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November 2010

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WATER CONSERVATION AND MAINTENANCE IN KILLEEN, TEXAS

PAGE 30

TECHNOLOGY TEST DRIVE: FLYEYE INSPECTION FROM CUES

PAGE 40

BETTER MOUSETRAPS: ROBOTIC PIPE INSPECTION

PAGE 36

DOUBLING UP

The City of Billings uses in-house pipe bursting to repair water leaks and upsize lines

PAGE 14



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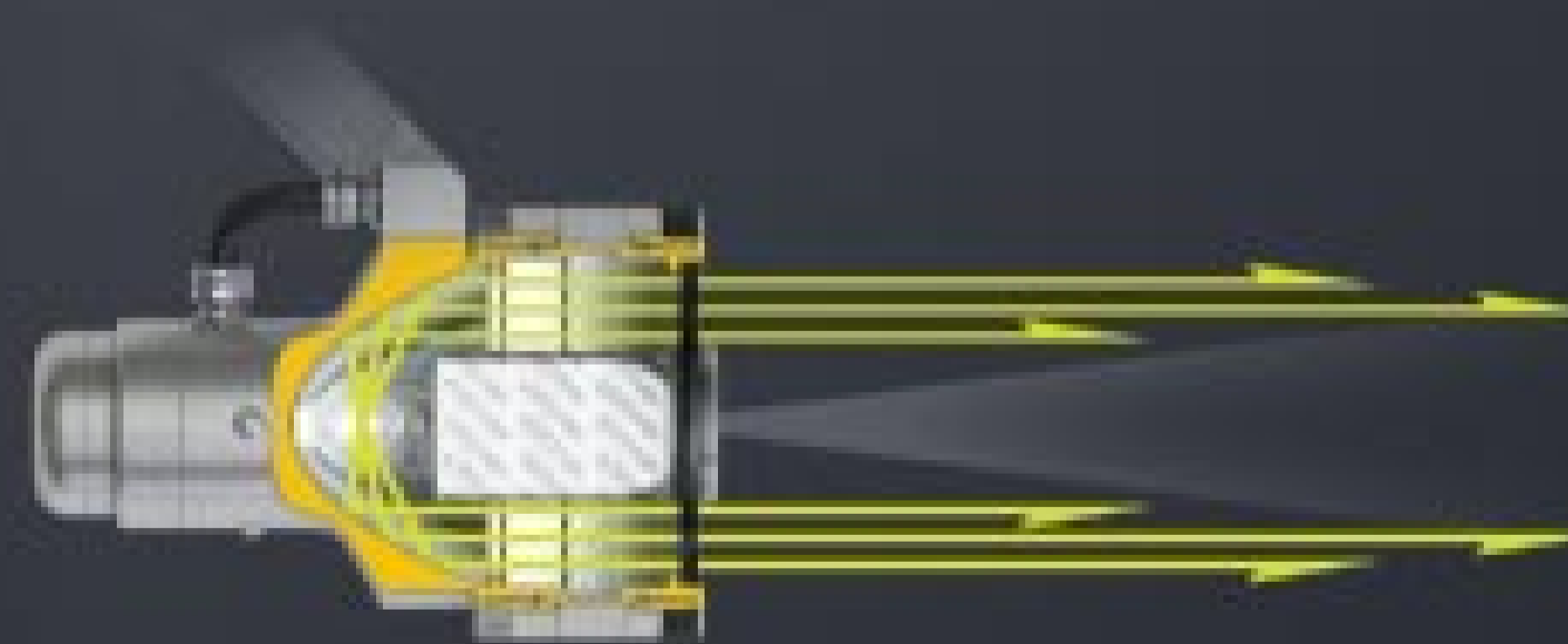
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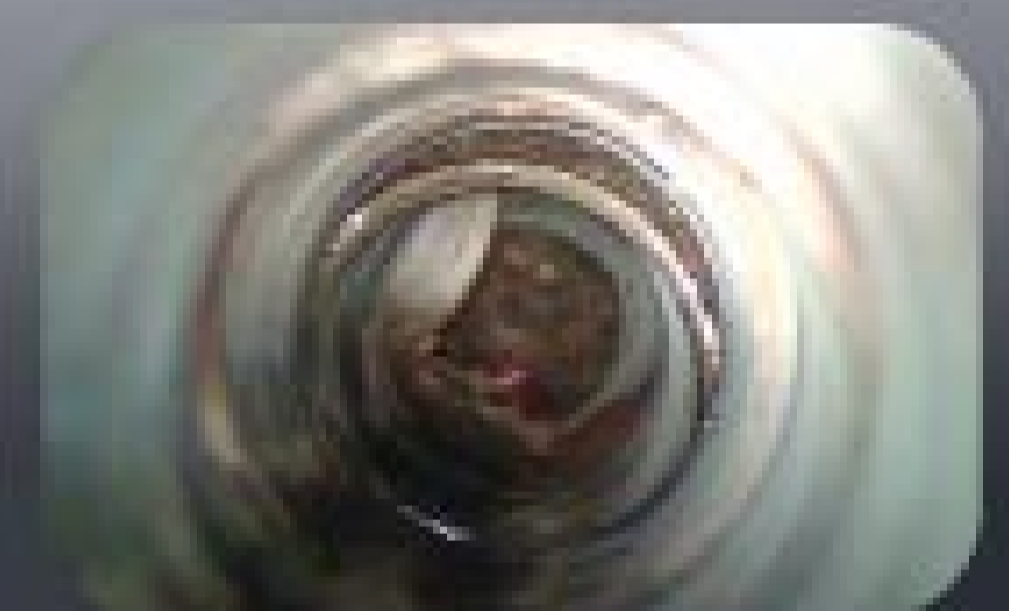
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INSIDE:

LOCATION AND LEAK DETECTION



COVER:

The City of Billings, Mont., is a pioneer in double-upsizing its water distribution system and doing most of the work itself, using pipe bursting with fusible PVC pipe to replace old cast iron mains. Doing it in-house cuts costs by nearly 50 percent. Here, senior equipment operator J.R. Fox (left) and maintenance worker/equipment operator Jim Burchell remove the pilot expander for a HammerHead 100-ton hydraulic pulling unit. (Photography by Kelvin Pinney)



COMING IN DECEMBER 2010

Special Issue: Field and Office Technology

- ◆ Special 2011 wall calendar
- ◆ Sewer: Sidescanning software and GIS in Daly City, Calif.
- ◆ Sewer: Pipe bursting of sewer mains in Ross Valley (Calif.) Sanitary District
- ◆ Sewer: Data-driven system rehabilitation in Detroit, Mich.
- ◆ The Human Side: Getting team members engaged in your mission

FEATURES

14 WATER: Doubling Up

The City of Billings uses pipe bursting with in-house crews to repair water distribution leaks and enlarge mains to ensure adequate flow for fire protection.

By Jim Force

20 STORM: Winning With Allies

The City and County of Honolulu rely on educated volunteers to help control stormwater pollution and improve stream water quality.

By Scottie Dayton

30 WATER: Planning to Grow

Water conservation and a regularly updated master plan help a Texas military town keep up with growth and deliver efficient, high-quality service.

By Suzan Marie Chin

36 BETTER MOUSETRAPS: On Their Own

A robotic pipe inspection system enables a western Pennsylvania municipal authority to complete an assessment and avoid a consent order and fine.

By Scottie Dayton

40 TECHNOLOGY TEST DRIVE: The Whole Big Picture

A combined laser, sonar and video inspection technology from CUES helps users cost-effectively assess conditions in large sewer pipes without interrupting service.

By Ted J. Rulseh

COLUMNS

8 FROM THE EDITOR: It's Just Not Right

The economy may be struggling, government budgets may be tight, but large layoffs of public-sector workers are not by definition something to celebrate.

By Ted J. Rulseh

34 Worth Noting

People/Awards, Learning Opportunities, Calendar

38 NASSCO CORNER: Safe and Effective Pipe Cleaning

NASSCO aims to supplement its *Jetter Code of Practice Manual* with a video that explains and demonstrates proper cleaning methods.

By Ted DeBoda, P.E.

44 THE HUMAN SIDE: Avoiding the Power Trip

Power is valuable, but it can do damage if abused. Here are seven principles you can apply to keep your power as a leader in perspective.

By Danita Johnson Hughes, Ph.D.

