE AMERICAN WATER WORKS ASSOCIATION M36 WATER AUDIT TOOL

### 1. There's great value for small utilities in conducting the water audit.

"Even if your resources are limited, at least you know the issues and what you can afford to focus on."

### 2. Read the manual.

"It's very easy to populate the data, but in hindsight, we realized we should have read the manual more carefully to make sure we had the most valid data for each entry. M36 offers a great resource manual and a great guide."

### 3. Don't place too much faith in your first audits.

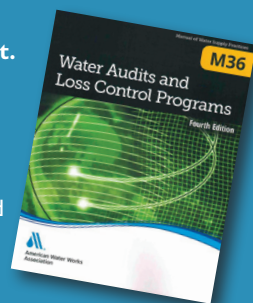
"Even if early results are inaccurate, they'll point you in the right direction and help you decide on an action plan to get to the next level of accuracy. Producing valid data can be time consuming, and the process may take as long as five or six years."

### 4. Consider both pressure and flow in your models.

"In our experience, we should have looked at pressure zones first, because they provide instantaneous data, and flow zones second."

### 5. Use the tool to create a water loss control program specific to your utility.

"This policy document is a touchstone that should be used throughout the process, to remind you of the *why*, not the *what*."



with no bedding or improper bedding and this results in the most breaks. This is Chinook country, so we have multiple freeze-thaw cycles in a winter, with temperatures rapidly shifting as much as 50 degrees F."

Completion of the asset management plan gave the utility a solid basis to pass its 2018 capital asset plan for the distribution system.

### Quicker response

As a small utility, Rocky View Water Co-op contracts all of its construction and repair work to outside providers.

"However, as an organization, we were not responding to potential leaks as fast as we could," Mason says. "As an example, we had two leaks in 2017 representing water loss of more than 8 gallons per second. One was located inside a week and the other in a day. In the past, they might have taken three weeks or longer to locate."

The co-op also now stresses higher quality repairs. For example, a large number of customer connections were originally completed with plastic sliding wedge fittings.

"They seem to have a 20- to 25-year life span, and we have literally hundreds out there," Mason says. "It's our most common cause of leaks. My grandfather was a saddle maker, and he had a sign up in his shop in 1902 that said, 'If you want it bad, you'll get it bad, and if you want it cheap, you'll get it cheap.' Instead of replacing those fittings with more plastic, all new installations and replacements are brass. If we do a service dig, we want it to last for 25 years."

### Meters matter

Mason accelerated the existing water meter replacement program to conclude in 2017.

"It gave us a huge bang for our buck," he says. "The worst of the older meters were underreporting water use by 20 to 30 percent. The worst case was 78 percent and one customer had no meter at all for seven years."

The meters were replaced by the E-Coder) R900i manufactured by Neptune Technology Group. "We now have only 20 meters left that aren't on the AMR platform," Mason says. "Last year, we purchased the data logging component to that system. We can now read all of the meters in an afternoon using a laptop and remote reader. Although we bill quarterly, we started to read monthly because the meters have the capacity to identify a possible intermittent or continuous flow leak, so we can send a report to the customer."

The utility also tested its production meters and is replacing one of them this year after discovering a potential variance of 30 to 40 percent. "If the production figure is wrong, then every-





**Operations Manager Lawrence Michetti works with an Opti View TrojanUV sampler for dosing and recording.**

thing is wrong,” Mason says.

The original five DMAs have also been reduced to three, following discovery during a leak repair that two of the DMAs were cross connected. The two DMAs will only be restored following further validation.

“What that process also showed us is that we should have started by monitoring pressure instead of flow,” Mason says. “Flow only measures volume, which can be valuable for longer term trends, but you can get a reading on pressure anomalies instantaneously, even if your DMAs are poorly designed.”

The utility now performs daily reads on DMAs and has begun to install remote pressure monitoring stations with alarm set points. The co-op has budgeted for installation of 15 to 20 stations over the next several years.

### Clamping down on leaks

Crews use a Hermann Sewerin GmbH AquaTest T10 acoustic leak detector to pinpoint suspected leaks.

“With plastic pipe, it’s hard to do traditional acoustic leak detection, so we’ve been using it on curb stops,” Mason says. “It’s not as accurate as it is with metal pipe, but we have successfully detected a number of leaks. Our normal flow is 5 to 6 decibels, so everything above that is probably a leak. We’ve also been experimenting with driving steel stakes into the ground near plastic mains to see if it improves our acoustic readings. It’s worked at least once, so we’re continuing to experiment with that idea.”

Leak repair efforts have also identified a lack of main valves required to isolate pipe segments. A recent main repair required contractors to suspend service to 130 customers. Rocky View Water Co-op has budgeted for 25 hot tap insertions in the longest lengths of main over the next four years.

All of the efforts have paid off. The 2016 water audit reported nonrevenue water at a little over

23 percent. “By our early estimates, 2017 should show nonrevenue water between 18 and 19 percent,” Mason says. “Some of it is due to improved metering, but part of it is definitely improved leak monitoring, detection and system repair. I think of the co-op as just coming out of its rough-and-tumble teenage years. We’re now heading into maturity.” ♦

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# A REFERENCE POINT FOR SUCCESS

NASSCO's Specification Guidelines are a valuable industry resource

By *Ted DeBoda*

**N**ASSCO's mission to set standards for the assessment, maintenance and rehabilitation of underground infrastructure is accomplished, in part, by the provision of specification guidelines for a variety of trenchless technologies.

Provided as a service to our industry, these guidelines have been prepared by NASSCO and peer reviewed by committees consisting of suppliers, installers, engineers, and system owners to ensure accuracy and usability to help you do the best work possible.

Available online at [www.nassco.org](http://www.nassco.org), visitors to the website can search for specific guidelines by technology or category, including:

- Lateral renewal/repair.
- Cured-in-place pipe (CIPP).
- Grouting/joint sealing.
- Manhole rehabilitation.
- Fold and form/folded and reformed.
- Pipe bursting.
- Cleaning.
- CCTV/inspection.
- General guidelines.

The detailed documents within each category include information such as suggested project steps, mandatory prebid/preconstruction and project meetings, general and special provisions, execution of work, payment, and a variety of other resources and suggested action items.

Other NASSCO resources available online include manufacturer specifications provided directly by the supplier. While these specifications are not endorsed by NASSCO, visitors using these products and services appreciate the ability to quickly find these references on the NASSCO website.

It is our hope that you will use NASSCO Specification Guidelines as a reference point from which you will apply your own engineering judgment as project-specific details are considered. It is our intent to add to, but not replace, the valuable input from experienced engineers and contractors while assuring the continued advancement and growth of trenchless technologies.

NASSCO's Specification Guidelines are available to the public at [www.nassco.org/resources/guidelines-specs](http://www.nassco.org/resources/guidelines-specs) and are downloadable in PDF format. NASSCO members can also download the documents in Word format through their unique member login. For more information, please visit [www.nassco.org](http://www.nassco.org). ♦

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# CLEARING THE AIR

Technology that feeds oxygen and ozone into force mains and lift stations cuts odor and corrosion for Tennessee utility

By Ted J. Rulseh

**B**randon Ambrose and his maintenance team have enough to do maintaining 230 miles of gravity sewers, 19 miles of force main and 31 pump stations. The last thing they need to deal with is odor complaints.

And yet, over the years, the team in Mount Juliet, Tennessee, fought a long battle against hydrogen sulfide odor from wastewater in force mains. They controlled the odor with chemicals, but Ambrose, wastewater supervisor, wanted a more cost-effective and sustainable way to deal with H<sub>2</sub>S.

He found it in a technology that generates pure oxygen and ozone and injects it into the wastewater at pump stations. First used in a successful pilot test at one pump station, the unit has been deployed permanently at four stations, and three more will be added this year. It has reduced H<sub>2</sub>S levels at pumping discharge points from spikes of more than 400 ppm to less than 10 ppm. Payback on the equipment from chemical savings ranges from 1 1/2 to three years.

**“We can’t take the chemical out of the equation, but instead of feeding perhaps 100 gpd, we can get away with 20 gpd. The cost-effectiveness of these systems for us is mainly about reducing the chemical feed.”**

Brandon Ambrose

## High-volume pumping

Mount Juliet has no wastewater treatment plant, instead sending an average of 3.5 mgd to Metro Water Services in Nashville, about 30 miles east. In-house team members handle the vast majority of collections system and pump station maintenance, including pump rebuilds, seal replacements, pipelaying and electrical work. They also service about 3,000 Myers 2 hp residential grinder pumps (Pentair).



The FORSe 5 oxygen and ozone injection system is used to prevent hydrogen sulfide odors at lift stations in Mount Juliet.

