

# I&I

INFLOW & INFILTRATION SOLUTIONS AND EQUIPMENT

Supplement to:  
MUNICIPAL  
SEWER  
WATER

## Understanding Stormwater

Oregon utility takes a trenchless  
approach to storm flow issues

Page 10

**BEST PRACTICES:**  
Sanitary district engages  
customers, cuts flow

Page 8



CASE STUDIES Page 26





Visit us at UCT Booth #635

## SSO prevention starts here.

**Duke's Razorooter® II is a diquat-based herbicide that is registered by the EPA for controlling roots in sewer lines.**

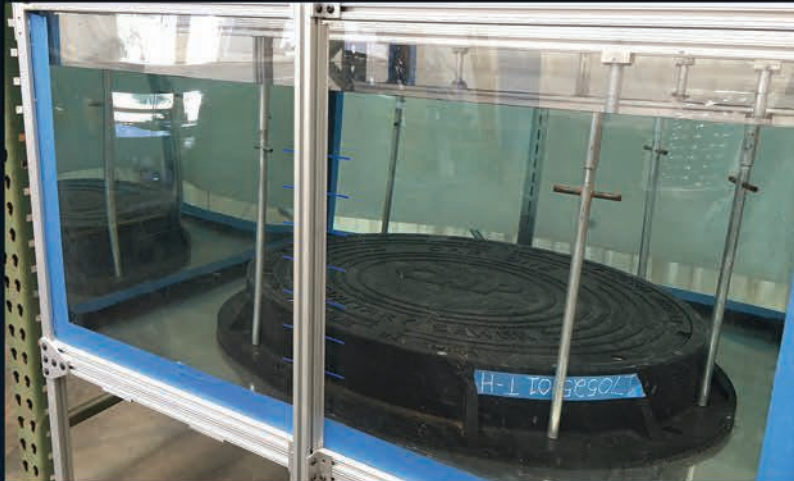
Duke's has sewer root control down to a science. Nearly 40 years of experience, 300 million feet of treated sewer lines, and a quality guarantee make Duke's the root and grease control company you can count on. This long-term success is possible because of what happens behind the scenes. Duke's trained team of experts in the laboratory, on the street and in the office constantly work to develop the best products, deliver world-class customer service and ensure every application is successful. Guaranteed. **Visit [dukes.com](http://dukes.com) or call 1-800-447-6687 today.**

**Sewer root control done right.**



# Submarine Hatches Don't Leak... Neither Should Manhole Covers

*CAP Covers Demonstrate Superior  
I&I Resistance*



*16 inches of water above cover  
in tank for 1 month*



*No cover leaks through port in  
tank bottom... 100% watertight!*

**← Water Line**

**Suffering from  
Infiltration  
and Inflow?**

**Just CAP That!**



*Innovation, Infrastructure,  
Made-In-The-USA*

5216 N. 26<sup>th</sup> Street  
McAllen, TX 78504

844-344-CAP1 (2271)  
[www.justcapthat.com](http://www.justcapthat.com)



Winter 2019



INFLOW & INFILTRATION  
SOLUTIONS AND EQUIPMENT

## BEST PRACTICES | 8

### It's All About the People

Minnesota regional sanitary district provides actionable intel to engage customers and gain support.

By Jared Raney

## BEST PRACTICES | 16

### A Better Picture of Your Pipes

A combined approach to sewer inspection yields better assessment and significant savings.

By Mazen Kawasmi, P.E.,  
and Jessica Brown, P.E.

## CONTRACTOR SPOTLIGHT | 19

### Equipped for the Challenge

Wisconsin contractor builds its reputation serving the municipal market.

By Ken Wysocky

## NEXT ISSUE:

Spring 2019

VISIT US ONLINE: [facebook.com/iaimag](https://facebook.com/iaimag) | [twitter.com/InflowandIMag](https://twitter.com/InflowandIMag) | [linkedin.com/company/iaimag](https://linkedin.com/company/iaimag)



## COVER STORY | 10

### Understanding Stormwater

Oregon utility uses a variety of trenchless technologies to remedy storm flow issues and sanitary sewer overflows.

By Jim Force

COVER PHOTO: St. Helens (Oregon) Wastewater Utility worker Ethan Stirling guides a Rausch camera into a manhole at the start of a sewer line inspection. Regular inspection is part of the utility's plan to reduce wet-weather flows and eliminate SSOs. (Photo by Julie Thompson)



## UTILITY SPOTLIGHT | 22

### Staying in Front of Problems

Proactive approach to inspection and maintenance limits collections system risks.

By Giles Lambertson

## BEST PRACTICES | 24

### Stop Wasting Time

Monitoring system can determine how frequently you need to clean specific sections of your collections system.

By Jay Boyd and  
Paul Forshtoeffel

## CASE STUDIES | 26

By Craig Mandli



# I&I

# BARRIER

## DURABILITY

## CONTRACTOR-FRIENDLY

MADE IN THE  
**USA**

HIGHLY-VISIBLE YELLOW

18"-24" HEIGHT OPTIONS

WORKS WITH CONCRETE &  
PLASTIC GRADE RINGS

WEATHER-PROOF  
UV-RESISTANT  
POLYETHYLENE

ALIGNMENT EDGE

"INSURANCE POLICY"  
FOR WATER  
PREVENTION



# STRIKE

PRODUCTS



# THE CHOICE IS EASY



## CONCRETE

- Heavy
- No warranty
- Unreliable
- Prone to breakage
- Safety concerns
- Short lifespan
- More expensive over time
- Multiple angles not achievable

*Get the best value in  
manhole grade adjustment  
systems....*



## PRO-RING

- Lightweight
- Industry leading 25 year warranty
- Reliable-50 year design life
- High strength & traffic rated
- Safer to install
- Durable
- Less expensive over the long haul
- Variety of heights and angles

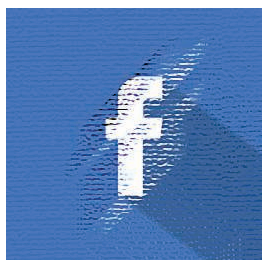
800-345-3764 • info@cretexseals.com • www.cretexseals.com

## Advertiser Index Winter 2019

ADS Environmental Services	32	Inflow Seal	27
Composite Access Products (CAP)	3	Mr. Manhole	29
ConShield Technologies	21	Pipeline Renewal Technologies	17
Cretex Specialty Products	6	Sealing Systems, Inc.	15
CUES, Inc.	7	Strike Products	5
<b>DUKE'S</b> Product. Service. Guarantee.		<b>Marketplace</b>	31
Duke's Root Control, Inc.	2		



facebook.com/iaimag  
twitter.com/InflowandIMag  
linkedin.com/company/iaimag



Drop by.

facebook.com/iaimag



Published four times yearly by COLE Publishing, Inc.  
1720 Maple Lake Dam Rd., PO Box 220, Three Lakes, WI 54562

Call toll free 800-257-7222 | Outside of U.S. or Canada call 715-546-3346  
Mon.-Fri., 7:30 a.m.-5 p.m. CST

Website: iandimag.com | Email: info@iandimag.com | Fax: 715-546-3786

**SUBSCRIPTIONS:** I&I™ is included quarterly (Jan., April, July, Oct.) along with a one-year (12 issues/monthly) subscription to Municipal Sewer & Water™ (MSW). MSW and I&I are free for qualified subscribers in the United States, Canada and Mexico. A qualified subscriber is any individual or company in the United States, Canada and Mexico that maintains, manages, designs or installs municipal or commercial sewer, water and storm infrastructures. To qualify, visit www.mswmag.com or call 800-257-7222.

Non-qualified subscriptions are available at a cost of \$60 per year in the United States and Canada/Mexico. Subscriptions to all other foreign countries cost \$150 per year. To subscribe, visit www.mswmag.com or send company name, mailing address, phone number and check or money order (U.S. funds payable to COLE Publishing Inc.) to the address above. MasterCard, VISA, American Express and Discover are also accepted. Include credit card information with your order.

Our subscriber list is occasionally made available to carefully selected companies whose products or services may be of interest to you. Your privacy is important to us. If you prefer not to be a part of these lists, please contact Nicole at nicole.labeau@colepublishing.com.

**ADVERTISING RATES:** Call Jim Koshuta at 800-994-7990 or email jim.koshuta@colepublishing.com. Publisher reserves the right to reject advertising which it considers misleading, unfair or incompatible with the character of the publication.

**EDITORIAL CORRESPONDENCE:** Address to Editor, I&I, P.O. Box 220, Three Lakes, WI, 54562 or email editor@iandimag.com.

**REPRINTS AND BACK ISSUES:** Visit iandimag.com for options and pricing. To order reprints, call Jeff Lane at 800-257-7222 (715-546-3346) or email jeff.lane@colepublishing.com. To order back issues, call Nicole at 800-257-7222 (715-546-3346) or email nicole.labeau@colepublishing.com.

**CIRCULATION:** 16,295 copies, four times yearly.

© 2019 COLE PUBLISHING INC.

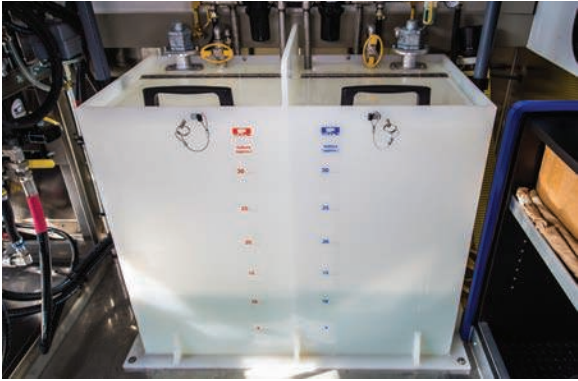
No part may be reproduced without permission of publisher.



Jim Koshuta



# NoDig solutions with the best GROUT/REHABILITATION vehicles in the industry! No one offers you more.



## CUES CUSTOM GROUT INSPECTION VEHICLES

Customize a TV/Seal truck-mounted system based on your needs! CUES is the industry leader of portable, truck, and trailer mounted grout rehabilitation systems for mainline, manhole, and lateral joint sealing with the latest CCTV equipment and decision support software.

- Retrofit any vehicle or trailer
- Combo trucks are available for TV, Cutter & Easy Grout
- Do not need an office using wireless Easy Grout
- Plenty of room for packers & grout material
- Climate-controlled office
- **Contractor-grade**



Come see us! Booth #6030



800.327.7791 | [salesinfo@cuesinc.com](mailto:salesinfo@cuesinc.com)

• • • • • [www.cuesinc.com](http://www.cuesinc.com) ◀



# IT'S ALL ABOUT THE PEOPLE

## Minnesota regional sanitary district provides actionable intel to engage customers and gain support

By Jared Raney

**E**nacting a sweeping inflow and infiltration ordinance across 17 member communities presents plenty of challenges. Getting all those communities to buy in, along with the general public, has been the path to success for the Western Lake Superior Sanitary District.

Achieving public engagement in any project can be daunting, but in the case of I&I, the best way is simply making sure customers understand the issue at hand.

"People want to do what they can do to help," says Karen Anderson, director of community relations for the Western Lake Superior Sanitary District.

The district encompasses 17 communities in a 530-square-mile region around Duluth, Minnesota. Like many, they experienced severe I&I issues through the 1990s and 2000s, kicking off a series of Environmental Protection Agency lawsuits, penalties and new permit requirements.

