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January 2018

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El Paso Water's utility Chief Technical Officer Gilbert Trejo (left) and Water Resources Manager Scott Reinert.

TAKING CARE OF THE NEXT GENERATION

PIPELINE REPAIR & REHABILITATION DIRECTORY

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El Paso (Texas) Water invests resources in real-time hydrological programs and long-term projects to ensure freshwater for the future

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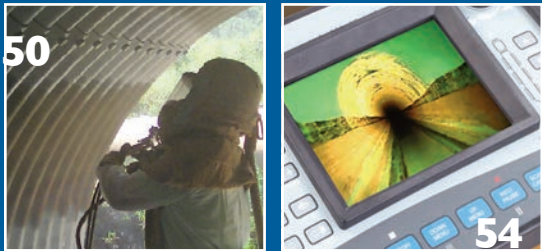
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PIPELINE REHABILITATION AND RELINING



ON THE COVER: El Paso Water's Chief Technical Officer Gilbert Trejo (left) and Water Resources Manager Scott Reinert have helped guide the utility through some major initiatives aimed at ensuring a reliable, quality water supply for future generations. (Photography by Marcos Fernandez)



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JANUARY 2018

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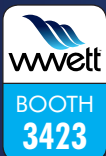


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WORKING TOWARD A HEALTHY FUTURE

Progressive, proactive measures can safeguard the lifeblood of your communities

I woke up a little late this morning. I scrambled to shower and get dressed and ran out the door. On the 20-minute drive to work, I thought briefly about a subject for this column. When I finally sat down at my desk, one of the first images I saw was a water tower emblazoned with Flint Water Plant in bold block letters. That's Flint, Michigan. The story was about the least healthy cities in the U.S.

I clicked through the story, glancing over everything from the obesity rate in Pueblo, Colorado, to the prevalence of sexually transmitted infections in Pine Bluff, Arkansas. When I finally got to the Flint page, there was the water tower again. Flint is the birthplace of General Motors and was once a hub of automotive manufacturing. But as the automotive jobs went away, the city's problems grew. The write-up didn't mention Flint's recent water



FROM THE EDITOR

Luke Laggis

crisis and focused instead on other health concerns, but the water crisis is still synonymous with the city.

Water is not scarce in the upper Midwest, which makes it much easier to take it for granted. In Flint, the problem was poor treatment and distribution practices rather than inadequate supply. As I read through the story, I couldn't help but compare Flint to a much different story in El Paso, Texas.

To be fair, while water supplies are nowhere near as plentiful in the western corner of Texas as they are in the Great Lakes region, El Paso is not hurting. It is thriving. In fact, people from all over the world visit El Paso to learn more about its progressive water management practices.

El Paso Water invests resources in real-time hydrological programs at the same time it launches longer-term projects to ensure water is there for future generations. This planning and implementation process constantly evolves.

In a normal year, the Rio Grande can supply half of the water El Paso needs. In dry years, the river's contribution shrinks dramatically or disappears altogether, so El Paso supplements its supply with water from the Hueco and Mesilla aquifers that underlie the region.

In drought years, Hueco's contribution to the total water supply almost doubles. This drawdown on the aquifer is not a sustainable solution because aquifers eventually can be tapped out, too. To complicate matters further, the Hueco water is not all drinkable. It holds about 10 million acre-feet of freshwater and 30 million acre-feet of brackish water.

Water reclamation is one of the acclaimed parts of El Paso's water success story. The program was developed in part to maintain the Hueco aquifer's freshwater volume and keep brackish water at bay. The utility is credited with operating one of the world's first wastewater treatment plants whose product meets human consumption standards. Some 6 million gallons of reclaimed water are utilized across the city's mesa and valley every day.

Flint and El Paso may not have much in common, but all water utilities share the common purpose of providing life to the communities they serve. The way you handle that responsibility has a huge impact on the health and future of your communities. El Paso is taking progressive steps to secure their future. Check out their story on page 24.

Enjoy this month's issue. ♦

Comments on this column or about any article in this publication may be directed to editor Luke Laggis, 800/257-7222; editor@mswmag.com.

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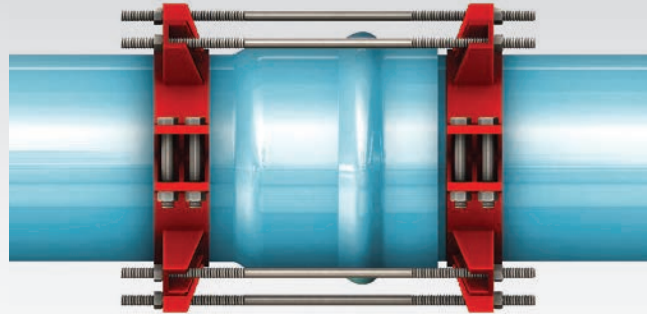
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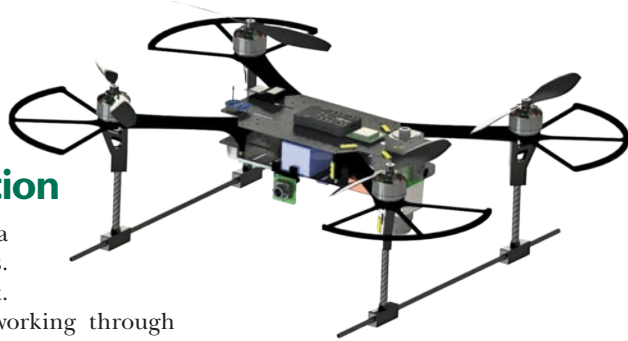
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NEW TECHNOLOGY

Drones Being Tailored for Sewer Inspection

Drones are being deployed in a number of ways these days. Add sewer inspection to the list. A consortium of companies working through the European Coordination Hub for Open Robotics Development has been designing a drone specifically tailored for inspecting sewers and is preparing to launch a prototype for field testing in Barcelona this year. Learn more in this online exclusive. mswmag.com/featured



AGING INFRASTRUCTURE

The Opportunity for Private Investment

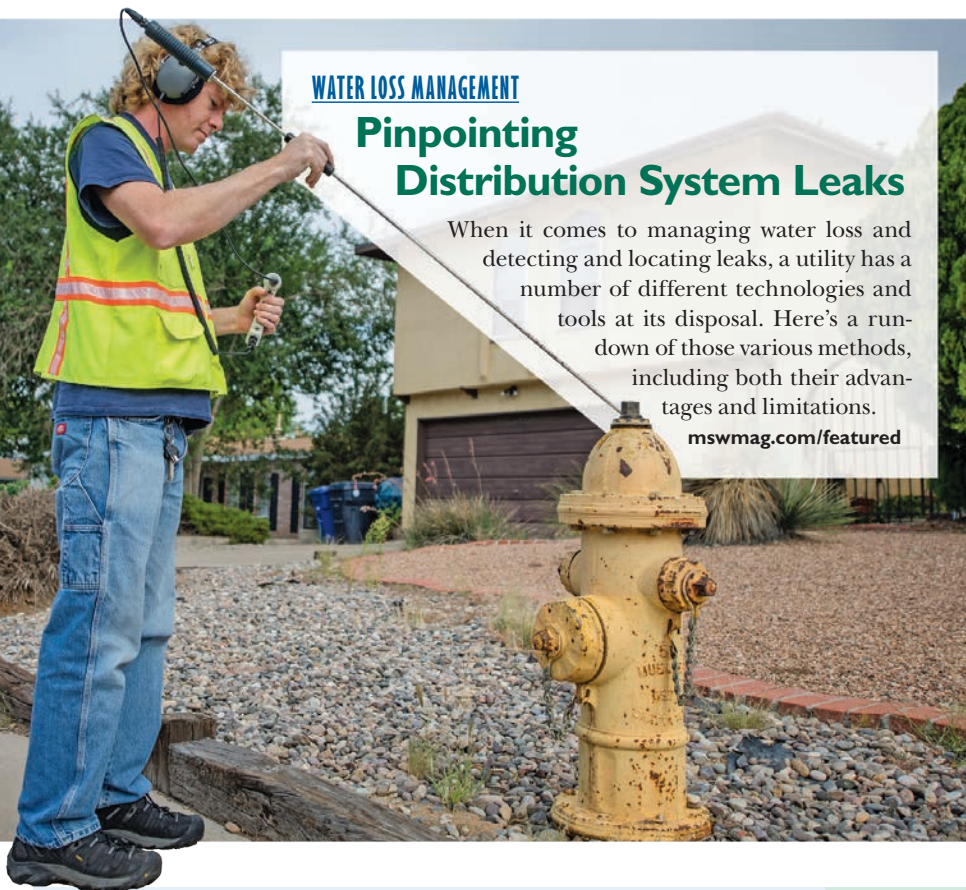
Tightening budgets can make it difficult for municipalities to tackle their infrastructure issues. That was the launching point for a new report recently released by Bluefield Research — a look at the opportunity that exists for private investment in municipal infrastructure. Read more about how private players can be a key part of fixing the country's infrastructure woes. mswmag.com/featured

WATER LOSS MANAGEMENT

Pinpointing Distribution System Leaks

When it comes to managing water loss and detecting and locating leaks, a utility has a number of different technologies and tools at its disposal. Here's a run-down of those various methods, including both their advantages and limitations.

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OVERHEARD ONLINE

“Everyone's trying to reach the goal of FOG-free sewer lines, but there is no single solution that will handle every FOG problem.”

— *Utilities Find Ways to Ward Off FOG*
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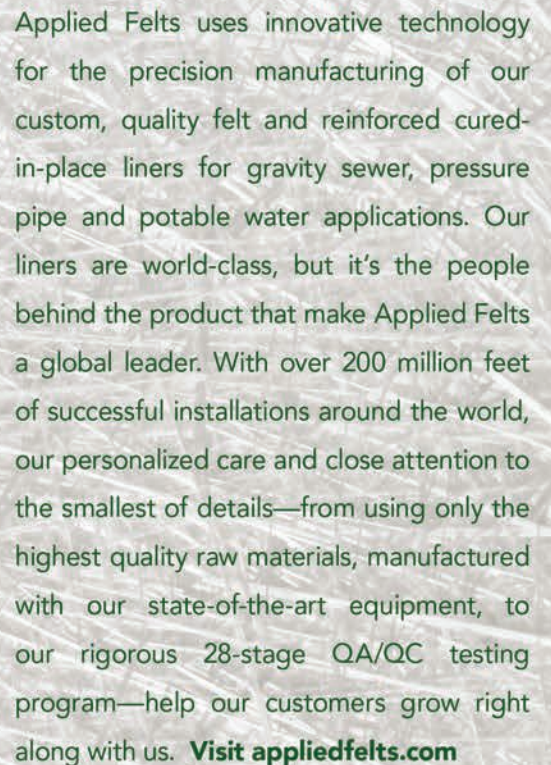
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BY THE NUMBERS



Water operators (from left) Isaac Kershner, Steve Hunt, Ron Blackman and Sam Lovato, Public Works Director Randy Randall, and Water Supervisor and Assistant Public Works Director Michael Carlson at the City Public Works Facility in Centerville, Utah. (Photography by Sallie Shatz)

Randy Randall and his operations team rely on data to pump water efficiently and take full advantage of the local utility rate structure

By David Steinkraus

The water distribution system in Centerville, Utah, has been recognized for its accomplishments, and it's because Randy Randall thinks about harmony.

That isn't a touchy-feely idea — it's practical, says Randall, public works director. It grows from recognizing the energy inherent in moving water and from understanding the needs of the local electric utility. Combined with Randall's enthusiasm for testing to determine what's really happening, the approach has saved hundreds of thousands of dollars in power costs.