The city’s population has roughly tripled in the past 10 years to 38,000, mainly with residents who commute to jobs in Nashville. The collections system is expanding rapidly to keep up with the growth. “We send a lot of water through force mains, some of them up to 15,000 feet long,” says Ambrose, who holds a Collection Systems 2 operator’s license. “Anytime you keep sewage in a line for a long time, that’s a bad thing.”

H<sub>2</sub>S odor issues became so severe at some pump stations that a calcium nitrate solution was being dosed at 70 to 100 gpd. The chemical is effective, and the team still uses it as needed, mainly at the city’s smaller pump stations.

Through an industry contact, he learned about the FORSe 5 oxygen and ozone injection system from Anue Water Technologies. In 2010, the company deployed a trailer-based demonstration unit to test the technology at the city’s Nonaville Road lift station, discharge point for a 7,900-foot-long, 10-inch force main with an average flow of 175,000 gpd.

After tapping the line to inject the oxygen and ozone, Ambrose and his team, with help from Anue Water Technologies technical service representatives, made adjustments to optimize the feed rates. Once that was accom-

(continued)

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**“From my desktop computer, from a laptop, or from an iPhone or iPad, I can go in and change the percentages of O<sub>2</sub> or ozone at any given moment.”**

**Brandon Ambrose**



An Anue technician observes system component status remotely using the FORSe 5 digital telemetry technology.

plished, average H<sub>2</sub>S levels at the discharge point dropped from 80-120 ppm to 20-30 ppm within three days, based on ozone feed at 20 grams per hour and oxygen feed at 60 liters per minute. An independent engineering firm verified the test results.

## Making it permanent

Satisfied with the outcome, Ambrose decided on a permanent installation at the Royal Oaks lift station, which sends 250,000 gpd to the Nonaville Road site. The installation was completed in 2013 through remodeling of an existing building on the site.

The FORSe 5 system is designed for force mains up to 10 miles long with pressures to 200 psi and flows up to 30 mgd. Its main components include:

- A high-volume air compressor.
- An oxygen concentrator that takes in ambient air and produces a dry and purified stream of oxygen with purity greater than 90 percent by weight.
- An ozone generator that receives the purified oxygen and produces ozone at an average concentration of 5 percent by weight.

A control system with a touch-screen interface enables users to adjust the flows of oxygen and ozone. “From my desktop computer, from a laptop, or from an iPhone or iPad, I can go in and change the percentages of O<sub>2</sub> or ozone at any given moment,” Ambrose says.

Before the FORSe 5 system installation, H<sub>2</sub>S levels at the Royal Oaks station discharge routinely exceeded the maximum meter reading of 400 ppm. Afterward, the level dropped to a consistent 10 to 12 ppm. Two years later, the city installed a system at Nonaville Road in a prefabricated building. Feed rates at those sites are about 40 liters per minute O<sub>2</sub> and 10 grams per hour ozone.

In 2016, additional systems went online at the Cedar Creek station (2.9 mgd capacity), which sends the flow on its way to Nashville, and at the Central Pike station (4.5 mgd capacity). Ambrose expects to install three more FORSe 5 units within the next year: “With the urban growth this community is having, there is no end in sight. We’ll probably end up with 10 to 12



The system’s main components include a high-volume air compressor, an oxygen concentrator that takes in ambient air and produces a dry and purified stream of oxygen, and an ozone generator that receives the purified oxygen and produces ozone at an average concentration of 5 percent by weight.

systems and maybe as many as 15 in the next 10 years.” The target sites will be larger lift stations, especially those near residential areas.

## Standard practice

As the community expands, the city will either install an oxygen/ozone system at new large pumping stations or require the developers of large subdivisions to do the installations. The FORSe 5 systems’ large capacity gives the city room to accommodate growth at each site.

During droughts and hot weather, when H<sub>2</sub>S production in the lines can be extreme, the systems are supplemented with the addition of liquid calcium nitrate, especially in force mains. “We can’t take the chemical out of the equation, but instead of feeding perhaps 100 gpd, we can get away with 20 gpd,” Ambrose says. “The cost-effectiveness of these systems for us is mainly about reducing the chemical feed.”

Besides reducing odor from H<sub>2</sub>S, the Anue Water Technologies systems limit its corrosive effects. The ozone also helps break up fats, oils and grease in wet wells. “We have wet well washers that come with the FORSe 5,” Ambrose says. “Once we start putting ozone into a wet well, we knock the FOG buildup down to near zero.”

Ambrose expressed satisfaction with the equipment and with the service the city received from Anue Water Technologies: “I’m always eager to see bigger, better and more user-friendly products. If you call Anue about issues with odor or corrosion, they will come out and check the site and demo one of their products if you want,” Ambrose says. “That’s what they’ve done for me.” ♦

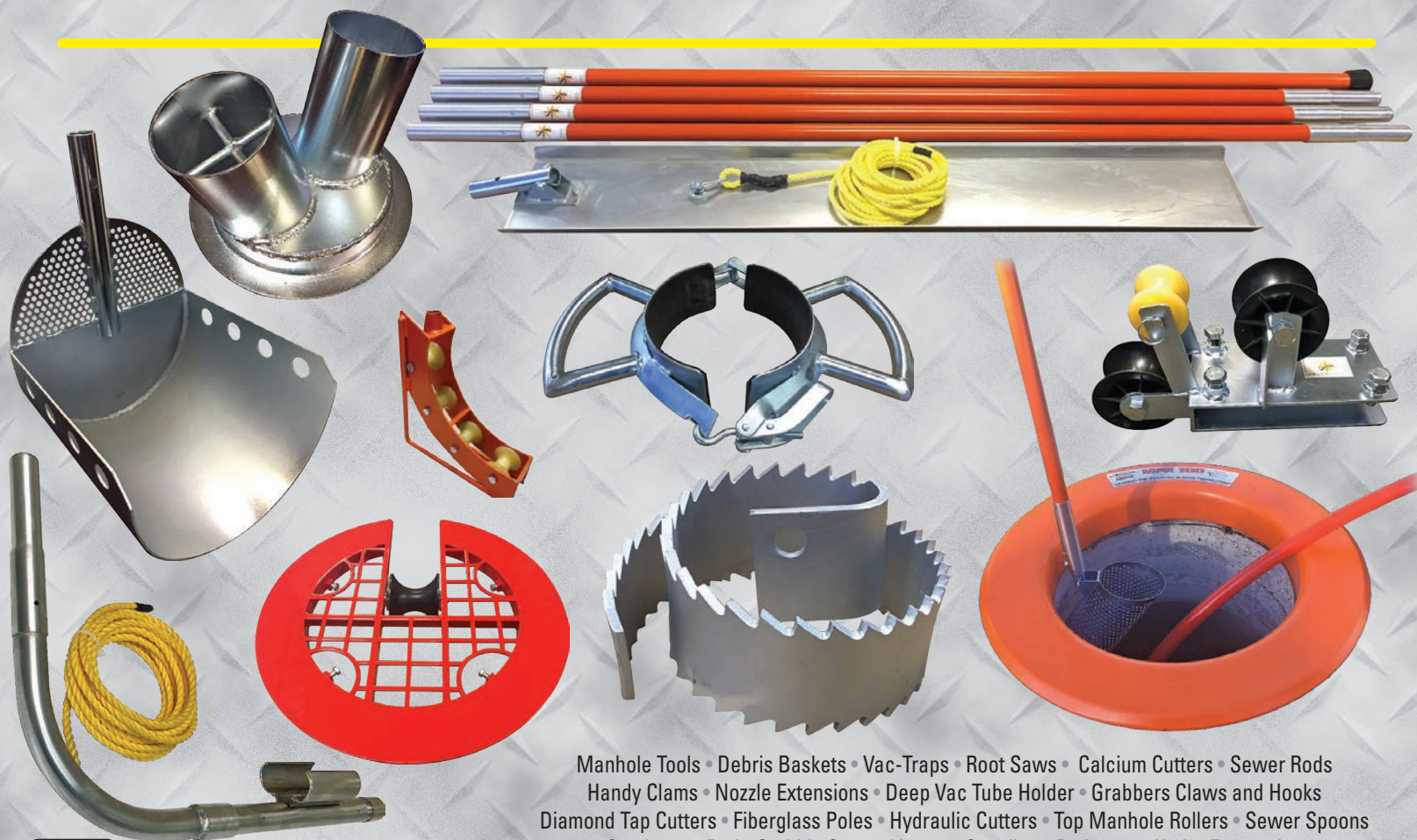


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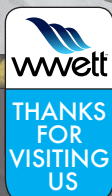
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# OPTIMIZE YOUR CLEANING OPERATIONS

For utilities with in-house cleaning crews, training may be the missing ingredient

By Jared Raney

Efficiency is often the bane of in-house municipal cleaning operations, but for those utilities seeking optimization among their cleaning crews, good news is here in the form of operator training.