Those problems culminated in a consent degree, signed in 2009 and completed in 2015. Through that time, public education was paramount.

"Along with the requirements of our consent decree, we were required to pass an I&I ordinance, which puts responsibilities on each of those 17 communities," Anderson says. "They may not have chronic overflows, but they have to start eliminating that I&I from the system."

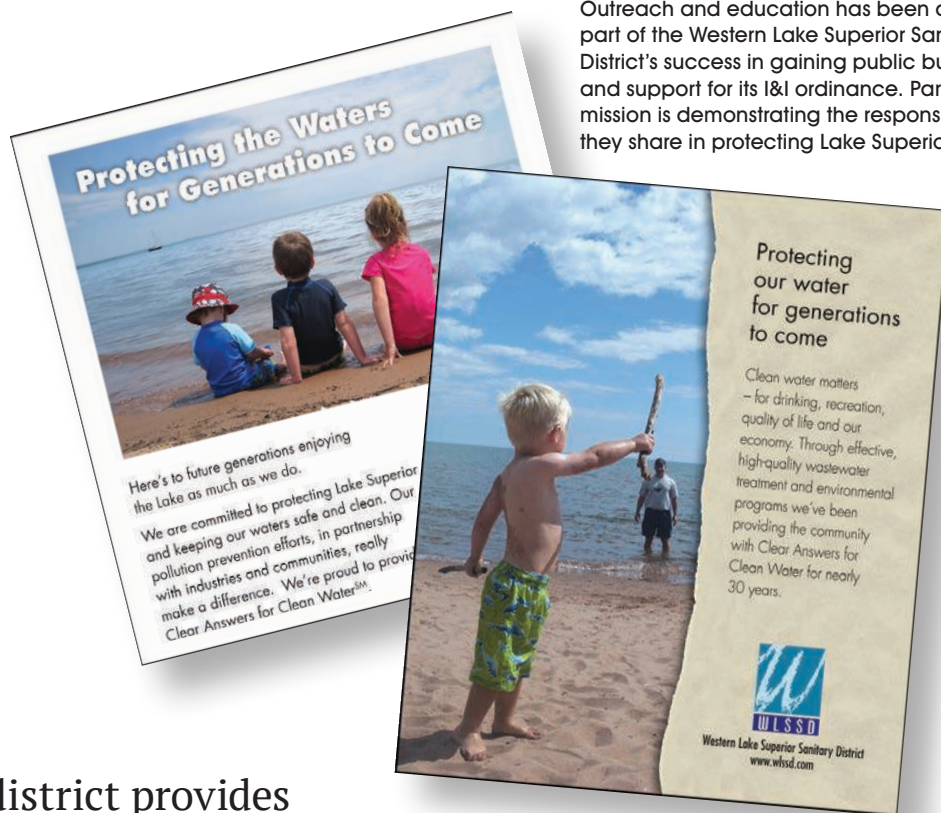
Each community in the Western Lake Superior Sanitary District creates and submits its own annual plan for I&I mitigation efforts and community outreach. The district provides resources and materials for education, as well.

### SIMPLE TERMS

In the water and wastewater industries, there can be a lot of trade-specific language. Anderson encourages utilities to keep that in mind when crafting outreach messages.

"In this industry, we don't use a whole lot of plain language, and we just have to remember we're working with people who don't know what a foundation drain is," Anderson says. "We had to try to think about the words that people don't know."

Outreach and education has been a big part of the Western Lake Superior Sanitary District's success in gaining public buy-in and support for its I&I ordinance. Part of the mission is demonstrating the responsibility they share in protecting Lake Superior.



"I remember being in college here in town — they were talking about I&I — and thinking, 'I wonder what that means?' Because I&I was a big deal, and I lived here, but I didn't have any idea what they were talking about," she says.

As important as the quality of the content is the quantity. Consistent and ongoing outreach is important to keep the public's attention and increase awareness.

When the Western Lake Superior Sanitary District was sued by the EPA, their efforts were handicapped by a lack of awareness — even among community leaders of its member cities and townships.

A popular mayor in Duluth, who eventually helped the district push its I&I ordinance, was completely unaware of the problems they were having, despite being on City Council prior to his election as mayor.

Getting that mayor on board was a huge steppingstone for the district.

"We were very fortunate that the mayor of our largest customer community was making it a priority and talking about it himself, too," Anderson says. "That's how we ended up with success: He had a lot of support."

"The message that the city of Duluth used is that we have a responsibility here, to the lake," she says. "We talk about clean water being important to our quality of life, recreation, health and commerce. We each have a responsibility to do these things to preserve that."

### DOWN THE DRAIN

Another important facet of the district's outreach strategy is encouraging individuals to contribute to the cure. I&I and other city or regional issues can seem abstract to the average citizen — too big for them to do anything about.

But in the case of I&I, there are steps private homeowners can take to help.

"You need to have public support, and you need to give them that compelling reason as to why it's important to do these things. But additionally, people want to do what they can do, and really that's where a lot of contribution comes from," Anderson says. "People think that sewers are the public responsibility, and they don't think about each one's contribution. Part of that is telling people what they can do."



In addition to giving the public an understanding of I&I, the district also distributes materials showing the effects of roof drains and foundation drains on I&I. When homeowners make the connection between something they've seen in their house, but didn't really understand, and a citywide issue, they are much more likely to do something about it.

"On the residential side, we did have a pretty robust education campaign around that. It was called 'Money Down the Drain,' talking about not just the cost of having to treat clearwater, but also showing the impact of just one roof in a typical rainfall and how much that would contribute," Anderson says.

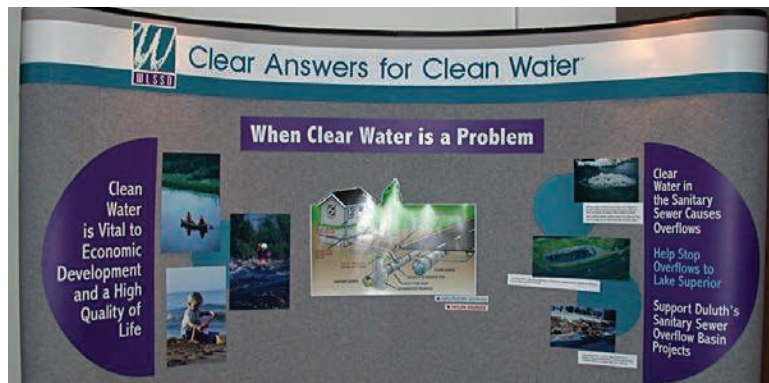
"We've tried to teach people what their individual contribution is because the problem seems really big and a sewer system seems to be a government's responsibility," she says. "People need to understand that we have a separated sewer system — clearwater belongs in the storm sewer, not in the sanitary sewer, and you can help. You have a contribution."

## CLEAR CONSEQUENCES

In the end, customers need motivation to put effort into a program like this — they need to know what they are working for and the consequences of failure.

The last element of any public education is giving people hope that there will be a positive effect if they participate.

"Part of the imagery that we've used is really showing the results of clean water. Showing people using clean water in all aspects of their lives," Anderson says. "Reminding people how important clean water is to their everyday activities and those things that are important to them — that they can contribute to making sure we continue to have clean water." **I&I**



In its efforts to educate the public on the effects of stormwater in their communities, the WLSSD sets up booths at local events and shows.

## ORDINANCE DRIVES CHANGES

When it came time to enact its inflow and infiltration ordinance, the Western Lake Superior Sanitary District had 17 separate member communities to bring into compliance.

As part of the ordinance, municipalities have to submit annual plans for I&I mitigation efforts and community outreach programs — and risk significant penalties if they fail to meet those goals.

"It's been a dynamic process, to keep an ordinance," says Jack Ezell, manager of planning and technical services for the Western Lake Superior Sanitary District. "It has evolved over time, things we've learned working with the

member communities, and we think we have an ordinance right now that really does work. I've seen the results in terms of wet-weather flow reductions and number of exceedances."

Ezell has been with the district for 44 years and has visibly witnessed the progress over that time.

"I remember sewage overflows when it seemed like we had a sprinkle, and we just don't see those anymore," he says. "We've virtually eliminated sewage overflows caused by wet weather in the district. Which is a huge achievement."

## MOVING FORWARD

Despite completing the consent decree and satisfying demands stemming from the Clean Water Act, the inflow and infiltration ordinance is still in place and the Western Lake Superior Sanitary District isn't slowing down.

"We just don't want to go back where we used to live, and I remember it well: We were reactive to wet weather and trying to chase things down after they happened," Ezell says. "Now, we think we're on a good path, where we can predict where problems will occur."

The district works with its cities and townships to create annual plans, including everything from large-scale public projects to customer education and private-side programs like foundation drain disconnections.

The ordinance itself provides guidance on mitigation tactics and programs — in addition to outlining penalties for failure to complete goals. Fines are one penalty, but the ordinance includes more drastic options.

"One of the consequences is we stop approving sewer extensions for new developments. And that does get attention," Ezell says.

"Fortunately that's been minimal, and I think the last couple years we haven't had anybody penalized."

Getting the buy-in from multiple parties is a challenge all municipalities face. Formatting guidelines and requiring compliance has been the No. 1 method to achieve broad peak flow mitigation for the district.

"We've seen great progress and great investment by our member communities over the past several years," Ezell says. "As a result, we're seeing exceedances drop substantially for wet-weather events."



Between 2008 and 2017, the district eliminated an estimated 27 mgd. That steady I&I mitigation, in addition to the construction of storage basins and infrastructure upgrades, resulted in completion of the consent decree by 2015.

"Our board of directors and the city councils throughout the district have followed suit," Ezell says. "It's been a long but successful process. All these communities have really made substantial progress in reducing wet-weather flow, and they've made substantial investments to get there."



# Understanding Stormwater

**Oregon utility uses a variety of trenchless technologies to remedy storm flow issues and sanitary sewer overflows**

STORY Jim Force | PHOTOS Julie Thompson

**F**or a city that sits on a giant rock, solving serious stormwater and sanitary sewer overflow issues requires a full range of trenchless technologies.

Under a state mandate to reduce SSOs, St. Helens, Oregon, used sliplining, cured-in-place pipe, pipe bursting and pipe ramming in a comprehensive remediation program that has reduced wet-weather flows to its treatment plant by about 80 percent and cut SSOs to less than one per year. That's down from 2.5 per year in the past.

Located 30 miles northwest of Portland, St. Helens sits above shallow bedrock of hard basalt with a compressive strength in excess of 40,000 psi. As a result, the city's infrastructure is quite shallow.

"The underlying rock was a major challenge," says Sue Nelson, P.E., Public Works engineering director. "We had to come up with the best way to proceed, without breaking the bank and returning to old-fashioned methods."

The program design was completed in 2009 and construction wrapped up in 2017. The project addressed mainlines, laterals, manholes and stormwater infrastructure. It was outlined in a technical paper at the No-Dig 2018 conference in Palm Springs, California.

## **ST. HELENS SYSTEM**

The city's sewer system serves about 13,200 residents of St. Helens and 2,000 residents of the neighboring town of Columbia City, as well as several industries. Wastewater is treated in a 43-acre lagoon and disinfection system that discharges approximately 4 mgd to the Columbia River (1 million gallons of domestic flow and 3 million gallons from one industrial customer). Total capacity of the secondary lagoon is around 115 million gallons.