Centerville (population 16,500) is one of a string of suburbs north of Salt Lake City at the feet

of the Wasatch Mountains. Most of the available land has been developed, and the population is expected to top out at about 20,000. Future development will consist of apartment buildings and other high-density uses.

Knowing the system

The water system draws from six wells that require no chlorination and from the Weber Basin reservoir that's operated by another entity (some chlorination is required because the source is surface water). "One of our geographical blessings is we're against the mountains, so we can place reservoirs there and don't have to construct

tall towers," Randall says. All that water in a high place carries energy, and in Randall's view, it is better to use and manage that energy than to let it dissipate and then add energy with a pump.

"You need to know how your system operates: What are the loads? What are the demands?" Randall says. "I've been here long enough to know how much we need to pump per day, per week, and per year." A few years ago, the system used 60 hp booster pumps, but they were running for one hour a day. Randall had a different goal: using smaller pumps during off-peak hours for the utility.

"We allow our reservoirs to act as a battery," he says. "We used to refill the reservoirs completely. Because the smaller pumps don't refill completely, the reservoirs drop a little bit more every day. At the end of a week, they're typically 10 percent lower, and we refill completely over the weekend. There's no hurry to fill the reservoir. As long as we have enough storage for fire flow and daily demand, what's the rush?"

(continued)

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PROFILE:

Water distribution system, Centerville, Utah

BUILT:

1838; refurbished 1982

POPULATION SERVED:

16,500

SERVICE AREA:

6 square miles

EMPLOYEES:

Four

SOURCE WATER:

Six wells and Weber Basin reservoir

SYSTEM STORAGE:

5.5 million gallons

INFRASTRUCTURE:

70 miles of mains

ANNUAL BUDGET:

\$2.8 million (operations)

WEBSITE:

www.centervilleut.net/publicworks

Public Works Director Randy Randall uses a water system model to show how gravity and existing pressure can be used to push water through Centerville without using energy.

Switching to smaller pumps cut the system's cost. A variety of 5 hp and 7.5 hp pumps move water into and out of the reservoirs. The larger pumps are still in place in case of need, such as to refill a reservoir that has been drained for cleaning. When the big pumps need testing, Randall doesn't start them with utility power; he hauls a portable generator to the pump house. Generators need to be exercised, and even at the city's low rates, starting a large pump incurs a \$600 demand charge.

Moving water naturally

The distribution system is split into five zones, and a series of electronic and hydraulic valves allow water that's flowing down from the reservoirs to move among zones by gravity. "It's really like

"It takes a lot of time to figure out what the power company really wants you to do, but if you do that, you can save a lot of money by working within their parameters."

Randy Randall

a card game where you strategize to reduce the kilowatt hours," Randall says. "And power companies want loads spread over 24 hours. They want lower and longer loads."

Pump houses are built into hillsides because surrounding them with earth on three sides insulates them. The area's winds brought a new problem and a new idea. "We have strong east winds," Randall says. "My dad's gas station was blown down twice, and we've had trains blown over. During one windstorm, air blowing through the vents in pump houses froze the pipes."

In response, the Centerville team built vent covers insulated with an inch of foam. In summer, they're removed so fans can cool the pump house. For winter, they snap onto a frame. During a winter day, sunlight heats the pump house interior. At night, the temperature remains above freezing because of the insulation and heat from the pumps.

Power of testing

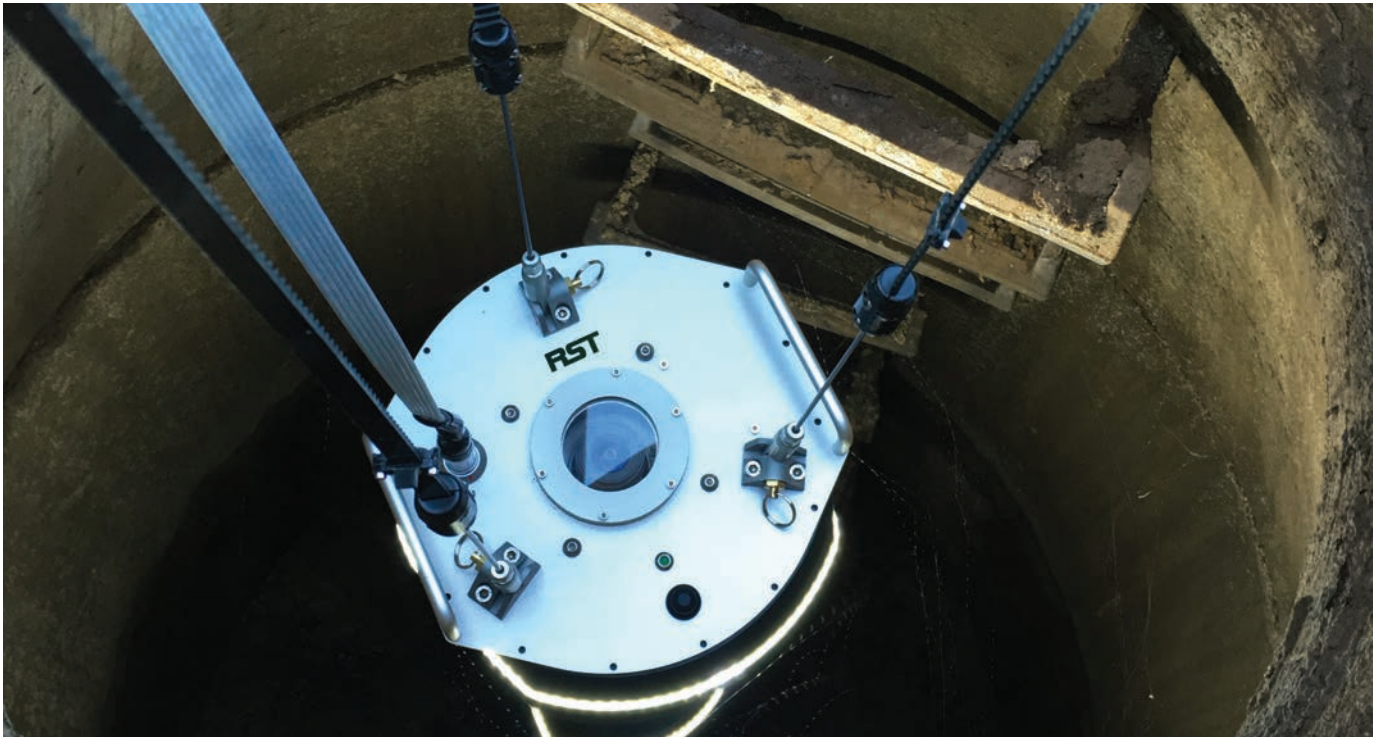
Testing is a hallmark of the approach taken by Randall and his team, which includes Mike Carlson, water superintendent; Sam Lovato, water worker I; and Ron Backman, Steve Hunt, and Isaac Kershner, water workers III. Testing is how the team measured leakage in the system. "It took a year to do all that, and one question I asked myself was how much water was leaking through people's homes every day?" Randall says.

The team collected data on baseline water usage, doing the testing at night when usage is minimal. They measured the flow in each zone by routing water around the pressure-reducing valve and through a small meter that's sensitive enough to detect a change of only 1 gpm. Using bypass pressure-reducing valves, recording flowmeters, and recording pressure gauges, Randall found the baseline: a 13 percent discrepancy between water produced and water sold.

"Our conclusion was that on average about 0.02 gallons per minute is lost in each building's water system through leaks," Randall says. "They can't make a meter for those low flows. It's just cost prohibitive, so you're accepting some loss in the system." The team tested all five zones in the system and found another twist: Areas with multiple rental dwellings lost about 0.07 gpm on average. They concluded that leaky faucets and fixtures in those homes were not being repaired. Overall, the city was losing an estimated 112 gpm at its 5,500 connections. Randall verified that by

(continued)

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A LOW-TECH BACKUP

While advanced SCADA equipment is beneficial in running a water distribution system, there are risks with any computer connected to the internet. So, the Utah city of Centerville developed a communications loss plan, or CLP.

It is a single-page document that shows technicians how to position valves and switches to operate the system if communications are out completely and all the computers are down, says Randy Randall, public works director. To make the plan work, the system has backups incorporating older mechanical technologies. Floats govern flows into a reservoir. Outside one reservoir is a plastic tube with a yellow ball in it to show the level of water. The other reservoirs connect to it, so one tube shows the level of all three.

“We have run our system for two to three weeks at a time using the CLP just to test it,” Randall says. “It really works quite well.” Under normal operations, iPad tablets tell technicians what’s happening in the system and allow them to control it. If someone manages to break in and interrupts the telemetry, the system shuts off communications with the tablets and can be operated without an internet connection. This provides another option before the CLP is needed.

Randall is not worried about hackers. He has taught cybersecurity for water systems and observes that the amount of information flowing through a SCADA system makes successful attacks difficult. Centerville’s system is relatively small, yet it gathers thousands of points of data, from the water depths in wells to the temperatures inside buildings.

A hacker might change a parameter or two but wouldn’t understand enough to dynamically change the system, Randall says. Also, the SCADA computer issues commands over UHF radio, which is not subject to internet hacking. At the same time, people who work closely with any system know it. By observing information in the SCADA system, he says, they will know when something is abnormal.



“I truly love to analyze and figure out how things function and how they work.”

Randy Randall

Local resident Kurt Tannbaum fills up water jugs at Centerville’s Church Well, which has no chlorine or fluoridation. Citizens from all over the Wasatch Front come to the well for drinking water.

checking wastewater flows.

Randall is using this information as a baseline so he can spot problems in the future. There is the possibility of launching a program to encourage people to fix leaky fixtures — or even to provide money for them to do so — but the electricity cost to produce the lost water is only \$5,000 to \$6,000 a year, and any leak-fixing grant program would exceed that cost.

Power economics

A good deal of what Randall has accomplished was possible because he took time to understand the power utility. “I had to talk to an incredible number of people to understand what’s really going on and how the power company operates,” he says. “One of the most important things I learned was how to read a power meter.”

One dial registers demand, and another records the date and time; that is important to on- and off-peak billing. Randall knows what day of the month the utility reads the meters; he also knows that it happens between 7 a.m. and 3:30 p.m. He and his team plan the use of pumps around that day and time. For example, if they want to switch from using Well 1 to Well 2, they do it on the day when the meter is read and after

3:30 p.m., which is during off-peak hours. As a result, there is only one demand charge for each month: one charge for the Well 1 pump on the day before the meter is read, and one charge for the Well 2 pump on the day the meter is read.

By managing when pumps come online, the team eliminates an extra demand charge. One day when Randall was out of the office, a pump went down, and the technicians could not get it back online. The power meter was scheduled for reading a few days later, so they opened a valve and bought water from the city’s outside supplier. That saved about \$1,000 for a demand charge. Savings from such decisions add up.

Centerville pumps 99 percent of its water using off-peak power. About five years ago, Randall calculated that careful management had saved the city about \$266,000 in annual power charges. Since then, the system’s energy bill has continued to drop by about \$10,000 per year. Randall’s analysis shows that energy charges account for about 38 percent of each power bill and demand charges account for about 25 percent. “It takes a lot of time to figure out what the power company really wants you to do, but if you do that, you can save a lot of money by working within their parameters,” he says.



Randy Randall shows how demand charges are saved by using a generator outside the Park Hills Booster Station.

Applying technology

Advanced SCADA equipment enables the team to keep the system running at peak performance. They also use the system to isolate leaks: It's a side benefit of running pumps at night to take advantage of off-peak power costs. That means the entire day is a continuous leak test.