One of the most comprehensive cleaner training programs out there is offered by Nezat Training and Consulting. Rusty Nezat, an industry veteran who has been training cleaners for 25 years, combined his years of field experience with research and testing to create a customizable training experience.

The core of his training is a video-based classroom learning experience. But the ideal scenario involves hands-on follow-up in the field, when Nezat often takes the city's crews out to clean a pipe they had previously thought would require a contractor.

**“The feedback is just always very encouraging because they always say, ‘No one ever showed me what you showed me today. Now I know why I couldn’t clean that 18- or that 24-inch pipe. It makes sense to me now.’”**

Rusty Nezat

“When we negotiate the proposal, I always ask them about those pipes out there that they’re going to put out for bid,” Nezat says. “The contractor is probably going to charge it X number of dollars. I say, ‘What if we clean it with your people?’”

It’s all based on a proprietary step-cleaning matrix that Nezat developed using a mock above-ground sewer system opened up on the top to give a clear view of what is going on in the pipe. They study different cleaning techniques, and trainees get a real-time view of what’s happening during cleaning — the cornerstone of his program.

“I tell them what they’re going to see, and then I show them. And then we discuss what they’ve seen,” Nezat says. “The feedback is just always very encouraging because they always say, ‘No one ever showed me what you showed me today. Now I know why I couldn’t clean that 18- or that 24-inch pipe. It makes sense to me now.’”

## Getting started

“Over the years, we’ve kind of morphed into doing evaluations, first of all. So what I’ll do is I’ll go into a city, and I’ll spend one day with each crew in the field, and I’ll run that truck with the crew.”

(continued)



Proper training is the key to an efficient and effective cleaning operation. It starts with thorough knowledge of the equipment and how it functions.



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Part of the evaluation is a top-level review of the operation: going over planning and control as well as maintenance records to quantify ongoing downtime.

During the evaluation, Nezat often finds issues with the trucks and equipment, which not only hampers the city's productivity, but can be unsafe — and many times they aren't even aware of the problem. The first order of business is for the utility to get their equipment fixed and operating at peak.

"We want to see if it's either an equipment issue or a component issue on the truck, or if it's just the operators not operating the truck properly or maybe the operators not maintaining the truck properly," Nezat says. "We incorporate that into our training program."

"So then we give them the report; ask them to fix the trucks; and say, 'When you get your trucks fixed, we'll come back and we'll do the classroom training.' So now it gives us time to customize our training programs to meet the needs we saw in the field."

### Based on need

Each training experience is tailored as much as possible; every utility has different pitfalls and problems to deal with.

"Some of the basics in our training program never change, like step cleaning, but we address all the other issues — the myriad of issues that we see when we go out in the field with them — and we address those things if it pertains to the productivity of their sewer group," Nezat says.

In an ideal scenario, the training takes several days: during evaluation, one day per crew with an extra day to meet with supervisors and look through records; one day of classroom training, assuming all crews can be brought in at once; and the optional follow-up field training, which can be anywhere from one to three days in the field per crew.

"At the end of the training program, we try to go out and spend at least one or two days in the field again with each crew. And what I tell the city is, 'Give me the worst pipe you've got out there, the pipe you were going to give to a contractor to clean because your guys couldn't clean it.' And I'll take their people out there, and we'll clean those pipes."

This equates to cost savings for the utility, and despite the cost of multiple days' training, Nezat says follow-up is important and can bring savings in the long run.

"If you don't reinforce what we talked about in the classroom, people have a hard time making changes," Nezat says. "Once you take them out there and they see how easy it is and how much more productive they can be if they do it a different way, then they're more adept to make that change and continue to make the change. So that's our training in a nutshell right there."

### All utilities welcome

According to Nezat's research, the average city only spends the equivalent of 43 to 60 minutes per day on cleaning efforts — not enough to keep the system at its most efficient.

"We're always trying to bump that up, and typically we can double their daily production rates through the training program," Nezat says.

The average cost per day is approximately \$1,500, but Nezat is careful not to put a set price on his services. Due to the custom nature of his business, prices vary, and he likes to give discounts to smaller utilities that may have a hard time affording the daily rate, or those under consent decree that are in greater need.

As training opportunities like this prove, even small municipalities have the potential to clean any pipe in their system; it's just a matter of knowing how. ♦

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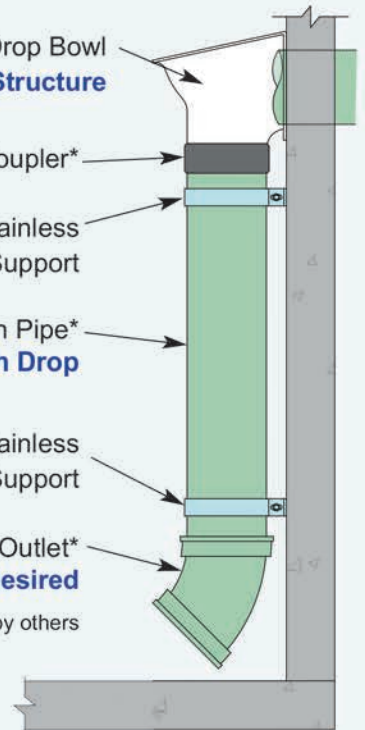
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By Craig Mandli

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camera lift, carriage, and illumination accessories mean **ROVVER X** transforms in seconds to inspect any-size line. Its six-wheel drive with proportional steering navigates past obstacles, and overlapping wheels climb offsets effectively. Powerful motors and a geared six-wheel drivetrain maximize travel range. It is built on an expandable digital backbone. Side scanning and laser profiling can be added, and technicians can view data from onboard sensors, automate tasks with macros, and measure defects on-screen. Its firmware updates automatically to the latest features. **866-936-8476; [www.envirosight.com](http://www.envirosight.com).**

#### Pearpoint/SPX P350 flexitrac

The **P350 flexitrac** video inspection system from **Pearpoint/SPX** is versatile, modular and easy to transport. The command module is interchangeable, giving users the ability to operate pushrod or crawler systems and switch from one to the other with just a simple keystroke. It has intuitive joysticks that provide fingertip control of the two powerful crawlers, the choice of three interchangeable cameras and LED lighting, making it easy for users to inspect pipes from 4 all the way to 35 inches. Powered or manual drums are available, offering cable lengths from 500 to 1,000 feet. The five pushrods span lengths from 30 feet of ultraflexible rod through to 150 feet of specialized rod and offer 1- and 2-inch cameras. **800-688-8094; [www.pearpoint.com](http://www.pearpoint.com).**

#### R.S. Technical Services Inc. (RST) mainline inspection system

The contractor-grade mainline inspection system from **RST** is designed to capture high-quality video for accurate pipeline condition assessments. The high-resolution camera includes 40-1 zoom; pan and tilt; and fully adjustable, high-intensity LED light arrays that produce more lumens than standard LEDs. Programmable limits for pan-and-rotate settings plus a home function that returns the camera to a straight-ahead position increase operator efficiency. Its steerable, six-wheel-drive mainline tractor features twin 90-watt Rare Earth permanent magnet motors that allow for 2,000-foot inspection runs and the ability to inspect larger lines without the need for additional gear trains or transmissions. The tractor — which is available in two lengths of 19 and 14 inches — has three forward speeds, reverse, and a freewheel setting that enables rapid retrieval to save time. **800-767-1974; [www.rstechserv.com](http://www.rstechserv.com).**



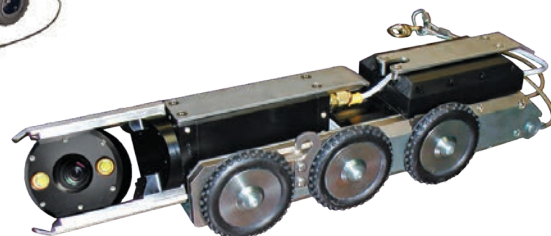
Aries Industries  
Mobile Pathfinder



Envirosight ROVVER X



Pearpoint/  
SPX P350 flexitrac



RST mainline inspection system



## TruGrit Traction wheels

**TruGrit Traction** polymer and carbide-grit camera transporter and cutter wheels are designed to provide maximum pulling power in all pipe types and conditions. This aftermarket traction wheel fits most major CCTV transporter brands. With their ability to grip slick pipe without damaging it, the wheels are especially helpful for lining contractors who don't want to destroy newly installed liner during the post-video inspection process. Thanks to an optimal blend of flexible polymer and carbide grit, the wheels don't get dull, even in clay and concrete pipe. **407-900-1091; [www.trugrittraction.com](http://www.trugrittraction.com)**.