In 2005, a flow study found that the hydraulic capacity of the system was less than required to handle inflow and infiltration from a 1.5-year rainfall event. In addition, the study determined that I&I would contribute as much as 24 of 25 mgd in a five-year rain event and identified the basins in the city contributing the largest flows.





St. Helens Wastewater  
Utility worker Scott Williams  
points to a pipe defect on  
the Rausch monitor during a  
video inspection.



Scott Williams makes notes in the inspection truck control room while inspecting a sewer line.







## ST. HELENS (OREGON) WASTEWATER UTILITY

### AREA SERVED:

5.5 square miles

### POPULATION SERVED:

13,240

### INFRASTRUCTURE:

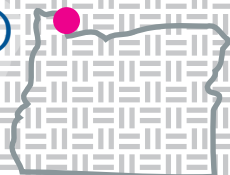
59.5 miles of sanitary sewers, 47.7 miles of storm sewers, 43-acre lagoon and disinfection treatment plant, averaging 4 mgd, discharge to Columbia River

### ANNUAL OPERATING BUDGET:

\$4,771,500 (\$2,353,000 sanitary sewer collections, \$1,325,000 wastewater treatment plant, \$1,093,000 storm drain system)

### WEBSITE:

[www.ci.st-helens.or.us](http://www.ci.st-helens.or.us)



The crew at the St. Helens Wastewater Utility includes, from left, inspector Tim Underwood, Scott Williams, Roger Stauffer, Scott Harrington, Buck Tupper, Ethan Stirling, Joel Beehler, Bryson Takemoto, Tim Illias and Public Works Director of Operations Neal Sheppard.

“The city took a holistic approach — tackling mainlines as well as laterals,” says Brendan O’Sullivan, civil engineer with Murraysmith of Portland. “That was the key — understanding the stormwater component of the program.”

### ON THE MAINLINE

The mainline program was designed to rehabilitate or replace existing sanitary sewers and construct new storm sewers.

CCTV inspection revealed numerous root intrusions, separated and off-set joints, and cracked pipes, and it enabled the city to concentrate on the lines and basins identified as the largest I&I contributors in the previous flow study.

“Once the needs were identified, we evaluated the various rehabilitation methods, including CIPP, pipe bursting, sliplining, as well as open-trench excavation,” Nelson says.

“We never wanted to rule out any technology until each was looked at to make sure what was best to address issues, as well as corollary concerns — especially the costs — and the impact on property owners. Many of our pipes ran through backyards and neighborhoods. We chose

trenchless as a way to minimize impact on residents.”

“Trenchless was a lot more palatable,” O’Sullivan adds. “Surface restoration of open-cut excavations alone could have involved 65,000 to 75,000 cubic feet (of soil), to say nothing of trying to get equipment into side yards.” The cost of excavation and remediation on private property weighed heavily in the selection process, he points out.

In the analysis, CIPP proved to be the most appropriate method, followed by size-on-size pipe bursting and open-cut.

**“The underlying rock was a major challenge. We had to come up with the best way to proceed, without breaking the bank and returning to old-fashioned methods.”**

Sue Nelson

With that data in hand, St. Helens embarked on a program to address sanitary sewer deficiencies in both public and private sewer lines. It had these specific objectives:

- Reduce the number of overflows.
- Restore the capacity of the sanitary sewer system for future use.
- Improve the existing storm sewers and install new storm sewers to eliminate flooding and convey storm flows diverted from the sanitary system.
- Focus on the largest basin contributors to achieve maximum improvement.



Utility workers Scott Williams (left) and Ethan Stirling lower a Rausch camera into a manhole at the start of a sewer line inspection.

All CIPP liners were designed per ASTM F1216 for fully deteriorated conditions and were fabricated of needle-punched felt tube. They were impregnated with polyester resin, installed using air inversion, and steam cured. The thickness of the liners ranged from 4.5 to 9 mm based on the design parameters, required structural properties and geographic location. CIPP installers included Michels and Insituform Technologies.

## MONITORING STYRENE

The public expressed some concerns about styrene during the construction, and the city implemented a testing program. Using gas meters immediately adjacent and downwind of the curing steam exhaust, the city monitored the first half-dozen CIPP liner installations. After the tests showed styrene did not exceed Environmental Protection Agency and OSHA thresholds, the monitoring was suspended.

In cases where the existing sanitary pipe was in too poor a state to allow for CIPP lining, pipe bursting or open trench were used, although each method presented its own challenges. "Some areas didn't have the minimum footprint or ample staging areas for CIPP," Nelson says.



Brendan O'Sullivan, civil engineer with Murraysmith of Portland, and Sue Nelson, P.E., St. Helens Public Works engineering director at work in the office.



## MAKING LATERAL CONNECTIONS

The St. Helens sanitary sewer project also addressed sewer laterals to private property, with the result that over 2,000 (about 60 percent) of the city's laterals were inspected and about 800 were rehabilitated.

The city's approach was unique, in that the focus was on the older sections of the city, and used CCTV inspections and clear, "layman's terms" communications to document poor lateral conditions to property owners.

"All CCTV inspection footage had to be uninterrupted from start to finish and begin with a video of the structure frontage," reports Sue Nelson and Brendan O'Sullivan in their technical paper at the No-Dig 2018 conference. "This

made it very difficult for owners to dispute the results of the CCTV inspection."

With the inspection video in hand, the city ranked laterals based on types of deficiencies and allowed the city to recommend repair or not, based on clear evidence.

"We held neighborhood meetings to discuss specific problems," Nelson says. "One section of the city had Orangeburg pipe laterals, which would have disintegrated upon connection with new laterals on the city side. (The pipe is bituminous fiber, installed after WWII as a less costly connection.)

"Homeowners were informed that they would have to pay for replacement of the section on their side. We offered payment options to lower

income folks, letting them pay the cost back over time on their water and sewer bills."

The city also supplied property owners with a lateral repair map showing the identified deficiencies, the necessary plumbing permit, a copy of the applicable plumbing code, and a brochure of frequently asked questions. The communications protocol and open-door approach paid off; St. Helens achieved a 94 percent owner repair rate.

On the city side, about 2,000 feet of laterals under streets and sidewalks were repaired — a few using robotics and ultralow viscosity chemical grouting at the connection, with the remainder completed via open trench.



Open-trench replacement of sewers located in side and backyards was difficult because access was limited due to existing structures, trees and landscaping. With pipe bursting, it was critical to analyze soil displacement forces to ensure that existing surface structures, adjacent foundations, and utilities would not be negatively impacted during the pipe bursting operations. All pipe bursting operations for the mainline program were 6-inch-diameter size-on-size replacement, using PE3408 DR17 HDPE, as no increase of capacity was deemed necessary after evaluating the system hydraulics.

## PUBLIC OUTREACH

“City staff was sensitive to the problems of accessing public utilities through private property,” Nelson says. “We didn’t have a fully developed public information officer position at the time, but we posted information on the website and sent notices in advance to customers.”

She says the piping contractors played a key role. “Once the contractor was hired, we put out additional notices including door hangers, explaining who the contractor was and who the contact person accessing the property would be.”

The city also published maps of the construction areas and held neighborhood meetings to address specific problems, including the large number of laterals made of Orangeburg pipe material (see sidebar).

## PIPE RAMMING

Pipe ramming technology was the choice for the next phase of the mainline program: replacing two undersized storm culverts, one 24 inches and one 36 inches in diameter. The new culvert had to navigate 50 feet of roadway fill containing numerous public and private utilities and an RV park whose year-round residents couldn’t be displaced.

Based on geotechnical and surface conditions and diameter of the pro-



Brendan O'Sullivan and Sue Nelson look over work plans in the field.

required excavation above the steel pipe so it could be lifted over the ledge as the ram continued pushing the pipe forward.”

A 96-inch-diameter manhole with a 3-foot sump for sediment management was installed once the pipe ram was completed. Open trench was used to complete the remaining pipe to the new outfall structure on the Columbia River.

## GOOD INVESTMENT

Total cost for the project, including the preliminary flow studies as well as numerous manhole repairs, was approximately \$11 million. City funds, the American Recovery and Reinvestment Act of 2009, and the Oregon Department of Environmental Quality Clean Water State Revolving Fund paid for the project.

The results have been worth it.

“The rehabilitation of approximately 12 miles of the city’s 57 miles of sewer lines, 10,000 linear feet of storm sewer lines, and about 800 sewer laterals has resulted in an 80 percent reduction in sanitary flows pumped to the treatment plant during rain events,” Nelson and O’Sullivan report in their paper.

“And the number of SSOs has been drastically reduced. The city experienced an average of 2.5 SSOs each year between 1995 and 2009. Between 2010 and 2017, that number dropped to less than 1 per year. The capacity issues have been resolved and there have been no reported overflows of the storm sewer in the upstream basins.”

“We’ve seen a significant reduction in wet-weather flows at the treatment plant,” Nelson says. “They used to run as high as 24-25 mgd. We don’t see anywhere near that now.” **I&I**

**“The city took a holistic approach — tackling mainlines as well as laterals. That was the key — understanding the stormwater component of the program.”**

Brendan O’Sullivan

posed culvert, the project was designed with upper and lower pipe ram segments and two sections of open-trench installation.

For the first ram section, engineers selected a 66-inch-diameter steel pipeline with a wall thickness of 1 inch and an S-90 Hydro-Ram hydraulic hammer from IHC IQIP capable of imparting 90 kNm of energy per blow.

Within the first 40 feet, the grade began to drop due to soil consolidation. “Fortunately, the design had built-in flexibility to adjust the slope of the pipe without negatively impacting the maximum flows needed to be conveyed through the pipeline,” O’Sullivan says.

However, approximately 165 feet into the pipe ram and 36 feet below existing grade, a differing condition in the form of a basalt rock outcrop was encountered and the final section was completed using open-trench excavation.

The 170-foot-long second ram under the RV park was completed using a Torus Hammer manufactured by TT Technologies. “This ram was also challenging to complete,” O’Sullivan says. “A rock ledge was discovered that

## Featured products from:

**Insituform Technologies**  
800-234-2992 | [www.insituform.com](http://www.insituform.com)

**Michels Corporation**  
920-583-3132 | [www.michels.us](http://www.michels.us)

**RauschUSA**  
877-728-7241 | [www.rauschusa.com](http://www.rauschusa.com)

**TT Technologies, Inc.**  
800-533-2078 | [www.tttechnologies.com](http://www.tttechnologies.com)



# MANHOLE INFILTRATION SOLUTIONS



## FLEX SEAL UTILITY SEALANT®

An aromatic urethane rubber noted for extreme toughness, elongation, abrasion, resistance, acidic resistance and longevity.



## AQUA SEAL®

A dual component hydrophobic polyurethane water stop system designed to stop high infiltration in precast or brick lined structures.



## GATOR WRAP®

Forms a continuous rubber seal on a manhole joint which prevents water and soil from infiltrating through the manhole, catch basin or concrete pipe joint.



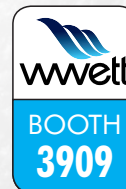
## INFI-SHIELD® UNI-BAND

An inexpensive and permanent method of externally sealing the grade adjustment ring area of a manhole or catch basin.



## MANHOLE INSERT

Stop the unwanted inflow of rainwater through manhole covers.