"I looked at the SCADA system for one zone, and I said, 'That has changed,'" Randall says. "I'm talking about the slope of the graph on the screen that shows the demand on a reservoir. It was more than usual, and that means there's a leak. And all of this comes back to the principles of observation and understanding what the observation means. I looked at the previous week's graph, and I noticed the change."

Over 18 months, the SCADA system revealed three leaks that didn't break through on the surface. Using the valves installed for cross-connecting supply zones, the team fed one section of a suspected zone from one reservoir and another section from another zone. They progressively isolated smaller and smaller areas, and by watching the pitch of the graphs on the SCADA system, they could see which section had the leak.

The Centerville system has won efficiency awards from the Rural Water Association of Utah and the National Rural Water Association. One event that started the utility on that road was fire protection: A test found that some areas of the city with larger structures needed higher flows to the hydrants than existed. Randall obtained money for one check valve and two pressure-reducing valves to interconnect distribution zones and increase flows for emergency demands. Then, he considered how more valves could cross-connect zones so water could move under its own energy.

"One thing built on another, and here we are," Randall says. "I truly love to analyze and figure out how things function and how they work. I understand a lot of the principles of nature. From youth I've been interested in those concepts."

Although he is the public works director responsible for streets and other services, his passion is water. With a lot of thinking and some creativity, he makes the water flow affordably, and citizens can thank him each time they open a bill. ♦

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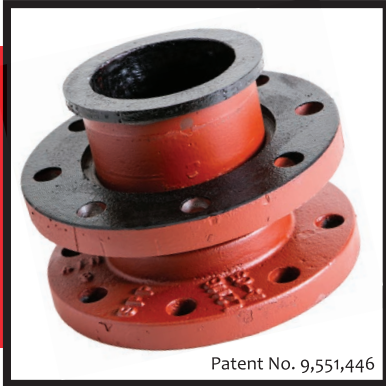
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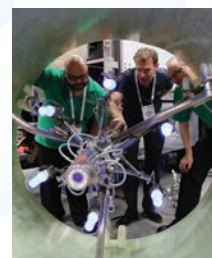
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ALL ABOUT CURED-IN-PLACE PIPE

Understanding the basics of CIPP rehabilitation will help you choose the right solution for your system

By Gil Longwell



Buried pipes are, by their nature, generally inaccessible. Their earthen cover provides shielding from most accidental damage and weather and temperature extremes. But, sooner or later, buried pipes will require maintenance or replacement, and then their shield becomes their Achilles' heel.

The previous, traditional approach to both spot repairs and restoration of lengthy deteriorated segments was to dig up the pipe and fix the problem. Excavation was messy, disruptive to nearby and competing activities, and could take a lot of time. Each of these added to project costs, which in turn reduced the total length of pipe that could be restored in this manner — in a season or for a single project.

In the late 1960s, the idea of repairing or restoring a pipe from the inside began to take hold. About that time, the first patents for pipe lining equipment were issued. The repair strategy started in Europe and made its way to the U.S. in the mid-1970s, but its use wasn't widespread until the 1990s.

Planning and reconnaissance

Before a liner can be inserted, the existing pipe must be cleaned and inspected. CCTV is used to determine the type of preparations needed. "Preparation can range from simple flushing to a hard and aggressive cleaning," explains Mike Burkhard, executive director of business and technology development at Reline America. "In some cases, root and obstruction removal may be necessary. Severely deteriorated or partially collapsed areas must be evaluated for their ability to withstand and/or accommodate the introduction of a new pipe, but even partially collapsed pipes can sometimes be relined."

The new pipe material must be flexible enough to be inserted into an existing pipe, but strong enough to provide structural strength and good flow characteristics once cured. It also must be impervious and resistant to the nature of the materials it will carry.

Manholes are the logical beginning and end points for liner installation. Pipe joints at the manholes and any midrun lateral connections, once restored, must be properly sealed. External groundwater must be kept from infiltrating wherever the new liner is joined to an existing lateral. Likewise, the surrounding environment must be protected from leaks.

Cured-in-place pipe provides an effective, trenchless sewer line rehabilitation option, especially when installed from an existing manhole.

Because every pipe segment is unique, there are few hard and fast rules in the relining industry. The door to a successful job is opened by a compre-

(continued)



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A fresh liner is lubricated and fed into an inversion unit for installation in a 4-inch-diameter sewer lateral.



Before installation, liners must be impregnated or “wetted” with a catalyzed resin. In some cases, prewetted liners are sent to the job site in a sealed container, but the wetting process can also take place on the job site in a purpose-built truck or trailer.

hensive understanding of the conditions that must be overcome and the use of proper materials.

Installation methods

Once selected, the new liner material must be cut to length to reach from one manhole to the next, then wetted, and pushed or pulled into the host pipe. Two different and equally effective processes have been developed to accomplish this task.

The pull method uses a stout rope or cable that is inserted at a manhole and advanced downstream until it reaches the next manhole, where it is secured to the end of the liner. The rope pulls the attached liner upstream,

first entering through the introduction manhole, then the pipe segment, and onward to the manhole through which the pull cable was inserted. Secured at each end, the liner is then inflated against the receiving pipe.

The inversion method uses compressed air or water to push the liner into the receiving pipe. One end of the liner is attached to a collar-like device at the insertion manhole. As air or water are introduced, the fluid “pushes” the liner to the next manhole. As it advances, the liner is turned inside out; this action is the genesis of the process’ name. When the liner protrudes into both manholes, it is trimmed, secured at each end, and inflated against the receiving pipe.

Once the liner is in place, it is cured, transforming the flexible liner into a rigid new pipe within the original pipe. Hot water, hot air, steam, pressurized ambient air or exposure to ultraviolet light are the primary curing methods. The process is selected based on the liner material, the resin and its chemical properties, and pipe diameter.

Materials

The liner itself may be made using a woven or “felting” process. The most common liner base materials are polyester and fiberglass. Lynn Osborn, P.E., a technical director for NASSCO, explains “Felting is a textile production process that uses repeated partial insertion and removal of barbed felting needles into several layers of unwoven base fiber. As the needle is withdrawn, it pulls the fibers of one layer into the next.” Felt, unlike woven textiles, will not rip along a grain line, typically known as the weft line.

During fabrication, a liner starts out as a long rectangle. The two long sides of that rectangle must be joined together to create a high-strength, fully sealed seam. With the two sides overlapped, multiple lines of stitching may be used to retain consistent mechanical performance around the liner’s circumference. Another process is to butt stitch the two sides together without overlap. Some liner tubes are fabricated by gluing the two sides together. Regardless of the joining process, when inflated, the flat rectangle becomes a cylinder.

Additional woven or felted layers or a jacket of plastic film may be used to address specific conditions in the host pipe. Some manufacturers apply a thermoplastic coating for certain applications. These techniques are aimed at making the wetted liner easier to insert into the receiving pipe or to achieve smoother bends. Transition liners are available for pipes that change diameters midrun.

Before installation, the liner tube must be impregnated with a catalyzed resin. This process is called wetting or wetting out. Wetting can be accomplished in the liner fabrication plant or similar processing facility. These “prewetted” liners are sent to the job site in a sealed container to preserve the materials. Wetting can also be accomplished in a purpose-built truck on the job site. In that situation, the wetted pipe leaves the prep area and is immediately inserted into the receiving pipe.

“The dimensions and weight of the folded or coiled ready-to-install liner combine to influence the selection of the wetting facility and its location,” Osborn says.

Vinyl ester, epoxy and polyester resins are cured with steam, or hot or ambient temperature air or water, adds Burkhard. Styrene-based wetting agents have found favor for use with liners intended for sewer line restoration. Regardless of the resin selected, the curing process makes the resin material rigid and preserves the inflated liner’s shape.

Lateral connections

Laterals that were sealed shut during relining must be “reintroduced.” First, these connection points must be located and the newly cured lining must be drilled, ground, routed or otherwise removed. Sealing these reconnected laterals presents a different set of challenges.



A crew shoots a liner into a residential sewer lateral from a cleanout in the driveway.

Working from within the larger pipe, a short, T-shaped liner (sometimes called a top hat or stove pipe) can be inserted into the lateral. This liner must sufficiently overlap the main liner and extend into the lateral to bridge any gaps and create a good seal against infiltration and exfiltration. In problematic situations, the surrounding soil can be grouted to supplement the internal-connection approach. Grouting can also be done from within the pipe.

Pros and cons

Compared to the traditional dig-and-replace approach, most CIPP jobs are planned to enable one or more relined segments to be completed in a single day. A single day disruption is more palatable to customers.

When relining is between manholes or similarly accessible points, it may be possible to avoid all excavation. Plugging an upstream sewer main can create some customer concerns, but a well-planned notification process will go a long way to minimize complaints. Manhole-to-manhole work significantly minimizes traffic disruptions as well.

Both pressurized and gravity-flow segments must be impervious at both ends and where laterals connect to the new liner. Groundwater must be protected from exfiltration of the conveyed fluids, and the system must be sealed against infiltration.

The largest-diameter pipe that can be successfully lined with current processes is about 10 feet

while the smallest is about 2 inches. With few hard rules, these limits are related more to liner fabrication and insertion limitations than they are to liner performance. Preserving flow capacity to convey fluids appears to be the greatest small pipe challenge. When lining extra-large-diameter pipes, the challenge is the enormous weight of the liner itself and its coiled or folded size, both of which affect transportation options. "In the end, the liner itself may limit the situations in which it is a viable solution," Osborn says. ♦



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A contracted well drilling crew drills a replacement well for El Paso Water, which has invested heavily in ensuring a reliable, quality water supply for future generations. (Photography by Marcos Fernandez)

TAKING CARE OF THE NEXT GENERATION

El Paso (Texas) Water invests resources in real-time hydrological programs and long-term projects to ensure freshwater for the future

By Giles Lambertson

El Paso (Texas) Water's winning formula for water sufficiency goes something like this: Blend one part leadership and one part education. Add expertise in hydrology. Constantly tinker with the recipe. Optional ingredient: prayers for rain.

"When people come visit us from all over the world, they soon see we have no technological secrets, no black boxes," says Gilbert Trejo, chief technical officer for El Paso Water, alluding to official delegations from Brazil, Israel, China, Iraq, Singapore and other countries. "We are just doing a lot of things that make sense."

Doing sensible things is not every city's legacy. How El Paso earned an international reputation for sensibly meeting the water needs of the community is a story that stretches back 65 years, according to Lisa Rosendorf, the utility's chief communications
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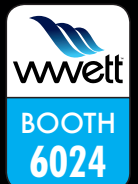
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“When people come visit us from all over the world, they soon see we have no technological secrets, no black boxes. We are just doing a lot of things that make sense.”

Gilbert Trejo

El Paso senior plant technician John Hawkins takes a water sample at the Kay Bailey Hutchinson Desalination Plant, which has the capacity to produce 28 million gallons of freshwater per day.



PROFILE:
El Paso Water

YEAR FOUNDED:
1952

CUSTOMERS SERVED:
680,000

EMPLOYEES:
957

ANNUAL BUDGET:
\$518.6 million for fiscal year 2017-18

and government affairs officer. “In 1952, there was a decision made by city leadership to insulate the water utility from some outside pressures by creating a public service board. The new board was less subject to political swings.”

Given this freer rein to manage, the utility’s chief executive officer and seven-person board could plug their financial, engineering, management and environmental skills into long-term strategies. Consequently, they have pursued plans without worrying that a water-sourcing plan might not bear fruit for several political cycles. A typical local politician might be interested in a five-year plan, but the utility can look ahead 50 years and prepare for it.