## GIS GPS

### PipeLogix GIS

With the addition of the **PipeLogix GIS** module added to ArcMap, supervisors can view all surveys performed on an asset. The toolbar filters survey data in the master database to highlight pipes with selected conditions, grades, or score values, allowing the user to link to the movie or survey. Survey conditions can be exported to a shape file or a geodatabase feature class. When opened in ArcMap, this layer displays the condition along the length of pipe. Selecting the condition will link to the movie and jump to the correct footage for viewing. Seeing the problem and where it exists on the pipe can make it easier to schedule repair and cleaning crews. The system is compatible with ArcGIS 10.0 through 10.5. **866-299-3150; [www.pipelogix.com](http://www.pipelogix.com)**.

## LASER/SONAR PROFILING EQUIPMENT

### InfoSense Sewer Line Rapid Assessment Tool

The **Sewer Line Rapid Assessment Tool**, or **SL-RAT**, from **InfoSense** uses active acoustics to provide a quick view of blockage conditions within gravity-fed sewers. The test takes three minutes with no flow contact. It allows a crew of two to inspect 10,000 to 20,000 feet per day. It is EPA validated and GPS enabled. Data can be downloaded to the Sewer Line Data Organizer, or **SL-**

**DOG**, cloud application for visualization in Google Earth, or integrated with enterprise/GIS applications. **704-644-1164; [www.infosense.com](http://www.infosense.com)**.

## LOCATORS

### BRIGHT DYES - Division of Kingscote Chemicals inspection dye

Concentrated leak inspection dyes from **BRIGHT DYES - Division of Kingscote Chemicals** dissolve rapidly in water and provide a vivid fluorescent color detectable in murky water, sewage or effluent. They can be used to validate sanitary and septic hookups; identify leaks, infiltration and exfiltration in plumbing connections; and perform septic inspections to identify leachfield issues as well as sources of contamination in wells. They are safe, nontoxic, biodegradable, and certified by NSF International to NSF/ANSI Standard 60 for use in and around drinking water. They are available in fluorescent yellow/green, red and orange, and nonfluorescent blue. They come in tablet, liquid or powder form. **800-394-0678; [www.brightdyes.com](http://www.brightdyes.com)**.

### General Pipe Cleaners Gen-Eye Hot Spot

The **Gen-Eye Hot Spot** pipe locator from **General Pipe Cleaners** includes a total field antenna array and on-screen icons designed to lead the operator to the target without a long learning curve. It can help quickly locate inspection cameras, sondes, active power lines, and utility lines with pinpoint accuracy, according to the maker. The easy-to-see, auto-backlit LCD display uses arrows to point in the right direction. The null icon indicates the pipe location, and the camera icon confirms when the locator is over the target. To locate utility lines, circle the energized pipe or tracer wire until the utility icon appears on the screen. Rated at IP65, it's water-resistant and dust- and dirt-proof. It has passed the 1-meter drop test, while the screen passed an 18-inch steel ball drop test. It locates two sonde frequencies, two power frequencies, and four line frequencies, and the USB port can be used in the field to upgrade software. **800-245-6200; [www.drainbrain.com](http://www.drainbrain.com)**.

(continued)



TruGrit Traction wheels



InfoSense Sewer Line Rapid Assessment Tool



PipeLogix GIS



BRIGHT DYES - Division of  
Kingscote Chemicals inspection dye



General Pipe Cleaners Gen-Eye Hot



### Subsite Electronics UtiliGuard

The **UtiliGuard** utility locating system from **Subsite Electronics** uses ambient interference measurement to automatically scan the surrounding area for noise and recommend the best frequency among 70 options. To help users make more accurate locates of obstructed utilities, it measures distances (depth) both horizontally and vertically to the utility. To ease use, the system has an intuitive, six-button, multilanguage operator interface and a high-contrast LCD display to ensure visibility in all conditions, including direct sunlight. A dual-output feature allows users to connect the transmitter to two utilities at once, and the system is Bluetooth-enabled to simplify data transfers. Its rugged housing with an IP65 rating protects against dusty, dirty, and wet conditions, and it has 100-hour transmitter and 30-hour receiver battery life. **800-846-2713; www.subsite.com.**

### SubSurface Instruments AML Series All Material Locator

**AML Series All Material Locators** from **SubSurface Instruments** use modulated, powerful 2.45 GHz ground-penetrating, UHF radio waves to locate subsurface objects. Using technology that was developed for lunar exploration, it locates materials indiscriminately, including PVC, PE, metal, wood, cable or pipe. It will work in clay, wet soil, snow and standing water. Man-made objects with a straight edge create a change in density or permeability from surrounding materials, which causes refracted radio waves to be detected by the AML. The highly sensitive dual left and right receivers activate a laser indicator that highlights the buried object's position on the ground. It includes GPS plotting and tracking, and it has 32 sensitivity settings. **855-422-6346; www.ssilocators.com.**

### Superior Signal Smoke Fluid Systems

**Smoke Fluid Systems** from **Superior Signal** are used to find faults and sources of surface water inflow in collections systems. Smoke fluid is both high-quality and economically priced. Blowers are engineered for smoke testing, using a double-insulated heating chamber with stainless steel injector to maximize dry smoke output and produce quality, liquid-based smoke. Blowers can be configured to work with Superior Smoke Candles. **800-945-8378; www.superiorsignal.com.**

### TURBO FOG Division of Kingscote Chemicals MH-75

The **MH-75** from **TURBO FOG Division of Kingscote Chemicals** is a self-contained smoke tester for easily identifying leaks, infiltration and cross connections in municipal collection lines. The smoke-testing system uses leak-proof liquid aerosol smoke cartridges to create dense white smoke. No additional smoke bombs or garden sprayers are required. Made of 11-gauge powder-coated steel, the blower is capable of generating over 7,500 cfm to accurately test more pipe in less time. Briggs & Stratton and Honda engine models are available. **800-394-0678; www.turbo-fog.com.**

## MAINLINE TV CAMERA SYSTEMS

### Electric Eel Ecam Pro 2

The **Ecam Pro 2** mainline pipeline inspection camera system from **Electric Eel** has a stainless steel-housed, 1.68-inch self-leveling color camera with sapphire lens; 20-LED light ring with an impact-resistant polycarbonate light ring cover; and high-resolution CCD element. The auto-iris adjusts light automatically. A flexible camera spring navigates 3-inch P-traps. The unit comes standard with 200 feet of braided fiberglass premium 1/2-inch-diameter pushrod (with a capacity of 400 feet available on the reel), industry-standard 512 Hz sonde, 10.4-inch daylight-readable monitor with click-touch controls, and one-touch recording directly to a USB flash drive. It has an on-screen footage counter, a two-hour battery with built-in charger, adjustable light controls, 16 pages of text writing with memory saves, voiceover recording, an 8x zoom function, audio/video out jacks, 8-inch wheels for easy maneuverability, a secure-locking reel brake, and rugged powder-coated steel tube and bar construction. **800-833-1212; www.electriceel.com.**

### Perma-Liner Industries Perma-CAM

The **Perma-CAM** from **Perma-Liner Industries** comes complete with a self-leveling color camera head with a sapphire lens and centering skid, and 200-foot heavy-duty push cable with a standard 512 MHz transmitter, all mounted on a heavy-duty, powder-coated aluminum frame. The 7-inch mon-

(continued)



Subsite Electronics UtiliGuard



Superior Signal Smoke Fluid Systems



SubSurface Instruments  
AML Series All Material Locator



TURBO FOG Division of Kingscote Chemicals MH-75



Electric Eel Ecam Pro 2



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itor comes with a weatherproof hand-held holder, complete with a custom sunshade. The HD monitor records to an SD media card and also has voice-over capability. The standard, Wi-Fi-compatible unit comes with a complimentary Samsung tablet. **866-336-2568; [www.perma-liner.com](http://www.perma-liner.com).**

### Pipeline Renewal Technologies CleanSteer 40

The **CleanSteer 40** from **Pipeline Renewal Technologies** uses high-pressure water for propulsion, steering and cleaning as it captures live inspection video from inside lateral lines. It is able to traverse multiple bends in pipe, steer through branches, and levitate above debris, allowing municipal contractors and commercial plumbers to locate failed pipes, cross bores and blockages, as well as perform cleaning. It is fully water-driven, as six propulsion nozzles generate the power needed to pull its own flexible hose through multiple bends, while a side nozzle on the camera can be aimed to steer through diverging pipes and hover past obstacles. An optional forward-facing nozzle can be pulsed to clear debris and other obstructions. The system works with any high-pressure water source, including pressure washers and combination trucks. Its 1/2-inch hose comes in lengths from 115 to 190 feet. **866-936-8476; [www.pipelinert.com](http://www.pipelinert.com).**