46 Product News

Product Spotlight: Netting System Captures Debris from Stormwater Runoff

By Ed Wodalski

48 Industry News

NOVEMBER 2010

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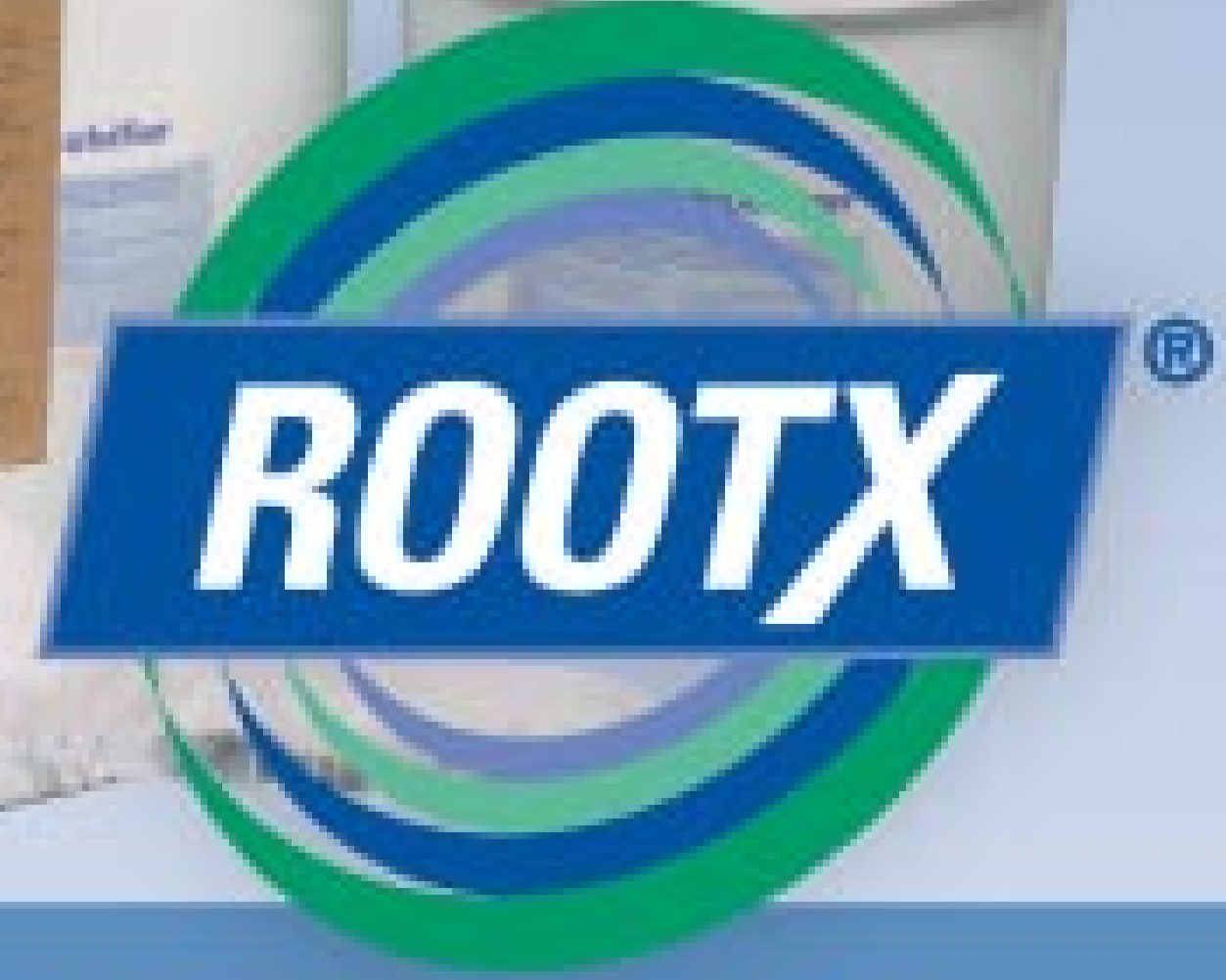
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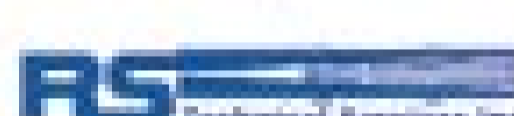