As a result, El Paso Water invests resources in real-time hydrological programs at the same time it launches longer-term projects to ensure water is there for future generations. This planning and implementation process constantly evolves. The utility can supply the 130,000 acre-feet of water that residents will consume this year with 20,000 acre-feet to spare. However, by 2070, an additional 70,000 acre-feet will be needed to meet the needs of the growing city. Water sufficiency is a moving target, and El Paso Water planners keep moving with it.

Supplementing supply

A cursory glance at a map can offer a misleading picture of El Paso’s water situation. The map plainly shows that the almost legendary Rio Grande — “Big River” in Spanish — runs past the city. It is one of the longest river systems in the country, meandering from its Colorado headwater just east of the Continental Divide down through New Mexico and El Paso clear to the Gulf of Mexico. A river of that size might seem to be an ample water source. If El Paso were the only municipal drain on the river, it might be.

The reality is that the river’s snow-melt runoff water is tapped by almost every potential consumer the river touches. As a result, the river is a depleted water source by the time it reaches El Paso. Furthermore, droughts periodically drop the water level to insufficient levels — the river ran dry in El Paso as recently as 2012. In a normal year, the river can supply half of the water El Paso needs. In dry years, the Rio Grande’s contribution shrinks dramatically or disappears altogether. Water demand doesn’t ebb, however, so El Paso Water at times supplements its supply with water from the Hueco and Mesilla aquifers that underlie the region.

About 9 inches of rain falls on the area each year. In drought years, Hueco’s contribution to

the total water supply almost doubles. This draw-down on the aquifer is not a sustainable solution because aquifers eventually can be tapped out, too — even big ones like Hueco, which is about 200 miles long and 25 miles wide. To complicate matters further, the Hueco’s water is not all drinkable.

“What we tell our public is that in the Hueco, we have 10 million acre-feet of freshwater and 30 million acre-feet of brackish water,” says Scott Reinert, the utility’s water resource manager. Brackish water by definition contains measurable amounts of salt — 1 to 30 parts per thousand — that’s not as salty as ocean water but neither healthful nor tasty.

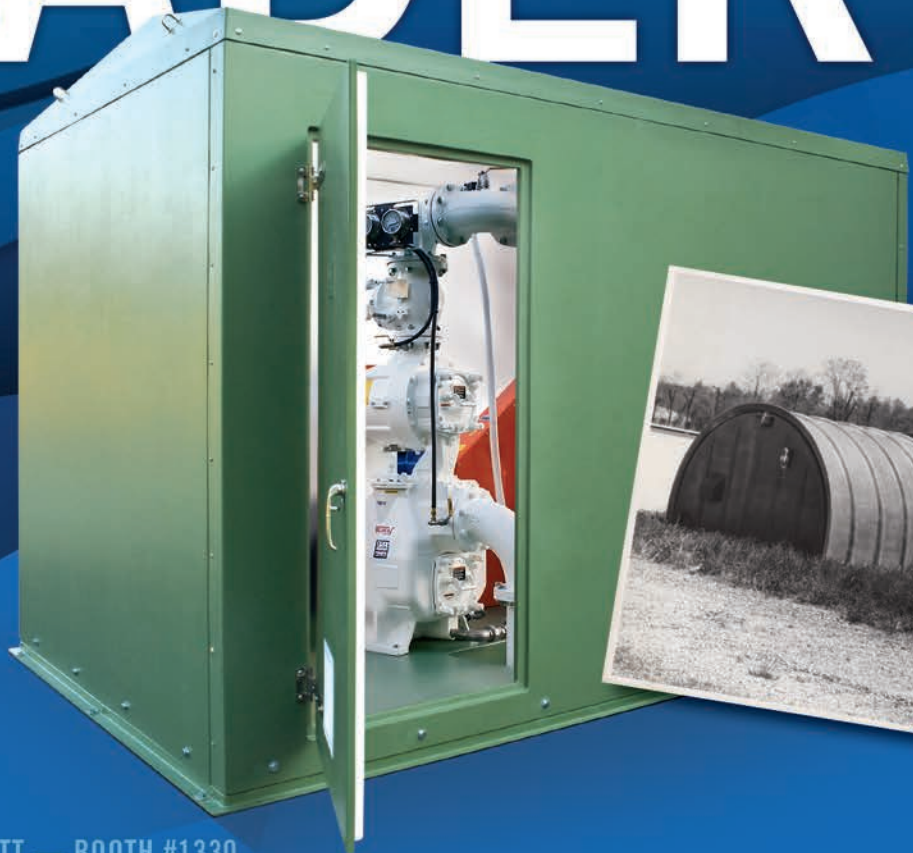
El Paso Water can’t mandate that snow and rain fall to replenish the river, so the utility concentrates on what it can partly control: the underground reservoirs. To that end, the utility pursues two related water supply objectives: maintain the Hueco aquifer’s freshwater volume and keep brackish water at bay. An important step in meeting these objectives was development of the utility’s water reclamation program.

Water reclamation

In 1985, the utility’s Fred Hervey Water Treat-
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“Our goal is to preserve our freshwater so we will always have a freshwater aquifer — water that we don’t have to desalt. We try to keep the brackish water from intruding into our freshwater source, using our desalination plant as much as we need to hold the line.”

Scott Reinert

ment Plant began to return processed water to the aquifer. As the utility declares online, “...water is too valuable to be used only once.” Some 10 million gallons of reclaimed water are being sent underground each day to replenish Hueco — more than 20 billion gallons so far.

Water reclamation is, in fact, one of the acclaimed parts of El Paso’s international water success story. The utility is credited with operating one of the world’s first wastewater treatment plants whose product meets human consumption standards — that is, undrinkable water is made potable. Four plants now process secondhand water, some of it injected into Hueco and the rest used in city parks, golf courses, fire hydrants, street sweepers, industrial cooling towers, and commercial landscaping. Some 6 million gallons of reclaimed water are utilized across the city’s mesa and valley every day.

Brackish water is the other utility board focus. Ten years ago, the utility joined with officials at the Army’s nearby Fort Bliss and opened a \$92 million desalination plant, the world’s largest inland facility to remove salt from water. It is a relatively high energy-demand operation because it employs reverse osmosis technology. As a result, the plant typically is operated at a low produc-

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Contractors Mike Flores, Manuel De Haro and Isidro Moreno work on a replacement well for El Paso Water. (Photography by Marcos Fernandez)

EDUCATION PROMOTES CONSERVATION

Every community must be persuaded to buy into any program that calls for common sacrifice. El Paso, Texas, residents seem to have bought into the notion that its finite water supply shouldn’t be frivolously used.

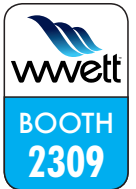
Water scarcity is no mystery to people living in this desert community. Rainy days are rare, and water is a blessing. Still, voluntarily taking short showers and reusing water when possible is not a natural human instinct, even when water rates are jacked up to penalize overconsumption.

El Paso Water’s chief communications and government affairs officer, Lisa Rosendorf, oversees the utility’s water conservation program. She says when the city implemented a demanding water conservation program more than a quarter century ago, a gradual community acceptance of the new norm followed. “There is an appreciation now that we need to conserve. Asking people to conserve our water resource is still

challenging, but it helps when you have a community that has its eyes open.”

Rosendorf says education “has been a huge component” of the city’s successful conservation policy. “We have a learning center that 5,000 students go through every year. They are learning at a young age the value of water.” The utility’s learning center is adjacent to its Kay Bailey Hutchison Desalination Plant and contains 16 interactive exhibits, ranging from general information about the Chihuahuan Desert to more technical explanations of desalination and aquifers. The 30,000-square-foot building also has a 250-seat auditorium and a training center.

In essence, the educational programs build and maintain support for smart water usage, which feeds continued progress. “The progress the city has made in water conservation and use all goes back to community acceptance,” says Gilbert Trejo, the utility’s chief technical officer.



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“Relying on one source of water is detrimental to any community. When we saw the Hueco water level declining, we started a 50-year plan. Hueco needs loving care and attention, and we are providing it.”

Scott Reinert

DIVIDED BY A RIVER, CONNECTED BY AN AQUIFER

El Paso is a border town situated in the far southwest corner of Texas. Just how far southwest is illustrated by the fact that the city is closer to Los Angeles than it is to the eastern border of Texas. More pertinent is that El Paso is just across the U.S.-Mexico border from Ciudad Juárez, the largest urban center in the Mexican state of Chihuahua.

The neighboring communities have had a long relationship. The first bridge to span the Rio Grande and connect them was built 250 years ago. They are also connected in another way: The two cities share a common water source, the Hueco aquifer. In fact, because Ciudad Juárez doesn't have access to the Rio Grande, its entire urban area draws water solely from the aquifer. We're talking 1.5 million people.

The good news is that El Paso and its neighboring city are staying in touch about their common concern for the aquifer and future water supplies. “We work with our counterparts across the border,” says Gilbert Trejo, chief technical officer for El Paso Water. “Their staff is generating models that — over the last 15 years — have proven very similar to ours. We are sharing information.”

Cooperation notwithstanding, the Mexican city's total reliance upon the Hueco aquifer doesn't make things any easier for El Paso. Accordingly, El Paso Water's 50-year regional water plan factors in Ciudad Juárez's current and anticipated demand.

“The demands of Ciudad Juárez on the aquifer are much larger,” Trejo notes. “It is important for us to understand their impact on Hueco.”

El Paso Water operator Maximo Manlic cleans a settling basin at the Kay Bailey Hutchinson Desalination Plant. The \$92 million facility is the world's largest inland desalination plant.

tion level — say, 10 million gallons a day — to limit the energy demand.

The desalination plant has the capacity to produce 28 million gallons of freshwater per day. “Our future increasingly is in our desalting,” Reinert says. The byproduct of the desalination process is concentrated brine, which is injected in safe areas deep underground. However, a new private facility next to the plant is beginning operations to create commercial products from the salts and minerals, with freshwater being returned to the utility. This could be a pivotal manufacturing process for both the company and utility.

Yet, converting brackish water to drinkable water is just part of the desalination plant's immediate purpose. “Our goal is to preserve our freshwater so we will always have a freshwater aquifer — water that we don't have to desalt,” Reinert says. Therefore, the water pulled up to the plant is collected from underground brackish water that's flowing toward the freshwater portion of

the aquifer. “We try to keep the brackish water from intruding into our freshwater source, using our desalination plant as much as we need to hold the line.”

Conservation efforts

This high-stakes drama involving hydraulic gradients and commingling of good and bad water is played out a few hundred feet in the earth, but the implications of it are in full view of every person living in El Paso or soldiering at Fort Bliss. It can be seen in city ordinances regulating water usage and other daily reminders that residents are living in a desert.

Water conservation became a way of life here after the El Paso City Council instituted an “aggressive” conservation program in 1991. Rosendorf says there was a fear factor in adoption of that ordinance — a prediction that El Paso would run out of water by 2009. That raised a general alarm and eventually resulted in year-round water restrictions and a rate structure that penalizes customers for high water consumption. In the quarter century since the conservation program was instituted, per-person water consumption in El Paso has been cut by 30 percent to 128 gallons per person per day. The hope is that residents will give up another 10 gallons per person per day.

They might. Despite the hassle, El Paso customers recognize that they enjoy a low monthly water bill. “We have the scarcest water supply in the region but have some of the lowest rates,” Reinert notes. The average 2016 monthly bill in El Paso — not including wastewater or stormwater billing — was about \$28 versus \$65 in Austin, \$46 in Houston, and \$35 in Fort Worth. For that matter, the cost of water is less than in Tucson, Arizona, (\$41) and Albuquerque, New Mexico, (\$30). Even if a proposed 7 percent increase in the water rate is approved, this ranking of city rates will hardly change.