### Ratech Electronics Elite USB with Wi-Fi

The **Elite USB** with Wi-Fi from **Ratech Electronics** lets users record pipe inspections directly to a USB flash drive and wirelessly via an app to an iOS or Android device while taking live video and digital still photos, which can be immediately uploaded to YouTube. The Wi-Fi interface is available on any current or existing Ratech Electronics systems in the field. It's available with a sun-readable, 10-inch LCD monitor and a self-leveling camera, ultra-micro camera or pan-and-tilt push camera. Systems come in cable lengths of 100 to 400 feet. **800-461-9200; [www.ratech-electronics.com](http://www.ratech-electronics.com).**

### RauschUSA minCam360

The 2-inch **minCam360** remote-controlled, pan-and-tilt push camera from **RauschUSA** has digital zoom and a tri-band sonde with selectable fre-

quencies. The Bluetooth remote includes a joystick for camera control. The cable reel is equipped with 200 feet of cable (with up to 300 feet available), and the removable batteries run for four hours. Its RID steering skid enables it to push into 45-degree Y and 90-degree T branches in the pipe. The 8.4-inch, sunlight-readable monitor enables recording video, voice and photo directly to an SD card. This system is designed as a capable stand-alone inspection system, including a text generator for detailed reporting capabilities and an on-screen distance counter. Applications range from 3- to 20-inch pipe diameters with all centering accessories. **717-709-1005; [www.rauschusa.com](http://www.rauschusa.com).**

### Spartan Tool Explorer

The **Explorer** modular camera system from **Spartan Tool** has a control box that is compatible with five different pushrods 5 to 14 mm in diameter and 130 to 400 feet in length. Up to nine hours of battery life lets the user complete multiple jobs without recharging. The open-reel design allows for easy cleaning, and the stainless steel camera heads provide for extra durability. USB, SD and cloud storage is available. It comes with WinCan software pre-installed, allowing the user to map entire plumbing systems. The screen allows clear viewing, even in direct sunlight. **800-435-3866; [www.spartantool.com](http://www.spartantool.com).**

### Trio Vision Xplorer inspection pole camera series

The **Xplorer** pole camera series from **Trio Vision** is ideal for fast inspection and diagnosis of primarily vertical structures, including manholes, industrial tanks, vessels and pipes. High-intensity LED lighting assures a perfect image. It offers easy, single-user operation from a Windows-based tablet platform. Options include wireless, high-definition full HD (1920x1080); powered tilt and laser measurement module; and a lithium-ion battery. The Android tablet-controlled Xplorer MH is specifically engineered to provide the best possible image in a manhole, using the perfect type and amount of light. Its 120-degree viewing angle lets the operator see more of the structure while wide-angle lighting ensures constant, balanced lighting. **800-443-3761; [www.trio-vision.com](http://www.trio-vision.com).**

(continued)



Perma-Liner Industries Perma-CAM



Pipeline Renewal Technologies  
CleanSteer 40



Ratech Electronics  
Elite USB with Wi-Fi



Spartan Tool Explorer



RauschUSA  
minCam360



Trio Vision Xplorer  
inspection pole camera series



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### Vivax-Metrotech Type-CP

The **Type-CP** inspection system from **Vivax-Metrotech** has a reel available in 200-, 300- or 400-foot lengths of stiff pushrod that's flexible enough for easy entry and turns. The 1.6-inch D34-CP self-leveling camera provides 700 pixels of resolution to inspect up to 6-inch pipes. It includes the vCam-5 control module with an 8-inch color LCD; transmitting sonde; full-function keyboard; internal microphone; AC/DC power; rechargeable batteries; distance counter; camera LED brightness control; and digital recording to the USB thumb drives, SD cards or internal hard drive. The control module ships ready to use with LACP software such as POSM, WinCan or MuniXS. **800-446-3392; [www.vivax-metrotech.com](http://www.vivax-metrotech.com).**

### Wohler USA VIS 700

The **VIS 700** high-definition inspection system from **Wohler USA** provides flexible features needed for a variety of inspection applications. It offers razor-sharp, high-definition images; zoom; a focus function via joystick for precise inspection; and the ability to stream live images and video via wireless LAN. It comes with a removable touch-screen monitor with adjustable handgrip; automatic screen rotation; on-screen keyboard for notes; a voice-over recording option; an easy-to-clean, removable pushrod; and variable pan-and-tilt speed via joystick. **978-750-9876; [www.wohlerusa.com](http://www.wohlerusa.com).**

## RECORDING/ARCHIVING/DATA DEVICE

### RIDGID SeeSnake CS12x

The **RIDGID SeeSnake CS12x** digital recording monitor has a large screen for easy viewing, dual battery functionality for maximum run time and Wi-Fi connectivity for simple footage sharing. It streams and records inspections to any iOS or Android mobile or tablet device with the free HQx Live companion app. The app can be downloaded through the iOS App Store and Google Play for immediate sharing of inspection footage. Images can also be saved to a USB drive for simple postinspection transfer to clients and team members. It has a powerful processor for quick startup

and enhanced performance as well as a 12.1-inch, high-contrast display providing crisp, clear images for easy viewing of footage in daylight. **800-769-7743; [www.ridgid.com](http://www.ridgid.com).**

## SOFTWARE

### CTSpec sewer overlay edition module

The **CTSpec** sewer overlay edition module lets the user edit pipe reference numbers, street names, the entry manhole, or the exit manhole in an automated way directly in the inspection record. This module allows the user to change the text of existing information; add missing information to the inspection record; change the position, color and size of the information; and add or remove an observation. **888-965-8987; [www.ctspec.com](http://www.ctspec.com).**

### CUES GraniteNet

**GraniteNet** condition assessment software from **CUES** is asset-based, which enables the software to easily interface with other asset-based software products such as Esri ArcGIS mapping systems and asset management systems to include Cityworks, Infor, IBM Maximo, and others. Intuitive and easy to use, the data and video can be accessed via a web portal. **800-327-7791; [www.gnet.us.com](http://www.gnet.us.com).**

### My Service Depot Smart Service

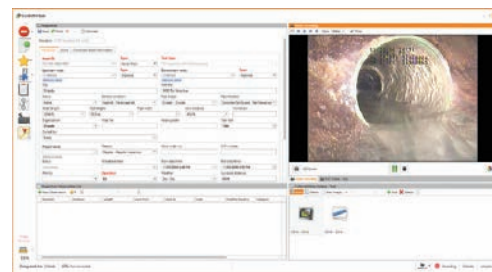
**Smart Service** from **My Service Depot** is a software system that functions as a direct add-on to QuickBooks, adding scheduling, dispatching, invoicing and customer management to the accounting software. It offers real-time integration with QuickBooks Pro, Premier, Enterprise and Online, allowing users to schedule and dispatch work to their customer base regardless of their preferred QuickBooks platform. It allows service companies to streamline their operations and eliminate waste by automating much of the standard job process. When a customer calls, an office dispatcher will create a job in the Smart Service scheduler, filling in job notes and assigning the work to a field technician. Then, the job gets sent to the corresponding



Vivax-Metrotech Type-CP



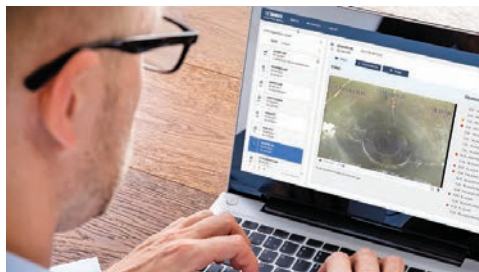
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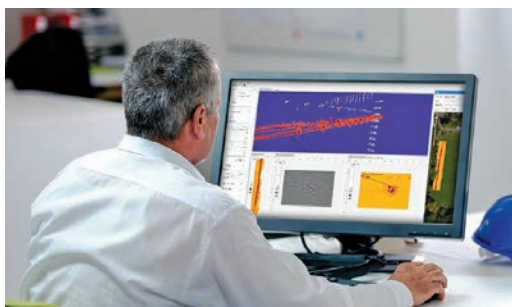


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technician's mobile device. When that tech arrives at the customer's location, they'll build a digital work order, collect a customer signature, and send the completed paperwork back to the office for invoicing. 888-518-0818; [www.myservicedepot.com](http://www.myservicedepot.com).