Sealing Systems, Inc.  
800-478-2054  
[www.ssisealingsystems.com](http://www.ssisealingsystems.com)



# A BETTER PICTURE OF YOUR PIPES

A combined approach to sewer inspection yields better assessment and significant savings

By Mazen Kawasmi, P.E., and Jessica Brown, P.E.

In the first four years after implementing its Interceptor Condition Assessment Program, or ICAP, the Fort Worth (Texas) Water Department prevented an estimated 59 sanitary sewer overflows and saved \$3.6 million to \$6.6 million.

For more than a decade, Fort Worth has been recognized as the fastest-growing metropolitan area in the nation, resulting in a great deal of resources being dedicated toward building new wastewater infrastructure to accommodate the rapidly expanding population. At the same time, the Fort Worth Water Department recognized the importance of serving and maintaining its existing wastewater infrastructure, which consists of more than 262 miles of sewer lines 24-inches in diameter and larger. The cost for the city to clean these lines for inspection is \$2 million, which can be a strain on limited resources.

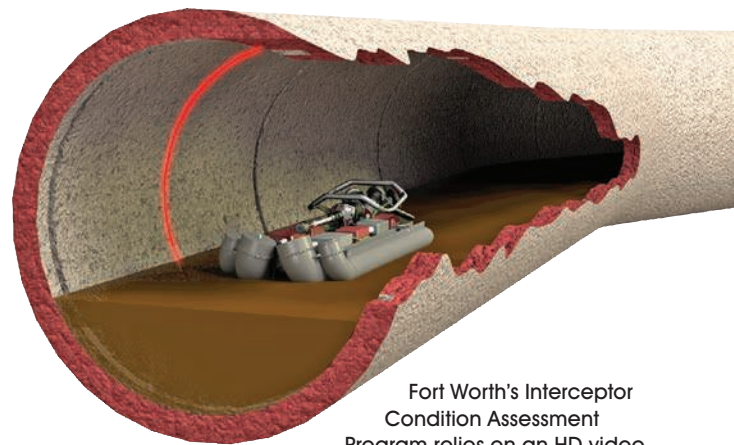
In an effort to find a more efficient, cost-effective, and accurate way to determine the condition of these vital sewer interceptors and develop recommendations for a long-term capital improvement plan, the city initiated an ICAP. The ICAP project team is using results from the 2012 Wastewater Collection System Master Plan, as well as input from the field operations group to prioritize sewer interceptors for inspection under the ICAP.

## A NEW MODEL

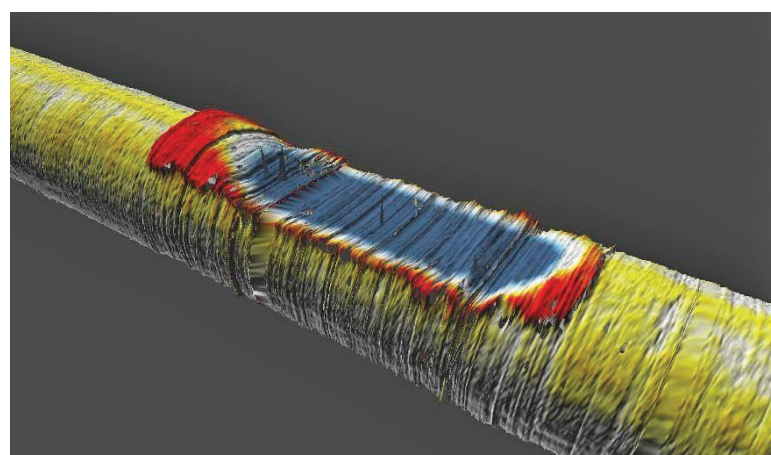
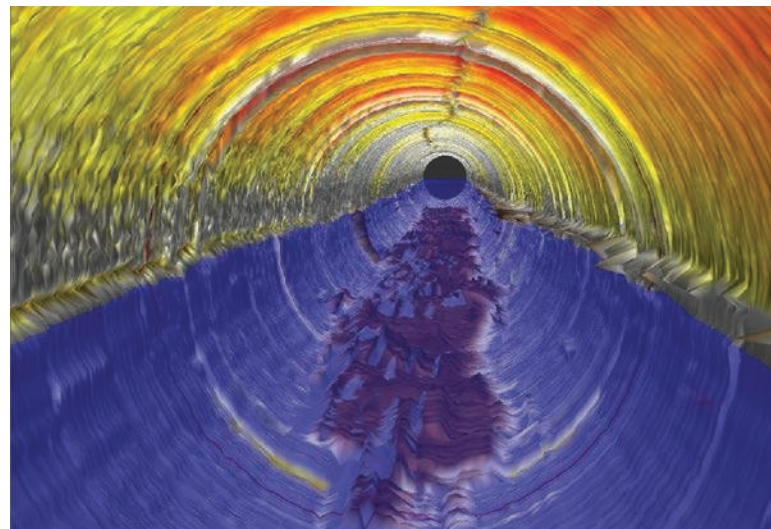
The first step of ICAP is the pre-engineering inspection process to create a map of the infrastructure. During this stage, the team walks the lines in the field and conducts thorough research to better understand the infrastructure, such as the size and composition of lines and locations of manholes.

Once a map is created, the field condition assessment can begin. This process involves the deployment of three types of technology: high-definition TV inspection, sonar inspection and 3D laser inspection.

- **HD TV inspection** is the most advanced method for capturing video images. Once the HD TV inspection data is collected, it can be viewed using conventional digital video viewing software.
- **Sonar inspection** is used to inspect the pipe below the water level flow line. The device sends a sonar signal and measures the time required for the signal to return. The technology then creates an image of the pipe below the water surface and identifies accumulation of debris, deformation due to deflection in the pipe, breaks or other defects. As



Fort Worth's Interceptor Condition Assessment Program relies on an HD video camera, sonar and 3D laser sensor technologies all mounted together on the FlyEye System developed by RedZone Robotics.



Two components of ICAP, laser and sonar inspection, create 3D models of the pipe above and below the waterline respectively. The models can then be combined for a more complete picture.



the sonar travels along the pipe, the data points are aggregated to create a 3D model of the debris and pipe surface below the flow line.

- **3D laser inspection** uses laser technology to create a 3D model of the pipe wall above the water flow line. Similar to the sonar technology used below the water flow line, the laser sends a rotating beam of light around the pipe surface and measures the amount of time required for the light to bounce back. Using thousands of data slices along the length of the pipe, a 3D model of the pipe wall is created.

In the case of Fort Worth, the HD video camera, sonar and 3D laser sensor technologies are all mounted together on the FlyEye System developed by RedZone Robotics. The rig is then pulled through the pipe segment on a pontoon float to collect data.

Once retrieved, the data is shared with the technology manufacturer to develop a 3D model of the entire pipe length. Combined with the HD video, the result is a high-resolution visual picture of the pipe and a 3D model of the pipe that is used for detailed condition analysis.

### TESTING THICKNESS

One of the most useful pieces of data to be collected from the inspection is the pipe wall thickness, as this information helps determine the condition of the pipe and its anticipated life span. Pipe specification data establishes the original interior diameter of each pipe segment, which can be compared to inspection data measuring the amount of wall thickness loss. The difference between the inspected inside wall location and the original inside wall location is used to calculate the inspected wall loss.

The inspected wall loss or remaining wall thickness is used to assign pipe segment condition scores, which are referred to as Remaining Useful Life scores. These scores fall into one of five categories. The ICAP project team used the following condition scoring system for reinforced concrete pipe segments:

- **Score 1:** Material loss of 0 to 0.5 inches from original inside wall. Estimated Remaining Useful Life is 36 to 50 years.
- **Score 2:** Material loss of 0.5 inches to interior face of first row of reinforcement steel. Estimated Remaining Useful Life is 21 to 35 years.
- **Score 3:** Material loss from interior face of first row of reinforcement steel to half the distance to interior face of the second row of reinforcement steel. Estimated Remaining Useful Life is 11 to 20 years.
- **Score 4:** Material loss from half the distance to the interior face of the second row of reinforcement steel to the interior face of the second row of reinforcement steel. Estimated Remaining Useful Life is 3 to 10 years.
- **Score 5:** Interior face of second row of reinforcement steel to outer pipe wall surface. Estimated Remaining Useful Life is less than 2 years.

Pipe segments scoring a five are considered to be in imminent failure and are in need of emergency rehabilitation. Pipe segments scoring a four should be included in the next available design and construction projects release.

In addition to assigning a Remaining Useful Life score to each segment, the sonar inspection data enables Fort Worth to more effectively clean its pipes by focusing just on the portions of the interceptors

that require cleaning. In the past, they would clean the entire interceptor due to the lack of available data. Utilizing the ICAP inspection data to limit cleaning to just the segments requiring attention has already saved the city \$4.5 million in large-diameter cleaning cost to date.

### REAPING BENEFITS

The city of Fort Worth and the project team's approach to wastewater system condition assessment achieved multiple benefits and provided a sustainable business process to inspect, score, and monitor critical major wastewater interceptors. In the first three years, Fort Worth was able to inspect 49 percent of the large-diameter lines.

The benefits of ICAP can be summarized into three areas:

- **Reduced capital improvements:** The capital improvement plan was estimated to be reduced as a result of the ICAP by two primary means.

**QUICK LOCK**

**1,000,000 Installed!**

## Point Repair That Solves Infiltration

Pushed in by your crawler and expanded with air, a Quick-Lock sleeve delivers structural trenchless sewer repair with heavy-gauge stainless steel and stops infiltration with a one-piece rubber gasket. It installs in minutes with two people and minimal equipment.

**DN 200 (8")**

**digging  
resin • pot life  
wet-out • cure  
bypass pumping  
wash-outs**

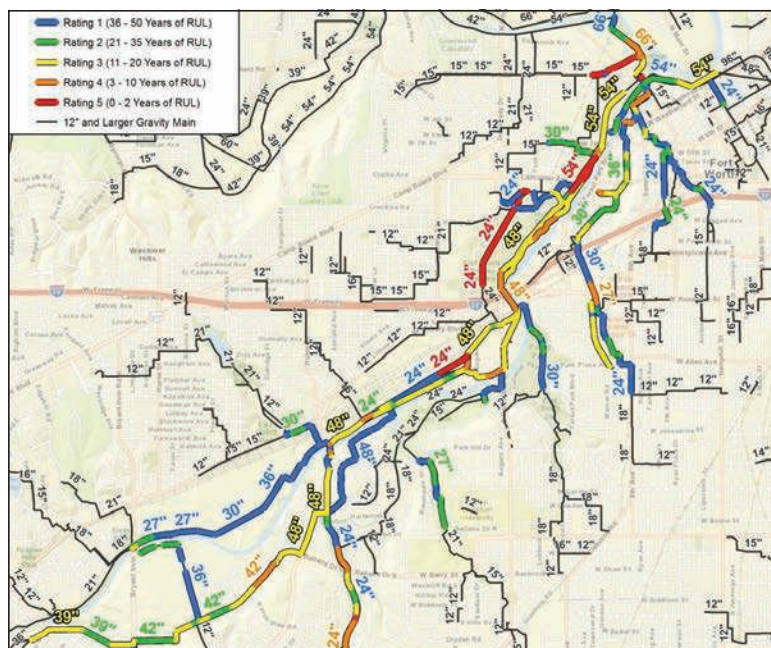
Quick-Lock is also offered as an end sleeve to protect installed CIPP liners.