The proposed extra revenue will fund expansion of the desalination plant and design of an advanced water purification plant that will increase utilization of reclaimed water for drinking. It also will pay for the purchase of land and water rights in another county 100 miles from El Paso for eventual importing of water. A measure of how effectively the utility has managed its current resources is that importing water won’t begin till 2040 — 10 years later than originally forecasted. Such future-dating is a benchmark of progress in the struggle for water sufficiency.

Long-term views

What are the lessons in all this for other water utility companies and water-stressed cities? One of them is long-range planning — what Rosendorf calls “having an eye for the long term.” Another lesson is diversification. “Relying on one source of

water is detrimental to any community,” Reinert says. “When we saw the Hueco water level declining, we started a 50-year plan. Hueco needs loving care and attention, and we are providing it. We slowed the decline of the aquifer when we began the other projects.”

Trejo says leadership is key. He cites city and utility boards that have overseen the landmark desalination and water reclamation programs in El Paso. “And our advanced purification plant is going to be the first of its kind to treat reclaimed water to safe drinking standards and distribute it directly to customers. We are the

pioneers. Leadership is taking on challenges and not being afraid to be the first one to do the right thing for the community.”

There are plenty of challenges remaining for El Paso, with the city population projected to reach 1.4 million by 2070. But the prospect of so many more water users doesn’t faze Trejo. “We are not in the business of controlling the city’s population. Our job is to provide water to the city, which we will do with the different strategies we have in place.” ♦

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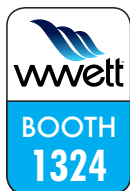
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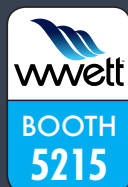
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STOP THE REVOLVING DOOR

Using data to improve recruiting, hiring and onboarding processes can help stem the flow of employee turnover

By Ken Wysocky

High levels of employee turnover take a quiet, yet significant toll on companies. That annoying swooshing sound caused by a steady stream of employees as they happily push their way through that figurative revolving door is nothing compared to the effects of silent cripples like lower profitability, productivity and morale.

To make things worse, the current low levels of unemployment have created a supply-and-demand issue that only exacerbates the problem of finding replacement workers. And the longer it takes to hire replacements, the more hiring expenses increase and the more morale erodes as existing employees grow weary of picking up the slack.

It doesn't have to be that way, says Carol Jenkins, an industrial organizational psychologist who works for OutMatch (www.outmatch.com). The Dallas-based consulting firm helps businesses develop automated processes that improve hiring and employee-development decisions through data-rich assessments and analytics. In other words, a primary cause of employee turnover is bad hiring decisions that technology can help companies avoid.

"Years ago, human resources traditionally was seen as a soft area. Its purpose was to make people feel good," Jenkins explains. "But now, we're seeing a shift to technology that can make hiring processes more efficient. We can create systems that layer all kinds of data together and create a clearer picture of job candidates."

As an example, Jenkins points to employee assessments that can help organizations understand what differentiates a successful performer from a poor performer. Managers then can keep those success traits in mind as they screen job candidates during the hiring process.

Recruiting is expensive

Quantifying the cost of turnover is difficult, which also makes it easier to ignore. Some experts opine that the average cost of losing an employee in



a highly skilled position is more than 200 percent higher than that employee's annual salary. Others peg the cost at roughly six to nine months of an employee's annual salary.

But no matter how you try to calculate it, there's no doubt that advertising a job opening, recruiting candidates, interviewing them, checking their credentials and references, giving pre-employment skills and drug tests, and then hiring and training them is anything but inexpensive.

What are the most common causes of high turnover? If it occurs quickly, it's likely the employee didn't have the right experience or the job wasn't what the employee expected. "A recruiter may have sold them something that isn't true," Jenkins says. "That's why it's so important to provide a realistic job preview so their expectations are very similar to what they'll actually be doing. That way, if they don't like what they hear, they can 'quit' before they get hired."

If employees leave after six months or longer, job stagnation may be the culprit. "They may see no chance of career progressions, or they have a bad relationship with their manager," Jenkins says. "Or the pay isn't high enough. Those things become more important the longer employees stay with a company."

Upfront analysis

Regardless of the cause, however, Jenkins feels strongly that proper hiring and onboarding processes are critical to reducing turnover. It's similar to the old expression about the computing industry, "Garbage in, garbage out." In other words, results are only as good as your initial inputs. And that's where systems and analytics come into play.

"Can the candidate do the job and will they do the job are two separate actors," she notes. The former can be measured by ensuring candidates possess basic job skill sets. The latter can be addressed with assessments. "Can someone work with customers, and do they like customers?" she asks rhetorically. "People who are negative or disagreeable will be frustrated with

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.

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“We can create systems that layer all kinds of data together and create a clearer picture of job candidates.”

Carol Jenkins

customers. That’s not always easy to see in interviews, but assessments can help allow you to see their passions and innate qualities.”

But can’t job candidates game assessments? Not very easily, Jenkins asserts, noting that questions are subtly worded to minimize candidates’ abilities to cover traits they don’t want to reveal. “You can tailor assessments to best see what success looks like in your organization,” she says.

Data and analytics can help in other areas, too. For example, they can help you ferret out candidates who are more prone to turnover. “Candidates who score moderate to low in integrity, for instance, tend to quit more than those who score high,” Jenkins says. Another tool in the low-turnover toolbox: Interview new hires after 60 or 90 days on the job and see if the recruiters are representing the job accurately so that candidates’ pre-hiring expectations aren’t shattered by on-the-job realities.

“You can also ask them how they feel about the connection with their managers,” she suggests. “Or if they feel like they’re part of the culture, or if they have a good friend at work, which is a key factor in employee engagement.

“You can even ask them if they’d take the job if it was offered to them again,” she continues. “And if you find gaps in the processes (for hiring and onboarding), then you can make interventions. But you then have to measure the results of the interventions — see if they moved the needle. That will help retain those employees longer.” ♦



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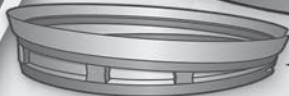
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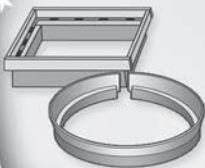
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GET IN THE ZONE

RehabZone grows parallel to industry innovations and improvements in a variety of trenchless services and technologies

By *Ted DeBoda*

One of the main attractions at the Underground Construction Technology International Conference & Exhibition coming up at the end of the month is the RehabZone.

This walk-through exhibit provides attendees with an interactive experience, allowing them to see firsthand the latest, most innovative technologies and trenchless solutions that have been proven over many years. The RehabZone also includes installation techniques, live demonstrations and opportunities to talk to industry professionals who work with trenchless technologies day-in-day-out.

First introduced in 2002, the RehabZone gets bigger and better every year, keeping pace and growing parallel to industry innovations and improvements in a variety of trenchless services and technologies, including:

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The 2018 RehabZone will also cover new topics such as health and safety, locating services, ground-penetrating radar, cross bores, and directional drilling. It will have a larger exhibit space to accommodate the growing number of interactive displays. Presented as a “no-sales zone,” the RehabZone is staffed by industry leaders who are available to answer questions and provide more information about products, services and methods. You will be able to easily identify them as they will be wearing reflective RehabZone vests.

The highly educational and entertaining RehabZone is only made possible through partnership between Underground Construction Technology, NASSCO and the industry leaders who sponsor the exhibit. The 2018 RehabZone Platinum Sponsors are Applied Felts/MaxLiner USA, BLD, HydraTech Engineered Products, Jack Doheny, LMK Technologies, Raven Lining Systems, TRY TEK Machine Works, and Vactor. For a complete list of Platinum, Gold, and Silver sponsors and to learn more about the RehabZone, visit www.rehabzone.org. ♦

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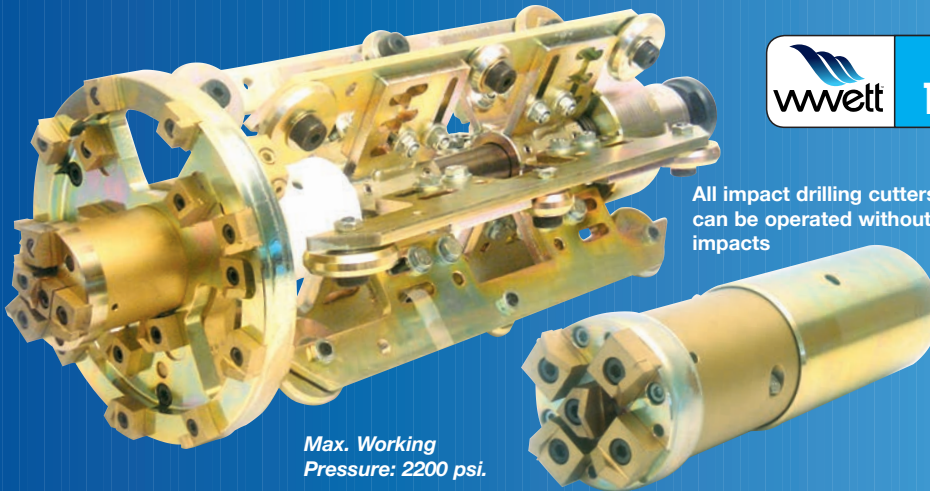
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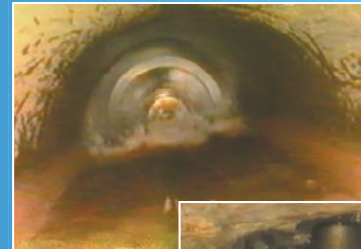


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PIPELINE REHABILITATION AND RELINING

By Craig Mandli



CIPP/CIPP ACCESSORIES

1. LMK Technologies T-Liner

The **T-Liner** from **LMK Technologies** is a one-piece homogenous main and lateral CIPP connection liner that is ASTM F2561 compliant. It has a uniform wall thickness and incorporates compressible lining material at the upstream and downstream ends, creating a smooth, tapered transition to the host pipe. Both the mainline and lateral sections are formed as a structural cylinder that renews 18 inches and 360 degrees of the mainline, and extends up the lateral pipe as one continuous lining. T-Liner with Insignia compression gasket sealing technology provides a verifiable nonleaking system. These compression gaskets are embedded between the host pipe and the T-Liner and are compatible with all pipe types, including polyethylene. **815-433-1275; www.lmktechnologies.com.**

2. Logiball Sleeve Installers

Logiball's line of **Sleeve Installers** covers 3- to 36-inch pipes in lengths as long as 25 feet if required. The multisize flow-through bladders have proven over time and through abuse to be very resistant and reliable. Large flow-through rigid sleeve installers are available for the installation of mechanical locking sleeves and multisize flexible sleeve installers for ambient-cure CIPP sectional liners. In the event of a damaged sleeve, all installers can be factory resleeved at a fraction of the replacement cost. **800-246-5988; www.logiball.com.**

3. Petersen Products Multi-Flex CIPP Packer

Multi-Flex CIPP Packers from **Petersen Products** are available for virtually any diameter and length using ambient, hot water and steam cure. They are available as standard items and many custom configurations, with or without a flow-through bypass. Since they have fixed inflated diameter independent of the pipeline, they bridge across broken sections of pipe for a continuous, smooth pipe I.D. The small deflated diameter, lightweight and flexibility allow easier installation and removal through a small opening and confined or manhole spaces. **800-769-4973; www.petersenproducts.com.**