### US Radar Radar Studio

**Radar Studio** from **US Radar** is a post-processing software system designed to allow users to fully customize their ground-penetrating radar search experience. Fully developed for viewing and processing radar data, it is an infinitely customizable system that allows users to update map changes in real time and process real-time migration for velocity calculation and depth calibration. With its user-friendly interface, this all-in-one radar data suite enables users to produce a variety of digital signal processes to manipulate data and enhance interpretation capabilities. It has satellite-view options including Google Earth imaging, GIS/GPS mapping and 3-D modeling as standard features, with numerous export options that include video, AutoCAD and ArcGIS. 732-566-2035; [www.usradar.com](http://www.usradar.com). ♦



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## Cloud-based system helps company speed up paperwork

### Problem:

At Roto-Rooter in Baton Rouge, Louisiana, paperwork was manually processed. There was a wait for the technicians to turn in their paperwork, and then it had to be scanned and manually entered into the JaRay system. Often it took five days to process and send out statements.

### Solution:

Famhost Apps proposed the cloud-based **RealTime Forms** application that processes invoices, purchase orders, bids, and inventory in real time and integrated into their existing JaRay Software System.



### RESULT:

Data entry was reduced, scanning was eliminated, and receivables were reduced by 25 percent. During the 2016 floods, the office was inaccessible, but jobs could still be dispatched directly to the technicians' devices, and technicians no longer needed to come into the office to turn in their paperwork. **800-658-1676; www.famhostapps.com.**

## System helps locate pipes under mud flats

### Problem:

The Wadden Sea in the North Sea — with its coastal regions in Denmark, the Netherlands and Germany — is the largest system of mud flats in the world. Local water utility Wasserverband Nord had to locate and document a freshwater pipe between the mainland and the island of Pellworm, but the tide comes in twice a day, and the area is only safe to walk on for a maximum of six hours when the tide goes out.

### Solution:

Wasserverband Nord enlisted the help of **Hermann Sewerin GmbH** to accurately locate and document the pipe using a cable running parallel to

the pipe. Hermann Sewerin GmbH provided the **UT 9000**, which is supported by an external GPS system, the GeoExplorer by S+H Systemtechnik GmbH. The device's self-explanatory menu navigation guides the technician to the position of the pipe one step at a time. Their lightweight and superior ergonomics make the devices easier to transport through the sticky mud. The high-contrast LCD monitor is clearly legible, even in extreme lighting conditions.



### RESULT:

The device helped locate the pipe in a short time, save the coordinates and accurately document the location. **888-592-9916; www.sewerin.com.**

## Town leverages inspection technology to meet goals

### Problem:

In 2013, the city of Warsaw, Indiana, knew they had problems. Like many other similar-sized towns, the city desperately needed to assess the condition of their storm and sanitary sewers in order to develop an improvement plan. Substantial portions of their system dated back to 1899 and had never received a visual inspection.

### Solution:

The management team undertook an extensive retrofit of their existing equipment, starting with new combination cleaning trucks and new **RapidView IBAK North America** camera inspection system. The management team set the ambitious goal of inspecting the entire sanitary system within three years. With over 86 miles of pipelines, this would equate to over 450,000 linear feet, or 150,000 linear feet a year. They immediately began to see success and leveraged the information they received from their new camera system to make better rehabilitation and maintenance decisions. As the project progressed, they understood the need for a faster, more proactive inspection tool and chose to add a **PANORAMO 2** system to their fleet. This system not only put them on a path to meet their inspection goals, but provided data that engineering and management staff used to make critical decisions and prioritize rehabilitation efforts.



### RESULT:

Although they faced some unforeseen delays due to flooding and emergencies, within four years they had completed their goal of inspecting their entire sanitary system. As a result of this effort, the city recently approved \$10 million in rehabilitation efforts. **800-656-4225; www.rapidview.com.** ♦



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## Founder of Jack Doheny Cos. passes away

*John "Jack" Leary Doheny was an industry leader for more than four decades*

Vacuum truck and sewer cleaning industry leader John "Jack" Leary Doheny, founder of Jack Doheny Cos., passed away Jan. 1 at his home in Vero Beach, Florida. He was 87.

After serving the country in the U.S. Air Force, Doheny joined his uncle's company and traveled across the U.S. with his father to demonstrate coiled and sectional rodding machines. In 1973, he started his own business, Jack Doheny Supplies, which today is under the Jack Doheny Cos. umbrella. Jack Doheny Cos. is North America's largest provider of sewer cleaning, pipeline inspection, and multiuse vacuum trucks for sale, rental, service, parts and training.

Doheny will be remembered for his industry leadership. In 2014, he was named a Standard Bearer by NASSCO, one of a select group of leaders who have contributed to the protection of underground infrastructure through the development and implementation of industry standards.

"I believe it would be hard to find anyone who is against sewer cleanup," Doheny shared during his Standard Bearer interview. "It's as American as Chevrolet and apple pie. For me, it's also a family tradition. My father lived to be 107 and was instrumental in changing the way sewers are cleaned. I am proud to be part of this legacy and hope to follow in his footsteps to contribute to this great industry for many years to come."

In lieu of flowers, the family requests donations be made to the Jack Doheny Memorial PACP Scholarship Fund, c/o NASSCO Inc., 2470 Longstone Lane, Suite M, Marriottsville, MD 21104.



**Jack Doheny**

## Felling Trailers adds new fabrication center

Felling Trailers added a new fabrication center, providing 15,000 square feet of space for new and existing technologies. The space connects the main warehouse to an existing building, allowing for an efficient flow of production parts from the fabrication area to the warehouse, then to the production floor. The key goals for the new center are to reduce nonvalue time inefficiencies, reduce the number of times material was being handled, and increase the safety and comfort of the work environment.

## Vortex acquires VacVision Environmental

Vortex has completed the acquisition of VacVision Environmental, a trenchless infrastructure and service contractor. Located in South Carolina and Florida, VacVision Environmental will bolster Vortex's presence in the Southeast. The companies will begin to integrate services and personnel immediately. ♦



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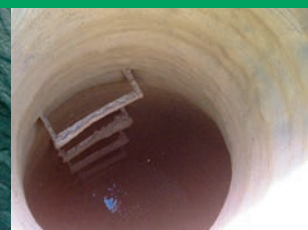
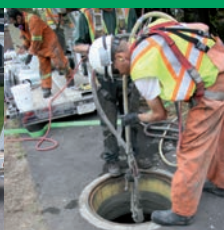
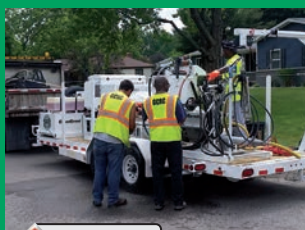
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Randall Dellaposta, Director of Equipment and Facilities at the Genesee County Road Commission (GCRC)



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## Product Spotlight

### Coating line offers fast return to service

By Craig Mandli

When you maintain a system that supplies clean water to thousands, downtime is the enemy. When you have to make major repairs to a part of that system, products that are easy to use and have characteristics that ready them for use quickly are ideal. Raven Lining Systems launched two updates to its AquataPoxy line for just those situations.

The newest additions to the AquataPoxy brand, the AquataPoxy 90 (epoxy lining) and AquataPoxy 190 (red oxide epoxy primer/finish coating), were designed to supplement Raven Lining Systems' existing portfolios for the potable water market. This includes a fast return to service in as little as 72 hours.

"What makes these products unique to this industry is they were designed to be some of the cleanest and safest protective linings on the market today," says Tripp Ishmael, Raven Lining Systems' vice president of research and development.

AquataPoxy 90 is a NSF/ANSI 61 potable water-certified, two-part, fast-curing, direct-to-metal, anti-corrosive epoxy coating. It offers a 21-day recoat window and can be used as a stand-alone coating or as a surface-tolerant primer for several different topcoats, including epoxies, polyurethanes, polyureas and other UV-stable topcoats. It is environmentally friendly to apply, as VOCs are less than 100 g/L, which meets California air-quality requirements. It is approved for minimum-size tanks greater than 25 gallons and pipes larger than 10 inches in diameter.



AquataPoxy 190 is a two-part, fast-curing, NSF/ANSI 61 certified, direct-to-metal, anti-corrosive epoxy coating that can be used as a blast-holding, direct-to-metal primer or as a stand-alone finish coat. It offers a 21-day recoat window for topcoat application. It can be used as a stand-alone coating or a surface-tolerant primer for several different topcoats, including epoxies, polyurethanes, polyureas, and other UV-stable topcoats. It is available in iron oxide red. It, too, is environmentally friendly, as VOCs are less than 166 g/L, which meet California air-quality requirements. It is approved for tanks greater than 5 gallons and pipes larger than 4 inches in diameter.

According to Ishmael, the AquataPoxy brand has been around for over 30 years, delivering environmentally safe, long-term corrosion prevention for potable-water infrastructures. The success of this Raven Lining Systems brand has spanned applications from storage tanks, water treatment plants, aquariums, and tunnels to the locks on the Panama Canal.