**wwwelt** **BOOTH 5224** **Pipeline Renewal TECHNOLOGIES™**

for on-site demo, visit [www.pipelinert.com/ql](http://www.pipelinert.com/ql) or call (866) 936-8476

**infiltration • offsets • roots • abandoned laterals • holes • cracks**

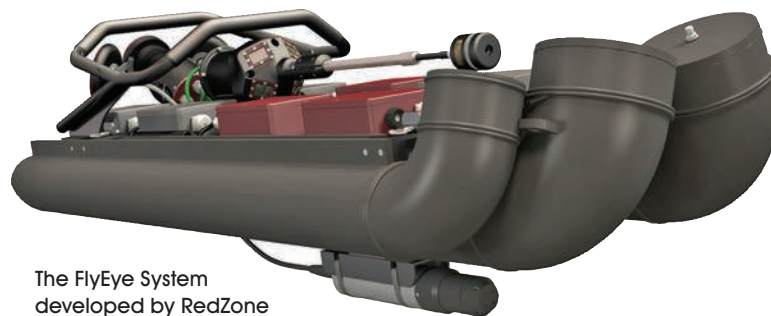




Inspected wall loss and remaining wall thickness are used to assign pipe segment condition scores, which are referred to as Remaining Useful Life scores. The scores can then be used to prioritize actions.

The first was the ability to restore capacity through focused detailed cleaning and removal of large debris in multiple interceptors. The city's InfoWorks CS hydraulic model (Innovyze) was reanalyzed in locations where significant debris was identified and removed from the wastewater interceptors to determine if cured in place improvements can be deferred or downsized in the future. The second was the replacement of portions of sewer interceptor instead of the entire interceptor.

- **Reduced reactive maintenance and cleaning costs:** Prior to the creation of the ICAP, the Fort Worth Water Department utilized the industry standards of "clean to inspect" to determine pipe condition and restore capacity. Cleaning under ICAP using the clean-to-inspect method was projected to cost \$1.7 million. Utilizing the sonar data developed from the ICAP results, the Fort Worth Water Department was able to "inspect to clean" at a significant cost-savings. Cleaning cost utilizing the inspect-to-clean method totaled under \$400,000, which represents an approximate savings of \$1.3 million over the tra-



The FlyEye System developed by RedZone Robotics features an HD video camera, sonar and 3-D laser sensor technologies all mounted together on one unit.



Fort Worth's Interceptor Condition Assessment Program has prevented an estimated 59 sanitary sewer overflows and saved the utility \$3.6 million to \$6.6 million in its first four years.

user group during development reviews and annual budget planning on business case justification for renewal/replacement projects. Remaining pipe wall thickness can now be monitored, allowing the city to get the most value out of its assets before replacing them.

## BIG SAVINGS

ICAP has replaced traditional practices and provides more accurate pipe condition assessments, leading to reduced inflow and infiltration, fewer overflows, identification of potential failures before they occur, maintenance schedules addressing critical needs first, and reduced impact from maintenance-related construction.

During the first four years of the eight-year program, the benefits are already paying off. The ability to limit interceptor cleaning to just the segments that are in need of service has saved the city \$4.5 million in cleaning costs to date while the ability to determine the Remaining Useful Life of the pipes enables the city to better plan for its short-term and long-term capital improvement budgets.

As the process continues over the next four years, Fort Worth will gain an even better understanding of the condition of its wastewater system and will be able to focus its resources to sections where it will have the most impact.

## ABOUT THE AUTHORS

Mazen Kawasmi, P.E., is an associate at Freese and Nichols, and Jessica Brown, P.E., is the firm's vice president. **IF**

**ICAP has replaced traditional practices and provides more accurate pipe condition assessments, leading to reduced inflow and infiltration, fewer overflows, identification of potential failures before they occur, maintenance schedules addressing critical needs first, and reduced impact from maintenance-related construction.**

ditional method. It is estimated that the ICAP methodology will result in savings of \$15.2 million in cleaning cost over the eight-year program.

- **Enhanced understanding and knowledge of asset status and life cycle:** The ICAP field assessment findings linked back to the city's computerized maintenance management system program, GIS, and hydraulic model, providing enhanced asset understanding to enable the city to prioritize replacement projects more effectively. ICAP field assessment findings provided the needed information to the engineering





Great Lakes TV Seal owners Greg Healy (left) and his brother Brett Healy, with some of their crew around a Vactor 2100 Plus Water Recycling System truck.

## EQUIPPED FOR THE CHALLENGE

Wisconsin contractor builds its reputation serving the municipal market

STORY Ken Wysocky | PHOTOS Mike Roemer

**G**reat Lakes TV Seal readily goes to extremes to serve its municipal customers, even if it means inspecting underwater sewer lines via barges and boats or using all-terrain vehicles to transport portable inspection systems through swamplands.

“That’s one of our niches — doing jobs that other people won’t do,” says Brett Healy, 45, who co-owns the Green Bay, Wisconsin-based company with his brother, Greg. “We look at jobs as challenges, and before you know it, you’re home — the time just flies. The key is finding and enjoying the challenges in what you’re doing. It’s either in your blood or it’s not.”

That can-do philosophy, coupled with a strong emphasis on professionalism and continual investments in new technology has served the company well since Healy’s father and mother, Jeff and Denise Healy, bought it in 1984.

Moreover, the company’s customer base expanded to include the entire state of Wisconsin and Michigan’s Upper Peninsula, with a clientele consisting mainly of municipalities that need pipeline inspections, cleaning and rehabilitation.

### BASED ON NEED

Jeff Healy took a two-pronged approach to new technology, and his sons have followed suit. The first focused on buying new equipment based on customers’ needs. “We wanted to be a one-stop shop — never be in a position

**“If we see a customer that has an issue, it gives us a reason to make a technology leap right then and there.”**

Brett Healy

where we have to tell a customer we can’t do something,” Brett Healy says. “If we see a customer that has an issue, it gives us a reason to make a technology leap right then and there.”

The second prong is centered on spotting new technology and creating a niche market for it. As an example, Healy cites the company’s investment in pipeline inspection cameras with pan-and-tilt capability when that technology first emerged in the market. “Dad knew that once engineers saw these cameras’ capabilities, they’d start to spec it in contracts,” he says. “He has great business instincts.”

Manhole rehabilitation provides a good example of how Great Lakes TV Seal prepares to capitalize on new trends. They noticed that as cities worked to reduce their inflow and infiltration, there was less air movement and water flow in sewers. That subsequently led to higher levels of hydrogen sulfide, which hastened the deterioration of concrete manholes and sewer lines.

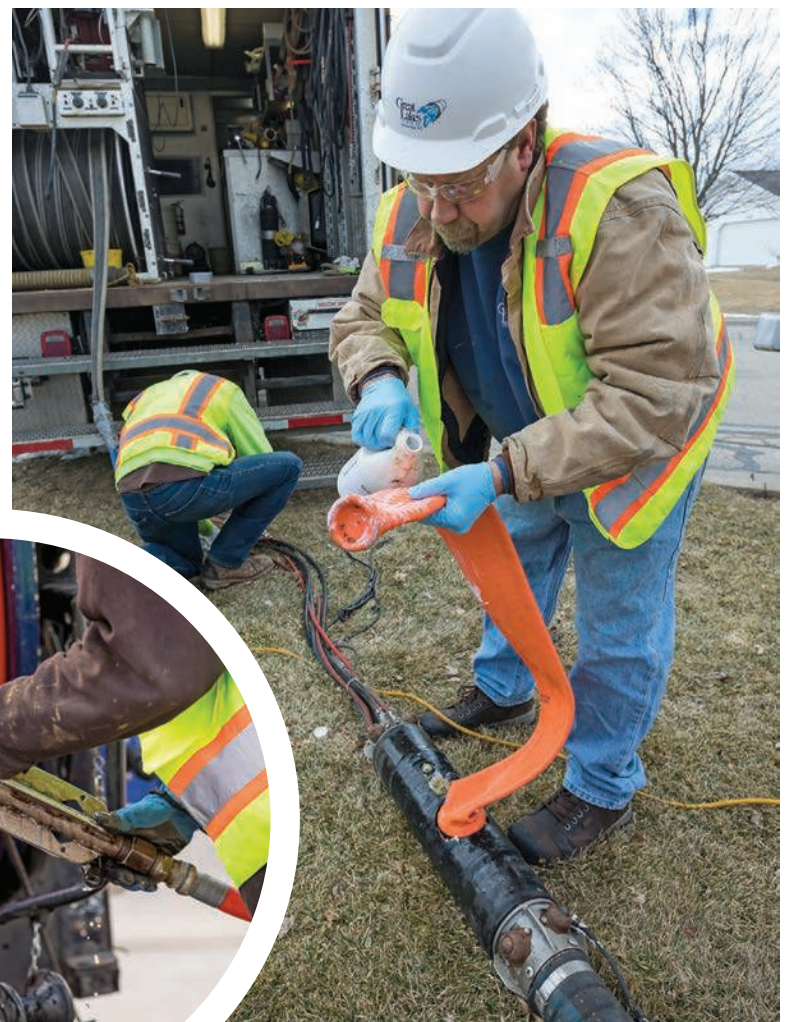


“We saw pipes and manholes deteriorating, so we did our due diligence on technology,” Healy explains, which led to services such as epoxy coatings for manholes. “Every one of our services was pretty much spawned that way. We aren’t afraid to pay more for the best equipment,” he notes. “Dad preached to us for years that people will pay for quality, so don’t cheapen up equipment or services.”

## BUILDING THE FLEET

For inspecting pipelines, Great Lakes TV Seal relies on 10 camera trucks featuring systems (including lateral-launch equipment) made by Aries Industries, Cobra Technologies (Trio-Vision) and RapidView IBAK North America; three Aries Industries grout trucks capable of rehabbing mainline pipes up to 30 inches in diameter; three Vactor 2100 Plus combination vacuum trucks; three waterjetting trucks featuring jetter units made by FMC Technologies, SRECO Flexible and Aquatech (Hi-Vac); a PipeHunter trailer jetter built by Texas Underground; and an easement machine made by KWMI.

“When we have to go through backyards or golf courses to get to interceptor lines for cleaning and we don’t want to disturb grass lawns, we use the easement machine,” Healy explains. “A lot of times the manholes on those (remote) interceptor lines are 1,000 feet apart. They usually go through swamps, so the fewer manholes, the better. Our trucks carry 800 feet of 1-inch-diameter hose, and the easement machine carries another 950 feet. We send out the easement machine while the vac truck still supplies the water and vacuum power.”



ABOVE: Greg Healy applies silicone lubricant to a bladder prior to stowing it in the lateral packer as they use a grout truck made by Aries Industries to seal a lateral connection to a sewer main in Bellevue, Wisconsin. INSET: Galen Staszak gets ready to rinse the mating surface and cover of a manhole so it seats properly after cleaning the line. LEFT: Marcus Jenerson (left) and Brett Healy launch an IBAK T76 tractor and Orpheus camera combo to inspect a municipal sewer main.

The company also owns robotic cutters for reinstating laterals or grinding down protrusions; they use units made by Schwalm USA and Dancutter, plus similar nonrobotic machines built by Nu Flow Technologies and Picote Solutions. For jetting nozzles and chain whips, the company invests in products made by Enz Technik AG, KEG Technologies and NozzTeq.