4. Quik Lining Systems Calibration Roller

The **Calibration Roller** from **Quik Lining Systems** provides the CIPP lateral lining installer with a tool to precisely provide a consistent thickness throughout the entire length of the liner. It will calibrate any thickness from a diameter of 2 to 12 inches and provides fast wet-out on the job site. Coupled with a vacuum pump, the roller will provide a completely wetted-out liner on a single pass. **605-695-6778; www.quiklining.com.**

5. Vanguard Pathogen Defense System

To combat the continuous exposure to dangerous pathogens, the **Vanguard Pathogen Defense System** is constructed from high-quality electronic components, aircraft aluminum and stainless steel. It is designed to eliminate up to 98 percent of bacteria and other pathogens commonly found and encountered by wastewater maintenance personnel. The system's modular design and lightweight make it simple to install and use on any combination, jet or CCTV truck. **800-781-3164; www.vanguard-systems.us.**

EXCAVATION EQUIPMENT

6. Super Products Mud Dog 1200

The **Mud Dog 1200** 12-yard-debris-capacity hydroexcavator from **Super Products** has a rear-mounted boom capable of a 19- to 27-foot reach, 335-degree rotation, 45-degree upward and 25-degree downward pivot. This range of boom motion allows crews to achieve greater work area access and deeper digging without halting production to reposition the trunk. Easy-to-use ejector plate unloading technology provides fast, thorough and safe debris removal. A tilt-unloading feature ensures liquids in the debris tank are cleared quickly and efficiently, even when unloading in an up-slope/nose-down position. Options include the Acculevel load-sensor system for precise debris tank level measurement. **800-837-9711; www.superproductslc.com.**

7. Suttner America turbo nozzles

Turbo nozzles from **Suttner America** are available with 1/2-inch inlets. Made of high-quality, durable brass, they can withstand harsh hydroexcavation environments. The inlet eliminates the need for additional fittings



and decreases the possibility of leaking. Stainless steel turbo nozzles provide improved materials (tungsten carbide seat and PEEK rotor), which extend life. They are available with flow ratings up to 40 gpm and pressure ratings up to 8,700 psi. Repair kits and protective covers are available. **800-831-0660; www.suttner.com.**

8. Tornado Global Hydrovacs F3 ECO

The **F3 ECO** from **Tornado Global Hydrovacs** holds 12 cubic yards of mud and more than 1,700 gallons of freshwater. This unit is more than 2,000 pounds lighter than the company's older models and can carry up to 10,000 pounds more payload in the debris tank, with reduced fuel consumption. The boom has a 342-degree rotation and 26-foot reach. All critical components are housed in an insulated and heated aluminum van body. Operators don't need to hoist the tank to empty it because of its curved, sloped floor. **877-340-8141; www.tghl.ca.**

HORIZONTAL DIRECTIONAL DRILLING

9. HammerHead Trenchless Roughneck R200

The **Roughneck R200** 2-inch rock hammer from **HammerHead Trenchless** is engineered specifically for horizontal directional drilling applications. It is designed to expand the capabilities of small utility drills, allowing 7,000- to 10,000-pound-class directional drills to effectively drill through solid rock as well as other difficult soil conditions. The unit drills a 3.125-inch pilot hole. Electronic controls allow the operator to adjust the airflow with the touch of a button from open to closed and anywhere in between, allowing them to manage the power of the hammer on the fly. **800-331-6653; www.hammerheadtrenchless.com.**

PIPE CUTTERS

10. CUES Kangaroo Cutters

CUES small and large **Kangaroo Cutters** are designed to reinstate wastewater service laterals, remove protruding taps, and brush finish existing cuts. The cutters function in a range of 6- through 30-inch pipe, are equally effective in CIPP or fold-and-form liners, and can be installed on any CCTV manufacturer's truck-mounted system. A .9 hp air motor for the small Kangaroo Cutter line provides more power, increased productivity and a

smoother cut when operating in 8- to 12-inch relined pipe. Kits are available to retrofit existing cutters, and service kits can be purchased for regular maintenance intervals on existing motors. **800-327-7791; www.cuesinc.com.**

11. Pipeline Renewal Technologies Micro Automatic

Using three remote-inflated air bladders, the arm of the **Micro Automatic** small-diameter lateral and drain cutter from **Pipeline Renewal Technologies** positions itself remotely by creeping and climbing, clamps itself for precise cutting in vertical or horizontal orientation, and uses a full 4-inch feed on the cutting head. Just 72 mm in diameter, the arm fits through small openings, and its agile articulation facilitates precision cutting as well as maneuvering through 90-degree bends in 4-inch lines. This versatile cutter can handle lines from 3 to 6 inches or 8 to 10 inches with modification. The cutter is controlled with a CAN-bus-based controller with twin multifunction joysticks. This allows for easy position recall, making repetitive work quick and intuitive. **866-936-8476; www.pipelinert.com.**

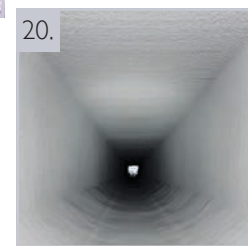
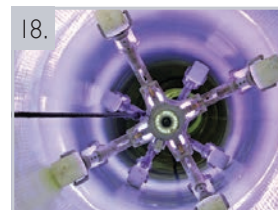
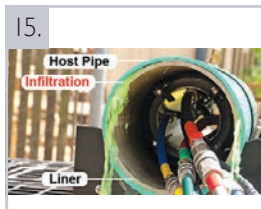
12. TruGrit Traction wheels

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.**

PIPE FUSION

13. McElroy Hornet

The **Hornet** from **McElroy** is an all-in-one tool for outlet fusion of polypropylene pipe. It helps installers maintain perfect alignment of the pipe and fitting for accurate fusions with less time and strain compared to manual methods. The V-base design allows it to self-align on the center of the main pipe. With a small footprint and weighing just 13 pounds, it is capable of performing outlet fusions in any orientation, making it ideal for overhead and vertical fusions in tight spaces. **918-836-8611; www.mcelroy.com.**



PIPE LINING

14. Aries Industries test and seal grouting system

The test and seal grouting system from **Aries Industries** reduces setup time and provides efficient hands-on control to quickly seal leaking joints. Grout — pumped to a leaking joint — flows through the leak, sealing the surrounding soil to form an impenetrable barrier. Sixty-gallon tanks and continuous-duty mixers provide high volume to seal large voids. Reels for fast deployment and retrieval as well as high-power winches quickly move the packer from joint to joint for high productivity. The unit's 800 feet of color-coded hose allows long runs. The truck comes with a bench, storage and room to work. The operator tests and seals the joints while working in the control room, where test data and the sealing process are easily viewed, recorded and logged. **800-234-7205; www.ariesindustries.com.**

15. Avanti International AV-100

AV-100 from **Avanti International** is a chemically reactive gel that has similar viscosity to water. It can permeate anywhere water can travel and has adjustable cure times from five seconds to more than 10 hours. It can be used to rehabilitate and sustain sanitary collections systems by eliminating infiltration in manholes, sewer mainlines, joints, laterals, and before and after various forms of CIPP lining. After lining, the chemical grout can be used to reinstate laterals. It creates an effective, long-lasting water barrier while providing soil stabilization. **800-877-2570; www.avantigrout.com.**

16. Cretex Specialty Products HydraTite

HydraTite internal joint seal from **Cretex Specialty Products** is a mechanical, trenchless remediation for leaking pipe joints consisting of a rubber seal that spans the joint and is held in place by stainless steel retaining bands on either side of the joint. The retaining bands are hydraulically expanded and locked in place using a wedge lock design, which forms an airtight seal around the joint, eliminating all possibilities of infiltration or exfiltration. These seals can be custom fitted into irregular-shaped conduits and may be used as end seals on CIPP projects. The system is a recognized method of joint repair by AWWA manual M28 and has been widely accepted and approved by engineers, municipalities and DOTs. It has a 50-year design life, does not require excavation, and has a low profile that ensures minimal flow loss. **800-345-3764; www.cretexseals.com.**

17. Formadrain DURAPOX

DURAPOX epoxy resin from **Formadrain** has a two-month open time, yet it can be fully cured within 90 minutes. This means lining technicians don't need to worry about wet-out conditions, schedule changes or how long the install takes. The company can even do the wet-out in its shop and ship the liner ready to install. The steam-cured, pull-in-place lining system can be used for lining laterals, spot repairs, industrial process pipes and lateral main connections. Pipe diameters range from 2 to 48 inches. **888-337-6764; www.formadrain.com.**

18. Inliner Technologies STX

STX UV-light-cured liner from **Inliner Technologies** combines a woven fiberglass tube with a light-cured resin to produce a high-strength product, resulting in a thinner wall design. CIPP from Inliner Technologies allows for the renewal of damaged underground pipes without excavation. Licensees are contracted by municipalities and manufacturing-based industrial facilities to renew storm, waste and process sewer piping that has been damaged by corrosion and/or structural deterioration. The product combines a nonwoven engineered tube or liner with an array of thermosetting resins determined by the pipeline problem and surrounding environment. The technology can span pipe from 4 to 120 inches in diameter; renew pipes with bends, diameter changes or noncircular geometries; and be used in gravity and pressure applications. **812-723-0704; www.inliner.com.**

19. Perma-Liner Industries Perma-Patch

The **Perma-Patch** system from **Perma-Liner Industries** can be used to rehabilitate a 2- or 4-foot pipeline section with a local spot repair solution. It uses a fiberglass mat with 100 percent solids epoxy resins, creating a structural repair with a minimum life span of 50 years. The system is sold in a complete kit, so there is no measuring or waste. It is designed for 3- to 24-inch-diameter pipelines with cracks, holes and separation in joints. The repair is inserted into the damaged pipe using an inflatable bladder, pushrod or pull cable. It is centered over the damaged pipe section and pressed tight against the host pipe area, creating a structural new pipe. **866-336-2568; www.perma-liner.com.**

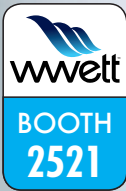
20. Quadex Lining Systems

Quadex Lining Systems can be used to restore pipes, culverts and tunnels, including ones that are corrugated metal, concrete, brick and stone. The

(continued)

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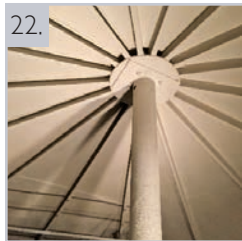
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combination of precision equipment and GeoKrete geopolymer ensures a fast and effective structural renewal to damaged and leaking large-diameter pipe and infrastructure. The geopolymer can also be applied in a broad range of temperatures. The chemical composition makes it inherently resistant to microbial-induced corrosion. **855-949-3441; www.quadexonline.com.**

21. RauschUSA QuickLock Flex Sleeve

The **QuickLock Flex Sleeve** from **RauschUSA** can be used to correct offsets and/or axial bending inside 8- to 24-inch pipe. Using a corrugated steel connection, which is fused between two 316L stainless steel sleeves, it can be installed over an offset joint to rehabilitate the pipe. The new design maintains the EPDM rubber gasket seal that is mechanically compressed against the inner pipe wall and permanently locked in place by two locking gear mechanisms in the sleeve. It meets ASTM Standard F3110-14 and is NSF61 certified for use in potable water. Applications include repairing leaking or offset joints, fixing cracks and holes, preventing root intrusion, and closing unused laterals. No chemicals or resins are used, so there is no cure time, and point repairs may be installed with flow. **717-709-1005; www.rauschusa.com.**