"Raven's products are some of the most trusted in the industry due to the rigorous NSF/ANSI 61 testing for certification purposes," he says. **800-324-2810; [www.ravenlining.com](http://www.ravenlining.com).**

### Petersen Products Multi-Flex Annular Seals

Petersen Products' Multi-Flex Annular Seals slip over the end of a pipe, creating a seal between the inner bypass pipe and the outer main pipeline. Annular Seals are possible for almost any size, pressure, chemical or temperature requirement. The seals are very flexible, easy to install, and offer many inflation connection options. The seals are ideal for bypassing a pipeline during repairs on a variety of small to large temporary pipeline connections. **800-926-1926; [www.petersenproducts.com](http://www.petersenproducts.com).**

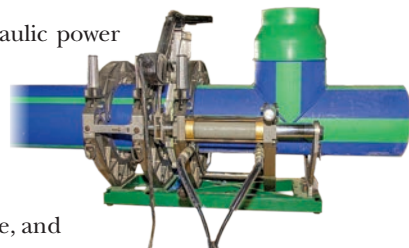


### McElroy Acrobat 315 fusion machine

The Acrobat 315 from McElroy meets the demand for polypropylene pipe fusion capability up to 12 inches while offering low- and high-force options for pipe. The compact, lightweight machine functions indoors in tight workspaces and outdoors in the smallest trenches. The machine can

be paired with two different hydraulic power units to meet the maximum system pressure desired. There are also two options for carriage pressure configurations: low force, for fusing in low-drag situations or with thinner-walled pipe, and

high force, for fusing in high-drag and vertical applications. The facer has a motor and gear reduction, which creates a lightweight, compact assembly that is balanced, and it also has a trigger-released lock to secure it in the carriage during use. **918-836-8611; [www.mcelroy.com](http://www.mcelroy.com).**



### Inflow Seal manhole cover sealing system

The manhole cover sealing system from Inflow Seal is a vertical rubber gasket that installs on the casting to seal out inflow. The EPDM seal is designed with internal hollow voids to enable the material to contract yet apply a seal-

(continued)



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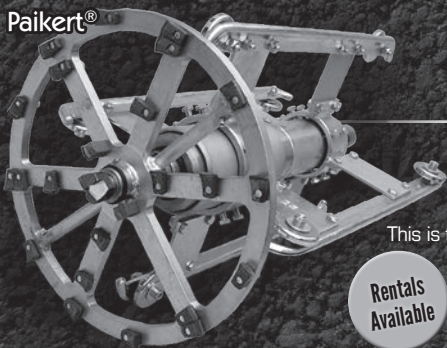


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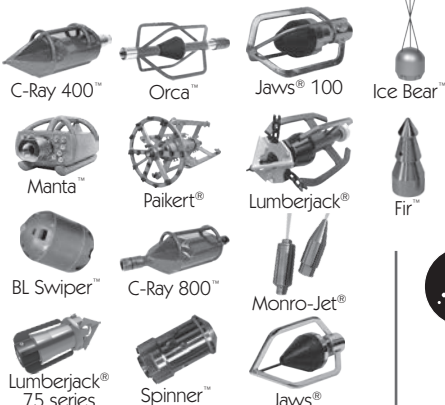
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ing force against the cover's vertical side. The rubber comes in a long continuous run and is cut to length to fit the size of the manhole casting opening. The seal is attached to the casting using a marine-grade adhesive/sealant. Silicone grease is applied to protect the seal, lubricate and enhance the water sealing capabilities. The system is capable of sealing up to 3 feet of water depth. **800-490-5325; [www.inflowseal.com](http://www.inflowseal.com).**



## Reed PDEB250 Cone Chamfer Tool

Reed's PDEB250 Cone Chamfer Tool efficiently chamfers the inside or outside diameter of plastic pipe. The cone shape fits the full range of pipe from 3/4- to 2 1/2-inch nominal diameter, including metric sizes, with one tool. Used with drill power or manually, the tool makes short work of external or internal chamfer jobs. Chamfer on plastic pipe provides an even penetration of glue, creating a better solvent weld. It complies with appliance and glue manufacturers' installation requirements. It has a hardened steel blade for smooth cuts and long blade life. **800-666-3691; [www.reedmfgco.com](http://www.reedmfgco.com).**



## Mueller swing check valves

To meet the higher pressure requirements of today's water infrastructure systems, all 2- to 12-inch Mueller UL/FM swing check valves are now rated at 350 psig cold working pressure. In addition, the product line has been expanded to include 2-, 14- and 16-inch sizes. The two largest sizes are rated at 250 psig CWP. Standard features include all ductile iron construction, bronze to BUNA seating, lifting rings, PN16 drilling, bosses for bypass connections and a drain plug. **800-423-1323; [www.muellercompany.com](http://www.muellercompany.com).**



## Water Cannon Inc. - MWBE 12-volt fluid transfer pump

The EF4000 Everflo 12-volt diaphragm pump from Water Cannon Inc. - MWBE is ideal for fluid transfer applications, agricultural sprayers and spot sprayers. The lightweight and versatile pump comes equipped with a polypropylene housing and valve plate, Viton valves, and a Santoprene diaphragm. It also features a low-demand switch that automatically turns the pump on and off as flow is required. This feature eliminates the need for a pressure regulator or bypass valve, making it more efficient. Power is only used when the pump flow is in demand. It is self-priming up to 8 feet and has a maximum fluid temperature of 140 degrees F. **800-333-9274; [www.watercannon.com](http://www.watercannon.com).**



## SpectraShield polymeric lining system

SpectraShield is the only polymeric lining system of its type designed specifically for wastewater structures. In addition to preventing corrosion and stopping infiltration, SpectraShield restores structural integrity with a semiflexible, stress skin panel effect. It is not susceptible to cracking with common ground movement conditions like freeze/thaw, wet/dry and traffic loading. Because of its ease of application and rapid curing, project costs and interferences are minimized. SpectraShield has been independently assessed to have a 100-year design life and tested extensively for adhesion, corrosion performance and resistance to hydrostatic pressure. The system's track record is now evident in thousands of structures throughout the U.S. and abroad, covering over 7.5 million square feet. **800-284-2030; [www.spectrashield.com](http://www.spectrashield.com).** ♦



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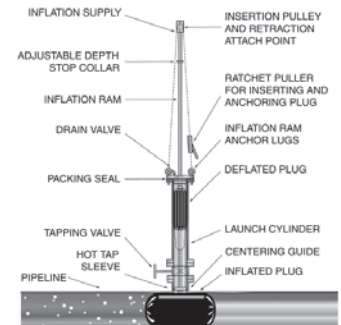
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## PEOPLE/AWARDS

**Madison County**, Illinois, and **HeartLands Conservancy** received an Outstanding Local Government Achievement Award from the East-West Gateway Council of Governments for the Upper Silver Creek Watershed Plan. The plan is a road map that communities, agencies and landowners can follow to improve water quality, reduce flooding and support healthy wildlife habitats.

The Massachusetts Department of Environmental Protection awarded the **town of Millbury** a \$150,000 grant to reduce sediment and nutrient loads as well as the quantity and velocity of stormwater in water flowing into the Blackstone River. In addition, the Massachusetts Department of Environmental Protection awarded the **town of Bellingham** nearly \$100,000 in grant funds to address stormwater runoff at the municipal center. The grants are part of \$1.53 million in funds from the U.S. Environmental Protection Agency that was awarded to local and statewide projects targeting water pollution from stormwater runoff and erosion.

**Karen Sundy**, assistant administrator for Perry Township in Ohio, was promoted to replace longtime administrator **Wally Siegel**, who retired in October 2017. Siegel, however, will continue to work on a part-time basis, serving as zoning inspector, stormwater director and economic development liaison.

**Craig Miller** was named general manager by Western Municipal Water District's (Western) Board of Directors in Riverside, California. Miller, in his role as deputy general manager, oversaw operations, engineering and water resources, including the district's capital improvement projects focused on local water reliability.

The **Florida Department of Environmental Protection** has provided more than \$90 million toward the recent completion of water-quality improvement projects in central and south Florida. The funding was awarded through the Department of Environmental Protection's Division of Water Restoration Assistance's various funding resources and programs. Recently completed projects are in Apopka, Gasparilla Island, Largo, Martin and St. Lucie counties, Sebring and Stuart (two projects).

**Upper Moreland**, Pennsylvania, was named the first recipient of the Montgomery County Conservation District's new Environmental Stewardship Award. The honor recognizes the township's partnership with the recently opened Thompson Lexus Willow Grove car dealership and their combined efforts at designing a stormwater management system at the site to protect the nearby Pennypack Creek.

## LEARNING OPPORTUNITIES

### Texas

The National Association of Flood & Stormwater Management Agencies is offering a Flood Risk workshop on Feb. 28 in San Antonio. Visit [www.nafsma.org](http://www.nafsma.org).