For rehabilitating sewer lines, the company relies on a variety of cured-in-place pipe lining technologies suitable for various applications, ranging from spot repairs to full-out lining. Vendors include AMerik Engineering, Trelleborg AB and Nu Flow Technologies. For cementitious and epoxy manhole coatings, Great Lakes TV Seal invests in AP/M Permaform systems.

## WHATEVER IT TAKES

Inspecting sewer lines isn’t always routine. The company periodically inspects sewer lines for a local sewage district. That’s usually not a big deal — except for the several miles of pipe that lie underneath the bottom of the Fox River.

Inspecting those lines requires small aluminum boats or barges. In some instances, Great Lakes TV Seal even has to rent a larger barge from a local bridge-building contractor. The boats carry technicians and safety equipment while the barges are used to transport equipment.





**STOP I&I AND MIC!**



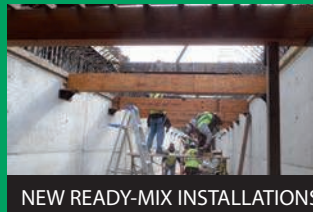
**MORE THAN 20 YEARS OF  
PROVEN PROTECTION FOR  
CONCRETE SANITARY SEWER SYSTEMS FROM  
MICROBIOLOGICALLY INDUCED CORROSION (MIC)**  
(Hydrogen Sulfide + Thiobacillus = Damaging Sulfuric Acid)

*Reducing flows can allow greater accumulations of organic matter, fostering Thiobacillus bacteria, hydrogen sulfide, and concrete-destroying sulphuric acid.*

Rehabilitate existing systems, and protect new structures, with the only anti-microbial additive with more than 20 years of proven protection in the field.



REHAB EXISTING STRUCTURES



NEW READY-MIX INSTALLATIONS



NEW PRECAST STRUCTURES

Rehab with AP/M Permaform & ConShield  
800-662-6465 • [www.permaform.net](http://www.permaform.net)

New Construction with ConShield Technologies  
877-543-2094 • [www.conshield.com](http://www.conshield.com)



**“We saw pipes and manholes deteriorating, so we did our due diligence on technology. Every one of our services was pretty much spawned that way.”**

Brett Healy

“The manholes aren’t completely submerged and are used as buoy markers for ship navigation,” Healy points out. “We tie up to them using cleats on the manhole. After that, it’s just like working on land, just without traffic signs and safety cones.

“We also have to stay in touch with the dam tenders to make sure the dams ahead of us aren’t opened, or the river water would get too low for a

Greg Healy (left) and Hunter Strick grout a lateral connection to a sewer main in Bellevue, Wisconsin.

barge,” he adds. “And if an upstream dam starts releasing water, it can flood out the manholes. There’s an element of risk because if the water starts rising quickly, you can’t shut the manhole right away because you’ve got to get the camera out first. But we’ve never had a problem — knock on wood.”

#### DEPENDABLE PEOPLE

Jobs like these wouldn’t be possible without really good people. “Our employees have to be positive and realize they’re working for the customer,” Healy emphasizes. “They also have to be problem-solvers. We always tell them that they should never say they don’t know something or that we can’t do something. We tell them to always first come back to the shop so we can talk about it.

“They need to understand that they must create cooperative relationships between them and customers, not just with Great Lakes,” he says. “It’s the greatest thing when municipalities call and ask for an employee by name. We’re very big on developing relationships — letting customers know that we’re here not just for the job we’re working on, but the next one and the next one and the next one.” **I&I**





The Florence (Kentucky) Public Service Department's sewer maintenance crew includes, from left, Jacob Carpenter, Jeremy Gruelle, Mark Teremi, Brandon Black, Pete Biggs, Bryce Meier, Greg Ferguson, George Caldwell and Brent Scudder.

**"We are trying to stay in our lane, to be really, really good at what we do."**

Eric Hall

## STAYING IN FRONT OF PROBLEMS

Proactive approach to inspection and maintenance limits collections system risks

STORY Giles Lambertson | PHOTOS David Sorcher

**T**he Public Services Department in Florence, Kentucky, keeps a close eye on its pipes, and it's paying dividends.

The city's wastewater collections system totals more than 130 miles of pipe with nearly 3,500 manholes. That includes 64 miles of clay pipe laid in the 1960s and another 68 miles of PVC pipe dating from the 1990s and early 2000s. The balance is concrete piping.

Nine department employees constitute the wastewater work crew — one supervisor and eight maintenance personnel. They're able to handle it all because they are supported and guided by the tools and technologies that help them stay ahead of collections system problems instead of reacting to them.

### SYSTEM MONITORING

Consider those 3,500 manholes. Some of them are inspected every day for evidence of infiltration, the presence of hydrogen sulfide gas, or ill-fitting covers. Urgent findings are addressed immediately, while routine findings are documented, photographed and entered into the department's Lucity software system. That record lets Adam Duncan, operations superintendent, and his staff filter the information, rank the condition of each manhole, and systematically service it.

To keep tabs on more than 130 miles of pipe, the Florence sewer division has a dedicated CCTV crew inspecting mainlines from 6 inches to 30 inches in diameter, along with the connecting lateral lines using a CUES LAMP system. Over a five-year cycle, the inspection crew documents infiltration problems, solids buildup, incursive roots and the general condition of the entire system.

Eric Hall, Florence's public services director, says having a dedicated inspection crew is a fiscally responsible way to pre-emptively avoid costly pipe failures and to monitor what is happening underground. "The management software lets us go in and grade a pipe and put out a plan to fix or maintain it. Performance measurements drive the process and, at the end of the day, it is cost-effective."

Fifteen years ago, the department started a flow monitoring program to keep tabs on inflow and infiltration in the sewer system. The program has accumulated information over the years that serve as benchmarks for normal and abnormal flow rates. With assistance from an engineering consultant service, the city constantly monitors data, looking for elevated levels of infiltration. Duncan says the filtered data guides pipe relining decisions — with up to 3 miles of pipe relined each year.

Software and associated hardware are keys to Florence staying on top of its underground responsibilities. Hall traces the city's reliance on new technologies and better asset management practices back to 2005 when, he says, "we really got into problem management. Now, within 15 minutes, I can run a filter through our documented information and prepare a list of responses. We do this regularly so that every year we know what we are going to undertake and how we are going to spend our money — all because we keep these records."

An IBAK T76 tractor and camera system is positioned for a sewer line inspection.







Bryce Meier receives a pipe patch in a manhole for a sewer line repair.



Maintenance workers Jeremy Gruelle (left) and Bryce Meier prepare a pipe patch for a sewer line repair.

## STAYING IN FRONT

The department's repair and rehabilitation work requires a small fleet of heavy equipment along with a new Vactor hydroexcavation unit and two water jetters. The jetters are routinely scheduled to clean out areas where FOG, roots or other impediments are recurring problems. The rated severity of each area, which is tabulated through inspections and monitoring, determines how often an area is cleaned.

The department recently began doing point repairs on lines using a CIPP patching system from Source One Environmental. The system involves remotely sliding a patch from a manhole to where a crack or hole in the pipe has developed and then holding it in place with a packer until it has cured. "We can do repairs on anything from a 6-inch line to a 26-inch pipe and do it all without having to dig up and then restore a site," Duncan says. More than 20 point-repair patches were made in 2017.

However, significant rehabilitation or replacement projects are contracted. Mainlines and manholes that need structural relining and pipes or manholes that have deteriorated beyond a point of feasible repair are bid out.

"We are trying to stay in our lane, to be really, really good at what we do," Hall says. "At this point, getting into the relining business or full replacement business just doesn't make sense and would not be cost-effective."

Hall says wastewater employees don't encounter a lot of sewer pipe needing replacement. "We try to get to pipelines before they collapse. We try to stay in front of it. We feel like our system is in really great shape." **I&I**



Florence Public Services Department maintenance worker Mark Teremi takes a depth measurement of a storm sewer.

## SMOKING OUT SUMP PROBLEMS

Not all inflow and infiltration issues stem from condition problems in mainlines. The Public Services Department in Florence, Kentucky, has found an issue with sump pumps in homes and businesses that aren't set up properly. When they're connected to the wastewater system, the extra flow they contribute can cause problems.

The department's annual sump pump amnesty program is not unlike programs in other municipalities. Adam Duncan, operations superintendent, says smoke and dye testing are utilized to identify likely emission points of sump pump water. Once an illicit site is smoked out, contact is made with the resident at the address.

The assumption always is that the errant connection of the sump pump to the sewer was an honest mistake or that it once was in compliance with regulations. Hence, the amnesty approach. Regardless of intent, however, the resident is offered help with correcting the matter.

"Once we have made contact," Duncan says, "we offer to reimburse the resident the first \$1,000 of expense incurred to hook the sump pump to the stormwater system. The city also will match half of the total remaining cost of connection, up to \$2,000. I think this is an especially proactive approach. We essentially are offering to share the cost of what is their violation."

Fewer than 10 residents are cited each year for illicit sump pump connections.



# STOP WASTING TIME

Monitoring system can determine how frequently you need to clean specific sections of your collections system

By Jay Boyd and Paul Forshtoeffel

**T**he city of La Mesa is located in San Diego County, California, 12 miles east of downtown San Diego. The “Jewel of the Hills” boasts being one of the earliest pioneer locations of the American movie industry. Its rolling hills and relatively arid landscape were ideal to make more than 100 Westerns.

Today, La Mesa has a population of more than 57,000. The city is a mix of quaint downtown villages, surrounding businesses and residential areas. To support these areas, the city owns and operates its collections system, employing a small, highly efficient staff of eight. This group keeps a regular, rigorous cleaning process as part of its preventive maintenance program.



Ten sites were selected for the La Mesa study, all of which had been on a monthly cleaning schedule. The sites were first cleaned to establish a clean-pipe baseline, and then the ADS ECHO monitors were installed.

The ADS ECHO is an Internet of Things monitoring system that includes sensing, data capture, communications, analytical and reporting functions. Monitors provide real-time feedback on changing levels in the invert, indicating when cleaning is necessary.



With 153 miles of sanitary sewer pipes and 50-plus miles of storm pipes to maintain, both the storm and the gravity pipe systems are cleaned on an annual basis. Adding to the annual workload, 100 sites are cleaned monthly to prevent potential overflow threats from such sources as roots and FOG.

## MAINTENANCE DEMANDS

The city’s preventive maintenance program has led to their excellent track record of preventing sanitary sewer overflows. However, the city recognized that regular, high-frequency cleaning was more than likely leading to overcleaning. At times, this practice was taxing on the field staff. Additionally, high-frequency cleaning was known to increase pipe wear from high-pressure sprays. In older parts of the city’s collections system, this could threaten damage to already high-risk pipes and lead to premature asset replacement. As a result, the city looked for a new approach to:

- Reduce operational demands
- Alleviate premature pipe wear
- Continue to prevent overflows.

## A NEW VISION

The city partnered with ADS Environmental Services, with whom they had successfully done flowmetering projects previously. Through technical discussions between the city and ADS Environmental Services, they agreed to setting up a pilot study to determine if sites were being overcleaned and whether the city could realize corresponding benefits from cleaning reduction.

The approach was to install a new generation of advanced level monitors, the ADS ECHO. These monitors provide real-time feedback on changing levels in the invert, increasing or decreasing, and therefore indicating when to clean.





Each remote site has an ECHO ultrasonic monitor that is equipped with the new generation LTE-M communication technology and an all-new antenna. The LTE-M and antenna combination enable installation without any drilling as the antenna is secured to the monitor in the manhole.