22. Raven Lining Systems AquataFlex 505 and 506

AquataFlex 505 and **506** high-performance protective coatings from **Raven Lining Systems** are designed to provide maximum versatility for performance and application. They are versatile novolac epoxy polyurethane hybrids, 100 percent solids, with zero VOCs. They are also NSF/ANSI 61 certified for potable water. They deliver strong adhesion properties to properly prepared concrete, steel, aluminum, wood, composites and many other substrates, and recently earned the USDA Certified Biobased Product Label verifying that the product or product family's amount of renewable biobased ingredients meets or exceeds levels set by the USDA. **800-324-2810; www.ravenlining.com.**

23. Source One Environmental GreyCoat Epoxy

GreyCoat Epoxy from **Source One Environmental** is a 100 percent solid monolithic epoxy that offers chemical resistance and lasting durability with adhesion to concrete substrates and metal surfaces. The epoxy can build up to 1/4 inch without sag or shrinkage, and has a quick cure time depending on the temperature. It is designed to structurally repair a variety of substrates such as manholes, wet wells and vaults, and provides adhesion in damp, humid surfaces. The material's viscosity also allows installation on vertical and over-

head areas. As an environmentally friendly product, it contains no VOCs, CFCs or HFCs, and protects against hydrogen sulfide and other chemicals typically found in a sewer system. It is packaged in a two-part bagging system that eliminates guesswork and product waste. **877-450-3701; www.s1eonline.com.**

24. Sprayroq SprayWall

SprayWall from **Sprayroq** is a 100 percent VOC-free, self-priming polyurethane lining that reinstates structural integrity while providing infiltration control and chemical resistance for concrete, steel, masonry, fiberglass and other surfaces of structures, allowing manned entry. Environmental and climatic factors such as freeze/thaw cycling, high humidity, or shrinking/swelling soil conditions have minimal effect. Its gold color is derived from its raw components' natural coloration. It provides coverage of 16 square feet per gallon at 100-mil thickness, and it is applied using a heated, plural-component spray system. Its quick curing time allows newly protected structures to be returned to service shortly after application is complete. **800-634-0504; www.sprayroq.com.**

25. The Strong Company Storm Seal

Storm Seal from **The Strong Company** is a specially formulated, fiber-reinforced, cementitious mixture designed for lining the interior of corrugated metal pipes, culverts, concrete pipes, catch basins and other stormwater structures. It is centrifugally cast using the Strong-Seal System mixer, pump and spinner, which are electronically controlled for consistent product and thickness of application. It may also be sprayed manually. **800-982-8009; www.strongseal.com.**

26. Trelleborg Pipe Seals Drainplus 2.0

Drainplus 2.0 liner from **Trelleborg Pipe Seals** is designed for rehabilitation of pipes with variations in internal diameter and bends. It has the ability to negotiate multiple 90-degree bends and overcome two changes in internal diameter. For example, the 4-inch liner has the ability to expand to 6 inches while still maintaining the required minimum 3-mm wall thickness — without any fins or wrinkles. The silicone coating provides high temperature resistance, and when used in combination with a range of epoxy resins, it can be steam cured without the need of calibration hoses. This allows fast processing time, so the installer can achieve maximum productivity while ensuring the highest quality in terms of mechanical properties and required design wall thickness. **800-626-2180; www.trelleborg.com.** ♦



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City navigates emergency repair of fragile storm drain

Problem:

When city of Huntington Beach, California, officials investigated reports of sewage odors, they discovered a storm drain was infiltrating groundwater heavily laden with hydrogen sulfide gas, fostering colonies of Thiobacillus bacteria that consume the gas and excrete sulfuric acid. The resulting acid had attacked the concrete storm drain, turning much of it into crumbly calcium sulfate (gypsum).

Solution:

The city's repair objectives were twofold: making cost-effective, emergency repairs on 515 feet of very fragile storm drain under 16 feet of soil and 5 feet of groundwater, and preventing further destruction from microbiologically induced corrosion, or MIC. The city selected the **CentriPipe** system from **AP/M Permaform**, which uses a precisely controlled spincaster to spray thin layers of high-strength, fine-aggregate composite concrete that adheres tightly to most substrates, casting a new concrete pipe within the failing pipe that is completely structurally sound, with no seams or joints. To prevent further damage and groundwater infiltration, two additional mixtures from ConShield Technologies were used in the centrifugally cast concrete: ConShield, which prevents MIC by making concrete permanently antimicrobial, and Crystal-X, which makes concrete watertight by filling voids in the cured product.

RESULT:

The newly rehabilitated storm drain is completely structurally sound, and it's also permanently and intrinsically watertight, antimicrobial, and MIC-resistant. **800-662-6465; www.centripipe.com.**

Coating used to repair 214-foot storm culvert

Problem:

In northwest Ohio, an 11-foot-7-inch-by-7-foot-5-inch structural plate storm culvert was in need of repair and rehabilitation. The corrugated pipe arch structure ran under Interstate 70, so replacement was not a viable option. The selected repair system or lining had to be applied in situ, and



it needed to eliminate corrosion, maintain the culvert's hydraulics, and preserve its structural integrity.

Solution:

The Ohio Department of Transportation decided to repair the storm culvert using a spray-applied resin system. The scope required the rehabilitation of approximately 214 feet of pipe arch. **HydraTech Engineered Products' PolySpray SS-100** was included in the project specifications. It offers a high-build, nonbrittle coating without sacrificing physical properties. It withstands mechanical shock, and a snap cure allows for immediate return to service. This high-build, seamless coating is perfect for waterproofing and encapsulation applications where rapid return to service is required. Before spraying the pipe arch, the contractor first removed all debris and then prepared the surface with an abrasive blast.

RESULT:

The rapid-setting, semistructural, monolithic coating provided structural support as well as resistance to incidental chemical exposure. This lining system will extend the life of the pipe arch without impeding highway traffic or hindering hydraulic performance. **513-827-9169; www.hydratechllc.com.**

Speedy repairs solve sinkhole damage in days

Problem:

A 50-foot-wide sinkhole developed in the South of Market neighborhood in San Francisco. Surrounding debris fell into the hole and damaged



100-year-old cast-iron pipe, which caused water loss to the area. The hole also needed to be filled in order to restore street-level traffic.

Solution:

The superintendent for maintenance and operations at San Francisco Water Power Sewer and his engineers decided to use 12-inch **HYMAX** couplings from **Krausz USA** to repair the pipes in sections, rather than replacing all the pipes. This product was chosen due to its strength, ability to provide a strong seal while allowing surrounding pipe to move with the earth, as well as ease and speed of installation.

RESULT:

San Francisco Water Power Sewer was able to complete the repairs in a matter of days by replacing only damaged pipes, instead of weeks if entire lengths of pipe had been replaced. **855-457-2879; www.krauszusa.com.**



Internal joint seal used to stop potable water leak

Problem:

Due to a leaky pipe, a city was losing 12,000 gallons of treated, drinkable water every single day. A fix was needed, and fast.

Solution:

Miller Pipeline was called in by the city to rectify the problem using its **WEKO-SEAL** internal joint seal. “Dewatering the pipe to make repairs was not an option. The demand was too high,” says Ryan Cooper, WEKO-SEAL specialist. Whatever the fix was, it had to be installed underwater and under pressure. Cooper spent time training divers on how to properly install the seal, and monitored the divers’ activity via CCTV on land. Over the hole in the pipe, divers layered 6-inch, 18-gauge stainless steel backing plates to provide strength underneath where the WEKO-SEAL would be applied. Then, they took two double-wide seals and staggered them over the hole, providing maximum protection against future leaks.

RESULT:

The fix was made in a fraction of the time that shutting services down would have taken and with immediate results. “It was beautiful: you could watch the geyser go down in a matter of minutes,” Cooper says. **800-428-3742; www.wekoseal.com.**



Combo and easement machines used for root intrusion

Problem:

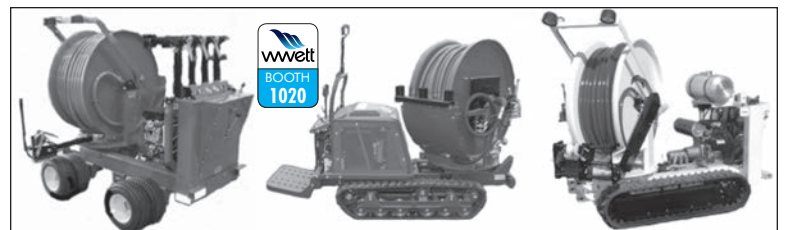
The city of Statesville, North Carolina, needed equipment capable of removing heavy root growth to keep sewer lines flowing.

Solution:

To tackle its root problem, General Supervisor Clyde Fox combined the advantages of the city’s **Vacall - Gradall Industries AllJetVac** combination sewer cleaner along with an easement machine and chain cutter. The easement machine with a rubber track undercarriage effectively extends the Vacall’s power to remote off-road locations that are not readily accessible by the truck. “With an easement machine, the jetting hose can reach beyond 600 feet, giving you another 600,” says Pat Barrett, salesman for Rodders and Jets Supply, which provided the city with the Vacall.

RESULT:

“I had a big root cleanout problem, and I found out the Vacall delivered a higher level of performance to power the chain cutter down in the 24-inch mainline,” Fox says. “The Vacall delivers 87 gpm at 2,000 psi, so it does a good job chopping up heavy root networks and washing them away.” **330-339-2211; www.vacall.com.** ♦



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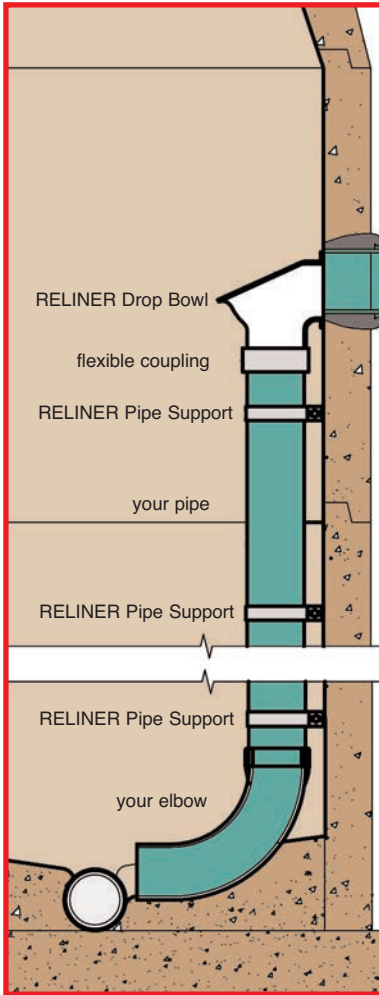
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Product Spotlight

Mobile inspection system provides low-cost reliability

By Kyle Rogers

High-end, sophisticated inspection systems are great. You'll feel confident in your ability to successfully handle anything a job requires. But sometimes such a system is too much. You need something simpler yet still reliable. That's the market Aries Industries is targeting with its Sentinel inspection system.

It is a self-contained mobile unit that requires only a single cable connection. The nonsteerable tractor can be set up quickly for operation in 8- to 15-inch pipe. A large-line kit with an auxiliary light allows for inspections in pipe up to 36 inches. The aircraft-grade aluminum reel keeps the system durable yet lightweight and includes 700 feet of cable. In total, the Sentinel weighs in at 120 pounds. The system's pan-and-tilt camera has a 40:1 optical zoom.

"The goals were to keep it in a small, mobile package and keep the manufacturing costs down so we could ensure customers a low-cost system," says Jeff Patin, a senior mechanical engineer at Aries Industries. "It's meant to be entry-level or ancillary to bigger operations. Say you have an expensive CCTV truck, but you have a situation where you only have to go in and take a look to prep for a liner or something. You don't want to have put a \$100,000 CCTV system into action just for that, so here's this small, mobile system that can be shared among trucks."