### Virginia

The American Society of Civil Engineers is offering a Young Member Leadership Symposium on Aug. 3-5 in Reston, Virginia. Visit [www.asce.org](http://www.asce.org). ♦

## CALENDAR

### March 1-3

American Society of Civil Engineers CI (Construction Innovation) Summit, Hilton Fort Worth, Fort Worth, Texas. Visit [www.cisummit.org](http://www.cisummit.org).

### March 6-9

National Utility Contractors Association Annual Convention, Wyndham San Antonio Riverwalk, San Antonio. Visit [www.nuca.com](http://www.nuca.com).

### March 25-28

American Water Works Association Sustainable Water Management Conference, Renaissance Seattle Hotel, Seattle. Visit [www.awwa.org](http://www.awwa.org).

### April 19-21

American Society of Civil Engineers Structures Congress, Fort Worth Convention Center, Fort Worth, Texas. Visit [www.structurescongress.org](http://www.structurescongress.org).

### April 22-24

American Society of Civil Engineers Surveying and Geomatics Conference, Cal Poly Pomona university, Pomona, California. Visit [www.surveyingconference.org](http://www.surveyingconference.org).

### April 22-25

American Water Resources Association Spring Specialty Conference: GIS and Water Resources, Rosen Centre Hotel, Orlando, Florida. Visit [www.awra.org](http://www.awra.org).

### May 6-9

American Public Works Association North American Snow Conference, Indianapolis. Visit [www.apwa.net](http://www.apwa.net).

### May 22-24

National Utility Contractors Association Washington Summit, Holiday Inn Capitol, Washington, D.C. Visit [www.nuca.com](http://www.nuca.com).

### June 3-7

American Society of Civil Engineers World Environmental and Water Resources Congress, Hyatt Regency Minneapolis, Minneapolis. Visit [www.asce.org](http://www.asce.org).

### June 11-14

American Water Works Association Annual Conference & Exposition, Mandalay Bay Convention Center, Las Vegas. Visit [www.awwa.org](http://www.awwa.org).

### July 9-11

American Water Resources Association Summer Specialty Conference: Managing Transboundary Groundwater, Worthington Renaissance Fort Worth Hotel, Fort Worth, Texas. Visit [www.awra.org](http://www.awra.org).

### July 10-12

National Association of Flood & Stormwater Management Agencies Annual Meeting, location TBA. Visit [www.nafsma.org](http://www.nafsma.org).

### July 29-Aug. 1

American Society of Agricultural and Biological Engineers Annual International Meeting, Cobo Center, Detroit. Visit [www.asabe.org](http://www.asabe.org).

### Aug. 12-16

StormCon, Hyatt Regency Denver at Colorado Convention Center, Denver. Visit [www.stormcon.com](http://www.stormcon.com).

### Aug. 26-29

American Public Works Association Public Works Expo: PWX, Kansas City Convention Center, Kansas City, Missouri. Visit [www.apwa.net](http://www.apwa.net).

### Sept. 17-19

National Rural Water Association WaterPro Conference, Fort Worth, Texas. Visit [www.nrwa.org](http://www.nrwa.org).

### Oct. 12-15

American Society of Civil Engineers 2018 Convention, Hyatt Regency Denver at Colorado Convention Center. Visit [www.asce.org](http://www.asce.org).

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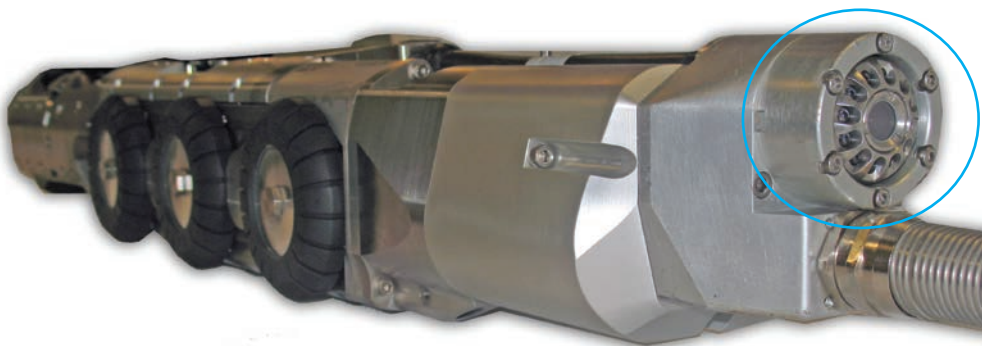
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**Looking for a new job?** Water District Jobs, an online job board, lists dozens of career opportunities in the water and wastewater industry, from water operators to general managers. New openings are posted every day. Visit <http://www.WaterDistrictJobs.com>. (M04)

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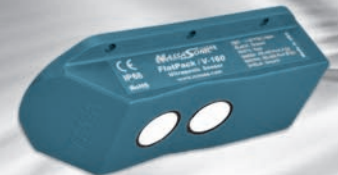
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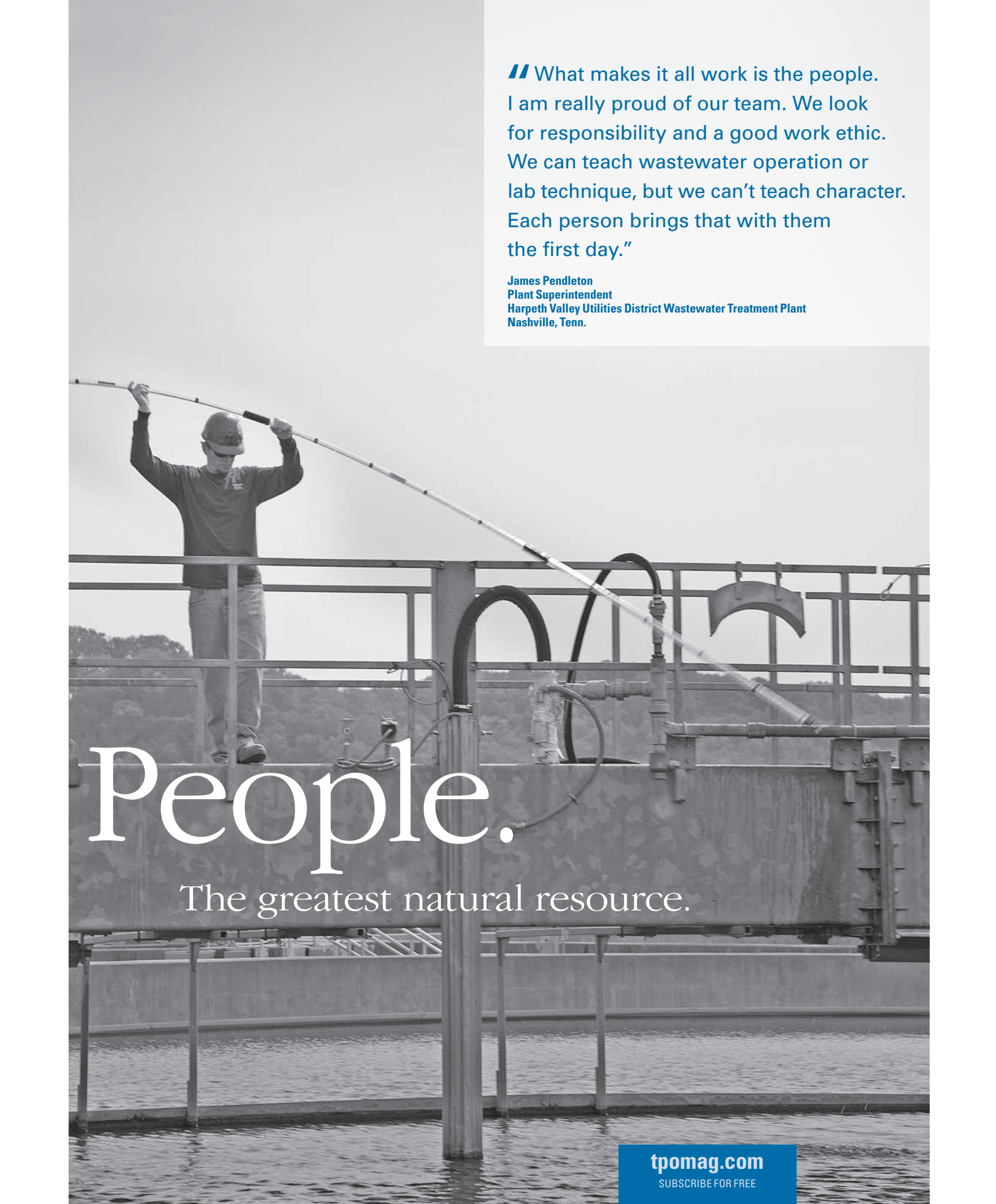
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