## Cost-effective technology now exists for utilities to gain savings, keener insights and better management of their collections system.

Ten sites were selected for study, all of which had been on a monthly cleaning schedule. The sites were first cleaned to establish a clean-pipe baseline, and then the ADS ECHO monitors were installed. Data was reviewed regularly and, in addition, automated “triggers” were set up as cleaning indicators.

### MONITORING SYSTEMS

The ECHO is an Internet of Things monitoring system that includes sensing, data capture, communications, analytical and reporting functions. Installed at selected sites, these systems compose a collections system monitoring network.

Each remote site has an ECHO ultrasonic monitor that is equipped with the new generation LTE-M communication technology and an all-new antenna. The LTE-M and antenna combination enable installation without any drilling as the antenna is secured to the monitor in the manhole. This means that installation takes minutes and without any structural disruption to streets, manholes or covers.

Data is collected and transmitted in regular intervals. Software enables users to independently set level measurement and data transmission intervals. Furthermore, to provide assurance that overflows are prevented, ECHO has five level alarms, including four for high-level and one for low-level flow conditions.

Consistent quality data collection is assured with an alarm indicating sensor position change. The software user interface gives continuous visibility to remote sites with maps, hydrographs, dashboards, equipment status and summary reports.

## THE FOUR MAJOR BENEFITS

Whether the Optimized Cleaning Process demonstrates as little as, for example, a 40 percent reduction or as large as a 95 percent reduction, there are four major benefits that can be realized:

- 1 Reduction of time pressure on operations to clean with corresponding monetary savings.
- 2 Reduced pipe wear, lowering mechanical stress on high-risk pipes and reducing wear on all pipes, thus extending the life of the asset.
- 3 Acquire continuous monitoring to prevent SSOs at high-frequency sites where none existed previously.
- 4 Acquisition of data for further analysis of collections system behaviors (e.g., dry vs. wet weather).

Cost-effective technology now exists for utilities to gain savings, keener insights and better management of their collections system. To acquire these benefits, utilities must look forward to solutions rather than rely on conventional practices of the past.

### RESULTS VERIFY SAVINGS

Using these new monitoring tools, data was continuously collected and cleaning was initiated based on the feedback from monitoring rather than a predetermined schedule known as an Optimized Cleaning Process, or OCP.

### CLEANING REDUCTION

A review of the pilot study took place upon the completion of the first four months. Under the previous, schedule-driven process, cleaning would have taken place 40 times: Each of the 10 sites would have been cleaned four times. During the pilot study OCP where cleaning took place based on remote monitoring feedback, only two sites were cleaned.

This was a 95 percent overall reduction in cleaning, and the city determined that the schedule-driven process promoted overcleaning.

### COST SAVINGS

Forty segments would have been cleaned under the previous, schedule-driven process. Using an average cost of \$400 per segment cleaned, the total cost for 40 segments would be \$16,000. The city cleaned two times over the course of four months and therefore incurred a cost of \$800. The savings for the four-month period amounted to \$15,200.

### CONCLUSIONS

It can be safely assumed that over the course of a year, a 95 percent reduction in cleaning would not be sustained. The city has 100 sites being cleaned monthly. Some, based on conditions, will still need to be cleaned monthly.

This OCP helps utilities calibrate and determine the correct cleaning schedule for each site. There will be variability from site to site. This study demonstrated that two of the 10 sites required cleaning in the first two months. Yet, when monitors were deployed across a network of high-frequency sites, a significant reduction (95 percent) in cleaning occurred. **I&I**



By Craig Mandli



## SEWER MANHOLE LEAK FIXED BY GROUT INJECTION

### PROBLEM:

Colchester, Vermont's wastewater system processes more than 100 million gallons of wastewater per year. When a significant groundwater leak was discovered at the joint between manhole pipe sections, IP&C Industrial Services was invited to evaluate the situation.

### SOLUTION:

IP&C Industrial Services determined that the most cost-effective solution would be to apply a **chemical grout injection system** from **AmTech Tank Lining & Repair**. The crew drilled an injection path into the center of the crack. Flexible packing was wedged into the joint to slow the inflow. Fast-setting grout was pressure injected throughout the crack and voids created by groundwater outside the manhole pipe.

**Result:** Once the grout set, the leak and outside voids were completely sealed off. The Town of Colchester realized significant savings compared with curtain grouting or replacement of the manhole pipes. **888-839-0373; www.amtechtanklining.com**

## CITY CHOOSES CENTRIFUGALLY CAST OPTION TO REHAB MANHOLES

### PROBLEM:

The City of Hampton, Virginia, has a collections system that dates back to the early 1940s, and nearly 75 percent of the system is below the groundwater table. During a rain event of 1 inch or more, groundwater and rain-derived I&I greatly overtaxes the system's capacity. In addition, inflow and infiltration contributes to the wear and erosion of pipes and manholes and increases pumping and treatment costs.

### SOLUTION:

After careful consideration, Hampton selected the **Permacast** self-install solution from **AP/M Permaform**. The system centrifugally compacts high-strength fine-aggregate concrete on the prepared interior of a deteriorated manhole. The crew also re-establishes the bench and inverts and installs a plastic manhole insert to stop the inflow. The bidirectional spincaster is raised and lowered with a winch to achieve thorough coverage and complete compaction without having to trowel.

**Result:** Using the flow data and similar rain events to analyze the results, the efforts reduced inflow by 18 percent in their initial pilot program. The city subsequently implemented a full I&I reduction program, with a goal to rehabilitate 100 percent of the city's 11,000 manholes. A three-person crew structurally now lines about 400 manholes each season between April and October. The crew averages between three and four manhole rehabs each day, depending on depth, condition, and access.

**800-662-6465; www.permaform.net**





# STOP<sup>The</sup> LEAKS



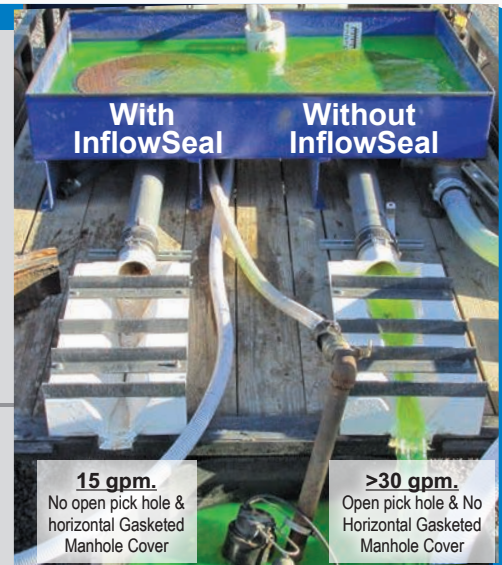
## Net Sewer I/I Removal — “Start at the top and work your way down”



Typical manhole cover seals are dependent upon a flat clean horizontal seat to seal. This is not the real world. The InflowSeal rubber gasket seals the vertical side of the casting. Our patent pending vertical rubber seal can handle debris in the casting seat and keep inflow out of your sanitary sewer system

Call **1-800-490-5325** to schedule a onsite demonstration with our mobile test tank **Seeing is Believing.**

[www.InflowSeal.com](http://www.InflowSeal.com)



## ACCESS ASSEMBLIES HELP A TOWN PREVENT I&I ISSUES AND IMPROVE SAFETY

### PROBLEM:

The Town of Cary, North Carolina, has dozens of streams and lakes located in its boundaries, and it is prone to occasional flooding. During major rain events, stormwater occasionally gets into the sanitary system, causing sewage backups that can overflow from manholes into nearby lakes. When sewage infiltrates creeks and lakes, fish and wildlife are endangered, and the town must deal with the resulting cleanup and potential fines. They needed to find a better solution. After trying elevated manhole covers, they discovered that the covers would pop off when stressed. A standard manhole cover weighs about 130 pounds and removing them while on a ladder 6 feet above ground was dangerous.

### SOLUTION:

EJ provided the **REVOLUTION Access Assembly**, an elevated manhole cover that required no lifting. Once the bolts are removed, workers can easily rotate the lightweight cover away from the opening to access

the manhole. It stays attached to the frame via a cast-in stainless steel rod. One worker can easily access the elevated manholes. It also seals tightly when closed, preventing I&I.



**Result:** “When the lid is seated correctly, the REVOLUTION works great for preventing any type of inflow, pretty much across the board, everywhere we’ve installed it,” says Robert Hirt, P.E., utility engineering supervisor for the Town of Cary. A backup along the Walnut Creek sewer outfall, following Hurricane Matthew in 2016, proved that point without a doubt.

**800-626-4653; [www.ejco.com](http://www.ejco.com)**

(continued)





## GROUT REDUCES I&I IN COLLECTIONS MANHOLE

### PROBLEM:

A municipality in Ocean County, New Jersey, had severe infiltration within its 8-foot-diameter manholes located close to a large streambed in an area with a high water table. The deteriorating manholes had reached a point of active and constant leaking through joints in the precast sections. A material was needed that would flow into the voids and cure rapidly, before the inflow could wash away the material.

### SOLUTION:

**Sauereisen F-370 Hydroactive Polyurethane Grout** 22-ounce dual cartridge was the chosen solution. Hydrophobic chemical grouts are ideal for stopping water infiltration in concrete structures and the convenient cartridge package allows for repairs in confined spaces where pump injection is not practical. The grout can be injected directly into the wall of the structure, where it will expand nearly 20 times its original volume to fill the void.

**Result:** Both the contractor and the municipality were very pleased with the ease of application and the results.  
412-963-0303; [www.sauereisen.com](http://www.sauereisen.com)

## LINER SYSTEM HELPS FLORIDA COASTAL CITY WITH I&I ISSUES

### PROBLEM:

Fernandina Beach, Florida, is situated on the shores of the Atlantic Ocean to the east and the Intracoastal Waterway to the west and receives an average annual rainfall of 51 inches. Consequently, the groundwater table is extremely high. Its principal sewer treatment plant is permitted for 2.5 mgd. The sanitary sewer system is older, with approximately 95 miles of gravity sewer, force mains and 1,461 manholes. The infiltration problem became so acute that plans were being evaluated for a treatment plant expansion expected to cost in excess of \$20 million.

### SOLUTION:

Beginning in 2005, John Mandrick, Fernandina Beach utilities director, began a phased I&I reduction program using the **SpectraShield Liner Systems** for manhole rehabilitation and cured-in-place pipe. It is a multilayered lining system designed to stop infiltration and prevent corrosion.

**Result:** By 2014, flows had been reduced by 800,000 to 1 mgd. A major plant expansion was avoided, operating costs were reduced, energy savings were realized and groundwater was conserved. The Environmental Protection Agency estimated the reduction in flow reduced operating costs by more than \$450,000 per year. The energy savings from the reduced flow volume is in excess of 200,000 kWh per year. Groundwater is now percolating into the local groundwater table and not the treatment plant.

800-284-2030; [www.spectrashield.com](http://www.spectrashield.com)



## INSIDE MANHOLE DROPS REPLACE FAILED OUTSIDE DROPS

### PROBLEM:

Many of the manholes in Saugus, Massachusetts, were originally installed with outside drops, which are difficult to access for inspection, cleaning and maintenance. As a result, the condition of most of these outside drops was unknown, and they could have been contributing to the city's I&I issues.