Even though the system is low-cost and mobile, Aries Industries has ensured that it isn't at the expense of reliability. One of the key aspects of the design, Patin says, is how seals are applied throughout the system. Aries Industries used a pressing technique on the seals that prevents any water intrusion, even if screws become loose.

"That design changes the reliability side of it and allows for fewer fasteners, so it lowers the complexity for the end user," Patin says.

Aries Industries also considered ease of use for the end user in its decision to make the system suited for both North American and international customers. The Sentinel has universal voltage capabilities and a focus on internal components to allow for easier do-it-yourself troubleshooting.

"It may not have a lot of network support, but looking at internal components makes it very self-sufficient," Patin says. "Sometimes systems have so many bells and whistles that the average person has to send it in to a repair center. This system takes less of a skill set. It is designed without some of those things that give you common failures." **800-234-7205; www.ariesindustries.com.**



Haala Industries stormwater grates and guards

Stormwater and wetland management grates and guards from Haala Industries provide a solution for pipe, manhole, culvert and other drainage cover applications. Gates and guards are DOT-approved in multiple states and produced to existing standards, allowing

them to be incorporated into construction design plans and eliminating the need for contractor fabrication. Custom fabrication is also available. They can be made from domestic materials including galvanized steel, stainless steel or aluminum. **888-454-2252; www.haala.com.**

up to 12 inches and can bore underneath driveways and sidewalks using the optional Porta Bore attachment. The dual rubber tracks with a ground pressure of 3.7 psi deliver floatation in soft conditions and help reduce job site restoration after an install. Powered by a 25 hp Kohler gas engine, the lightweight plow offers a transport speed of 3.7 mph. The unit is equipped with a pivot-mounted plow with a 55-degree swing angle that automatically adjusts when turning. **641-628-3141; www.vermeer.com.**

Vacall - Gradall Industries step-in compartment for AllExcavate hydroexcavators

The roomy, new step-in compartment from Vacall - Gradall Industries for its AllExcavate hydroexcavators provides warmth and protection from inclement weather. The standard heater compartment provides floor drainage as well as racks to hang dry clothing and store the high-pressure hand gun and extensions. There are larger compartments with extra room, among other options. Along with LED lighting, the cold weather



Vermeer SPX25 vibratory plow

The Vermeer SPX25 vibratory plow features a full-function remote control that provides a 360-degree view of the job site. It can install small pipes and cables at depths

package includes extra insulation, heated cabinets for the hose reel and water pumps, and boilers that can heat water for more effective hydroexcavation in frozen ground. **800-382-8302; www.vacall.com.**



Agru America polyethylene pipes and fittings

Agru America's pipe and fittings are made from polyethylene 100/4710 for durability and corrosion/abrasion resistance. The products available include large-diameter pipe, HDPE pipe fittings, Mine-Line pipes, electrofusion fittings and equipment, ball valves, metric solutions and semifinished products. **800-373-2478; www.agruamerica.com.**



McLaughlin ECO75 and VX75 vacuum excavators

ECO75 and VX75 midrange vacuum excavators from McLaughlin answer the demand from the

underground utility market for a compact vacuum excavation system with a 5-inch boom option that focuses on performance and fuel efficiency. A 74 hp Deutz Final Tier 4 diesel engine powers a 1,200 cfm vacuum blower, and the 8 gpm water pump is capable of 3,000 psi operating pressure. The larger boom pulls more material and reduces clogging to enhance job site production. The ECO75-500 can be mounted on a single-axle 26,000 GVW truck without the need for a commercial driver's license. The trailer-mounted VX75 features a twin-axle, heavy-duty I-beam construction that is compact and can be pulled by a 1-ton truck. **800-435-9340; www.mclaughlinunderground.com.**



Vactor next-generation HXX vacuum excavator

Vactor's new HXX vacuum excavator maximizes legal payload and improves operational efficiency. The placement of the debris

body and water tank on the chassis ensures equal distribution of the payload on the axles, regardless of how much water is in the tanks. A new PrecisionFlow water pump system features a single-piston design that is capable of higher flow and pressures than a triplex water pump system for production and reliability. The vacuum system is rated at 6,200 cfm and 28 inches Hg, and the water pump system is rated at 30 gpm and 3,000 psig. Water tank capacity is 1,200 gallons, and the debris tank has a 16-cubic-yard capacity. **800-627-3171; www.vactor.com.**



ProComSol HM-BLE HART Modem

The HM-BLE HART Modem from ProComSol contains a rechargeable lithium-ion battery that lasts for days on a single charge. The low-energy features of the Bluetooth 4.0 standard also allow for longer device life between charges. The connection between the modem and the hand-held device is wireless, so there are no wires to trip over, and it can be used to configure hard-to-reach HART devices safely from the ground. **216-221-1550; www.procomsol.com.**

Geophysical Survey Systems Inc. (GSSI) Palm XT antenna for ground-penetrating radar concrete inspection system



GSSI's new accessory for the StructureScan Mini XT is the Palm XT antenna. It is a miniaturized, hand-held ground-penetrating radar antenna that is designed to enhance the capabilities of the inspection system by providing access in tightly spaced areas and enabling overhead scanning. It features full keypad control via the top that allows for remote control of the user interface and has three data collection modes: standard, cross polarization and side car. The Mini XT can help identify structural elements, including pan deck and concrete cover, and can also provide real-time determination of concrete slab thickness. **800-524-3011; www.geophysical.com.**

A.Y. McDonald 8300 E-Series jet pump

The all iron 8300 E-Series jet pump from A.Y. McDonald is offered in 1/2 through 1 1/2 hp with flows up to 32 gpm. It has a 1-inch outlet and 1 1/4-inch inlet, contains an easy switch between 115 and 230 volts, and has a 304 stainless steel insert on the impeller. **800-292-2737; www.aymcdonald.com.** ♦





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INDUSTRY NEWS

JANUARY 2018

InfoSense wins 2017 Fast 50 Award

InfoSense announced it was the recipient of one of the *Charlotte* (North Carolina) *Business Journal's* 2017 Fast 50 Awards. This marks the third time this award has been given to the company.

StoneAge names new vice president of sales and marketing

StoneAge announced the appointment of Barbara Beaubien to vice president of sales and marketing. She previously worked for Flowserve's corporate headquarters, developing strategy and marketing for their pump, valve and mechanical seal divisions.

Hydra-Flex wins award for Ripsaw

Hydra-Flex was named the winner of the Best New Product Design category in the 2017 Minnesota Manufacturing Awards for its Ripsaw rotating turbo nozzle. Hydra-Flex was also a finalist in the Best in Class and Sustainability categories, and CEO Jaime Harris took home the Executive of the Year award.

Vortex Infrastructure changes name, expands

Vortex Infrastructure announced that it is changing its name to the Vortex Cos. The decision was driven by the rapid growth of the company's expanding portfolio of brands, products and services for the renewal of civil infrastructure. Including the recent acquisition of Ricor Services in Arvada, Colorado, the company also has locations in Texas, New England, Pennsylvania and Arkansas.

Aqua-Aerobic Systems partners with Pinnacle Ozone Solutions

Aqua-Aerobic Systems and Pinnacle Ozone Solutions have signed an agreement that confirms Aqua-Aerobic Systems as the exclusive municipal distributor for Pinnacle Ozone Solutions' ozone generation systems. The products will be marketed under the Aqua ElectrOzone M-Series brand. ♦

Got News?

Newsworthy items may include business expansion, honors and awards, new contract announcements, employee promotions, executive hires and new services.

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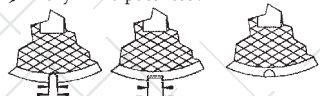
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PEOPLE/AWARDS

The **city of South St. Paul**, Minnesota, received \$300,000 from the Metropolitan Council to improve water conservation efforts, reduce the city's water use, reduce the volume of stormwater runoff polluting water resources, and reduce the amount of stormwater and groundwater that seeps into the sewer system.

The **city of West St. Paul**, Minnesota, received \$150,000 from the Metropolitan Council to help reduce the amount of stormwater and groundwater from private properties that gets into the city's sanitary sewer system.

The **city of Alexandria**, Virginia, Phase II municipal separate storm sewer system (MS4) permit and stormwater management program was recently recognized by the Water Environment Federation's National Municipal Stormwater and Green Infrastructure Awards Program. The city won the Program Management Category – Phase II for the 2017 awards. The program also was recognized as a Gold Level in Innovation and a Gold Level in Program Management.

The **Schuylkill River Heritage Area's Restoration Fund** announced grants were awarded to the following:

- Berks County (Pennsylvania) Conservation District Irish Creek stormwater project (\$19,800)
- Schuylkill Banks Bioswale Project, Philadelphia (\$15,000)

- Schuylkill Headwaters Association Dyer and West Creeks Project (\$80,000)
- West Norriton Township, Pennsylvania, stormwater management (\$50,000)

LEARNING OPPORTUNITIES

Virginia

The American Society of Civil Engineers is offering a Younger Member Leadership Symposium Aug. 3-5 in Reston, Virginia. Visit www.asce.org.

Wisconsin

The University of Wisconsin-Madison is offering a Using WinSLAMM: Meeting Urban Stormwater Management Goals seminar Feb. 27-28 in Madison, Wisconsin. Visit www.epd.wisc.edu. ♦

CALENDAR

Feb. 20-23

Water Environment Federation-American Water Works Association Utility Management Conference, Hyatt Regency Riverwalk, San Antonio. Visit www.wef.org.

March 1-3

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

March 6-9

National Utility Contractors Association Annual Convention, Wyndham San Antonio Riverwalk Hotel, San Antonio. Visit www.nuca.com.

April 19-21

American Society of Civil Engineers Structures Congress, Fort Worth Convention Center, Fort Worth, Texas. Visit 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.

April 22-25

American Water Resources Association Spring Specialty Conference: GIS and Water Resources, Rosen Centre Hotel, Orlando, Florida. Visit www.awra.org.

May 6-9

American Public Works Association North American Snow Conference, Indianapolis. Visit www.apwa.net.

May 22-24

National Utility Contractors Association Washington Summit, Holiday Inn Capitol, Washington, D.C. Visit www.nuca.com.

June 11-14

American Water Works Association Annual Conference & Exposition, Mandalay Bay Convention Center, Las Vegas. Visit www.awwa.org.

July 29-Aug. 1

American Society of Agricultural and Biological Engineers Annual International Meeting, Cobo Center, Detroit. Visit www.asabe.org.

Aug. 12-16

StormCon, Hyatt Regency Denver at Colorado Convention Center, Denver. Visit 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.

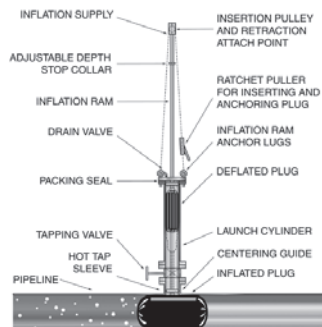
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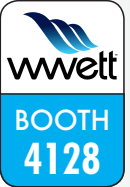
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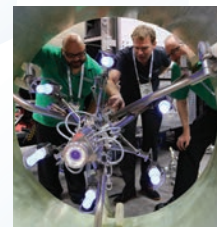


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The Omnibus Precision Power™ Control System puts the power precisely where you need it. One simple control operates ALL of the vacuum and water system functions of Vac-Con Combination Machines. A durable control screen lets you view coordination of systems while allowing precise movements of the hydraulic components. You use only as much power as needed, saving time and fuel. Omnibus Precision Power™ is what happens when you precisely blend the power of experience with the power of technology. **GO ON-LINE TO LEARN MORE.**



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