### SOLUTION:

National Water Main Cleaning, using design documents developed by CDM Smith, was contracted to fill in the outside drops and install **new inside drops** from **RELINER/Duran**. National Water Main Cleaning has established a procedure whereby the base of the outside drop is plugged with concrete prior to the drop being filled with pea stone or sand. A hydraulic cement cap is placed on top and worked to be smooth with the mainline pipe invert. The mainline pipe is then CIPP lined, followed by rehabilitation of the manhole.

After the installation of a cementitious liner in the manhole, the inside drop system is installed. The system consists of a fiberglass drop bowl that is bolted to the manhole wall just beneath the high-level inflow pipe, and stainless steel pipe support brackets are used to attach the drop pipe to the wall. A flexible coupler is used to connect the drop pipe to the drop bowl, and a bend is installed at the pipe base in the manhole invert.

**Result:** The system was easy to install and allows the drop to be cleaned and inspected from above.

800-508-6001; [www.reliner.com](http://www.reliner.com)





# Learn the Latest

Find out about I&I solutions involving wastewater collection systems — and drinking water distribution systems — from the best operators in the industry.

Check out



Subscribe **FREE** at [mswmag.com](http://mswmag.com)  
or call 800-257-7222



INTRODUCING THE NEW

## Platinum Series Six-Shooter

**Designed for high-volume manhole frame repair**

The Platinum cutter is a safe solution to your road repair needs. If you repair manholes, water valves, or do road penetrations to repair utilities, this cutter is for you. No one else offers a tool that can perform all these functions.

- ✓ The Easy-Drive System minimizes shock on the drive motor
- ✓ A larger main frame for added durability in heavy use environments
- ✓ Largest cutting diameter of any available cutter, up to 72"

PROUDLY MANUFACTURED IN THE U.S.A.

[www.MrManhole.com](http://www.MrManhole.com)

PH: 833-242-2221



## REHABILITATION OF DIGESTER INCLUDES CRACK REPAIRS

### PROBLEM:

A digester located in Texas was showing severe deterioration, including deep cracks along the floor that were leaking water in areas throughout the unit. The number of cracks and leaks suggested that the water membrane underneath the slab may have aged and fatigued.

### SOLUTION:

**Epoxytec** recommended a combination of **CPP Sprayliner** and **CPP Trowelable**. Blended with reinforcing agents and various fibers, CPP Sprayliner creates a fiber-reinforced polymer lining when cured, offering high strength and flexural properties for partially or fully deteriorated structures. Surface preparation included abrasive blasting to achieve clean, sound, profiled concrete. The concrete was then sprayed with an initial coat of CPP Sprayliner to achieve an even finish throughout the substrate and to attempt to seal any hairline cracks and low-pressure leaks. Cracks were drilled to relieve water pressure. After allowing the initial coat to cure, drilling on some major leaking areas was conducted to alleviate pressure away from the cracks. Next, standard CPP was applied to these open cracks to finalize the repairs (now with no pressure). Once the majority of the cracks were sealed and repaired and the material was



cured, the contractor grouted the relief drill holes and patched them with CPP Trowelable. The final step included spraying a coat of CPP Sprayliner to make all the surfaces uniform.

**Result:** All cracks were addressed, and CPP Sprayliner provided sealed protection that will prevent corrosion and future deterioration. This solution resulted in cost-savings and allowed a quick return to service without replacement or major reconstruction.

877-463-7699; [www.epoxytec.com](http://www.epoxytec.com)

(continued)



## MANHOLE INSPECTION TECHNOLOGY HELPS CONTRACTOR PINPOINT I&I ISSUES

### PROBLEM:

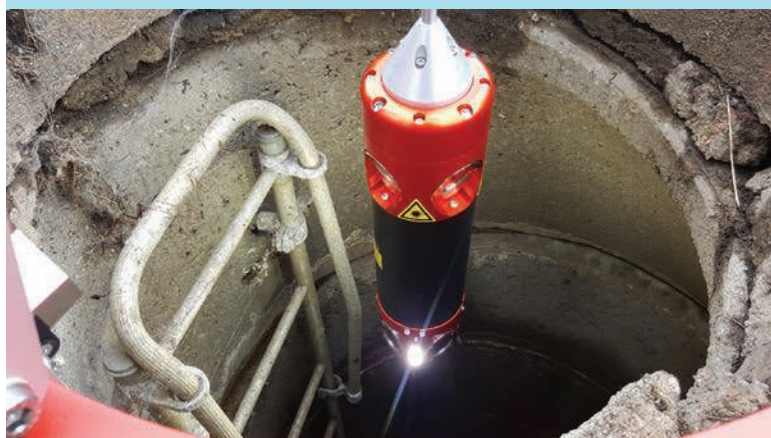
Utica, NY-based Subsurface Utility Imaging was contracted to inspect the pipelines and 300 manholes of a municipal sewer system. CCTV and smoke testing were used for the pipelines, but cofounder Robert Korosec, PLS, needed a better option for the manholes.

### SOLUTION:

Korosec and his crew used the **Envirosight's CleverScan**, a system that uses automation and photo capture technology to gather high-resolution images and 3D point clouds of manholes. "Given the large amount of manholes on this project," says Korosec, "and their poor condition, I felt we had to give it a try."

**Result:** With minimal training, SUI crews were able to put the system to work immediately, inspecting an average of 50 manholes a day and completing the manhole inspection portion of the contract in less than a week. Of the \$43,000 total project cost, just \$17,000 (40 percent of the contract) was spent on manhole inspection. Moreover, the inspection found far more sources of I&I. "The pipelines here were in pretty good shape, and we estimate were only contributing 5 to 10 percent of total I&I," says Korosec. This means that just \$17,000 was spent to identify up to 90 percent of the I&I sources in this municipal network, allowing the city to prioritize easier manhole repairs and eliminate major sources of I&I.

866-936-8476; [www.envirosight.com](http://www.envirosight.com)



## REPAIRING A SEWER WHILE SAVING THE TREES

### PROBLEM:

B. Braun, a large producer of medical products, operates a facility and wastewater treatment plant in a woodland park that is part of a delicate regional ecosystem with a dense forest with steep inclines. When a CCTV inspection showed that 1,000 feet of pipeline had been damaged by encroaching tree roots, they sought to rehabilitate the badly damaged wastewater system while preserving natural resources.

### SOLUTION:

Tkm-Service GmbH oversaw the project and met with an expert from **Trelleborg Pipe Seals** to find the best solution to deal with the forest's limited access and steep inclines. Trelleborg suggested the use of its **DrainFlexLiner** and **POX HC120+ resin** for hot water curing. The resin's generous pot life allowed the crew over three hours to prepare the liner, carry it down the hill using large wheelbarrows and invert the liner into the manholes. Purpose-built water towers let the steep hill and gravity work to their advantage. The resin's pot life helped maintain efficient workflow.

**Result:** After the liner cured, a leak test and CCTV inspection was performed. A liner sample was sent to a laboratory for further testing and the findings were positive: The cured liner was 100 percent watertight and the mechanical values exceeded normal requirements. The resin contains no VOCs or styrene, and not a single tree was felled.

800-626-2180; [www.trelleborg.com/pipe-seals](http://www.trelleborg.com/pipe-seals)



## CITY GETS PROACTIVE ON MANHOLE PROTECTION

### PROBLEM:

The city of Fairmont, Minnesota's wastewater collections system utilizes 75 miles of sewer lines with 30 lift stations. During routine inspection, one of the sanitary sewer force main manholes was identified as turbulent. The city decided to take the proactive measure of lining this 2-year-old precast manhole — which has a 6-foot diameter at the base and tapers to 4 feet by 13 feet deep — to protect the asset from any future corrosion and deterioration that would require costly measures to correct.

### SOLUTION:

"We want to protect our assets. We have seen similar structures deteriorated. This force main sanitary sewer is only 2 years old, but we decided to be proactive and selected **CLADLINER** to seal and protect," says Doug Rainforth, the city's water and wastewater superintendent. The rehabilitation of this manhole was completed from start to finish in several hours. After the surface preparation, involving high-pressure waterblasting, a mortar pump was used to spray on CLADLINER. Once the product was firmly set, it was smoothed over with a chip brush, hand trowel and damp sponge.

**Result:** Rainforth says the decision to take a proactive approach to addressing the city's sanitary sewer collections system will pay off for years to come.

877-708-2523; [www.cladliner.com](http://www.cladliner.com)



# I&I

It's your magazine.  
**TELL  
YOUR STORY.**

At I&I, we're looking for sewer and water departments with an interesting story to tell. If you'd like to share your story, send us a note at [editor@iandimag.com](mailto:editor@iandimag.com).



## = Thank You!

Hand-selected Wisconsin sausage and jerky delivered in a 20-qt. **RUGID** cooler.

**\$199.99** Delivered

*Meaty-Delivery™*

[meaty-delivery.com](http://meaty-delivery.com)  
833-777-8443

## LINER SYSTEM USED TO COMBAT HYDROGEN SULFIDE DAMAGE

### PROBLEM:

Albuquerque, New Mexico, has aging sewer infrastructure, a high percentage of which consists of concrete pipe that is more than 50 years old. Over the years, these pipes have suffered the effects of hydrogen sulfide, resulting in severe erosion causing sections of pipe to deteriorate completely.

### SOLUTION:

TLC Plumbing explored a number of options and, in consultation with city engineers, decided that the best solution was to use **Thermoform** from **Warrior Trenchless Solutions**. The PVC-A fold-and-form pipe liner would allow them to get through areas where other materials would be too risky. Also, it is a seamless liner that provides a tight fit to the existing host pipe and would prevent any I&I. The material is highly chemical-resistant and is not affected by the presence of hydrogen sulfide. It is environmentally friendly and

doesn't contain any water-soluble chemicals that can leach into the surrounding ground. The installation process doesn't rely on a chemical reaction. This meant the workforce and general public had no exposure to harmful vapors at any stage of the pipe rehabilitation process. The footprint required for the installation was minimal, and therefore disruption was minimized.

**Result:** TLC Plumbing initially evaluated Warrior Trenchless Solutions Thermoform with the city engineers and received their approval. TLC Plumbing has continued to install miles of this product for pipeline rehabilitation in Albuquerque and other surrounding municipalities without disruption to the existing asphalt, landscape, or environment. Pipeline integrity is being restored with a solution that will stand up to future assaults from hydrogen sulfide exposure.

[www.thermoformliner.com](http://www.thermoformliner.com) **I&I**





# THE ADS<sup>®</sup> ECHO<sup>®</sup> ADVANTAGE

Affordable and Reliable Collection  
System Monitoring Enabling You to...

- Scout Inflow & Infiltration
- Calibrate Hydraulic Models
- Optimize Cleaning Processes
- Monitor Pump Stations as a Back-Up
- Monitor By-Passes
- Mitigate SSOs

**New generation monitoring that makes the difference.** With its 28' measurement range and fixed-position sensor, you get accurate, quality readings, consistently.

Via the new LTE-M communications network, data is reliably delivered to cloud-based software. With graphs, reports, dashboards, and alarms, you'll always be ahead of your system.

ECHO is comfortably priced including our low-cost, comprehensive service option. We'll take care of the monitoring network while you enjoy your new insights.

Let our expertise work for you.  
Contact us today.

**C:** 800.633.7246

**E:** [echoadvantage@idexcorp.com](mailto:echoadvantage@idexcorp.com)

[www.adsenv.com/echo](http://www.adsenv.com/echo)



**Solutions You Can Trust**