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COMPANY	PAGE
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 American Highway Products, Ltd.	12
 Aries Industries, Inc.	19
AT&T	17
B	
B2 Business Brokers	43
C	
 Cam Spray	28
 Central Oklahoma Winnelson	47
 Chempace Corporation	18
 Cloverleaf Tool Co.	10
 CUES, Inc.	27
E	
 Environmental Products & Accessories, LLC	26
 Envirosight, LLC	2
Epoxytec	26
F	
Formadrain, Inc.	18
G	
GapVax, Inc.	11
H	
 Hi-Vac Corporation/Aquatech	58
Hurco Technologies, Inc.	23
L	
 LMK Technologies	59
M	
 Magna-Flow Environmental, Inc.	7
Mr. Manhole Systems	34
 Municipal Sales, Inc.	47

COMPANY	PAGE
MyTana Mfg. Company, Inc.	10
N	
 NozzTeq, Inc.	13
P	
Pearpoint, Inc.	39
 Perma-Liner Industries, Inc.	9
Petersen Products Co.	13
Pipeline Analytics	13
 Prototek Corporation	37
R	
Rausch Electronics USA, LLC	45
RELINER/Duran, Inc.	24
RIDGID	
RIDGID	25
 RootX, Inc.	5
 RS Technical Services, Inc.	28
RS Technik	33
S	
Savatech Corp.	35
Sewer Equipment Co. of America	12
Shamrock Pipe Tools, Inc.	33
 Street and Sewer Parts Superstore	42
 Superior Signal Company, LLC	48
T	
 T&T Tools, Inc.	24
U	
USABlueBook	29
USB-Sewer Equipment Corporation	24
V	
Vac-Con, Inc.	60
VACTOR	
Vactor Manufacturing	3, 18
Classifieds	56
Marketplace	54
Truck Stop	57

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IT'S JUST NOT RIGHT

The economy may be struggling, government budgets may be tight, but large layoffs of public-sector workers are not by definition something to celebrate

One sad consequence of the collapse in the economy is the way certain groups of people have been denigrated.

The unemployed, for example. Argue all day if you want about the wisdom of extending unemployment benefits for people out of work for long spells. But don't imply that those people — who include a brother, a nephew, and a close friend of mine — are for the most part loafers who will coast along doing nothing for as long as they can get regular checks from the government.

And preach to your heart's content about "limited government," but don't imply that government workers as a class are expendable and unproductive, and that it's inherently good to cut staffs and put state and local employees — like a sister, a brother-in-law, and a son-in-law of mine — on the street.

Nothing to celebrate

The inescapable fact is that shortfalls in state and local budgets are leading to layoffs of government workers, perhaps especially teachers. It would be nice if as a society we felt at least a little bit bad about that.

After all, we built things like streets, police and fire departments, park systems, water and wastewater systems, and schools for good reason, supporting them through taxes and fees approved by elected representatives (you know, that stuff about "consent of the governed").

Now we're chipping away at what we built, and the mere fact of "putting government on a diet" is not something to celebrate. Efficiency is great, and without a doubt, governments, like any kind of organization, could be more efficient. But when we start slashing staffs and railing against excessive pay and benefits for government workers, what are the long-term consequences?

Is there a point at which government jobs become so unstable and so financially unattractive that the most able people look elsewhere,

and before we know it our public agencies are staffed almost solely by the mediocre and incompetent?

Seeing the positives

Cynics might say, "That's what we have already." And of course, we all know the stories about the public works employees leaning on their shovels, the surly clerks at the Department of Motor Vehicles, and the overly picky inspector in the county building department. Of course, those are stereotypes, not unlike the private sector's featherbedding auto worker,

A big part of this magazine's charter is to celebrate part of the majority — public infrastructure professionals who do capable and exemplary work. Needless to say, in my role as editor, I encounter such people all the time.

rude customer service representative, and Peter Principle middle manager (promoted to his or her level of incompetence).

But if one takes a generally positive view of people, as I do, then one assumes that most people in the world of work, private or public sector, care about what they do and perform the best they can with the talent they have and the resources they're given. Which means the lazy, negligent, uncaring and inept are the minority.

A big part of this magazine's charter is to celebrate part of the majority — public infrastructure professionals who do capable and exemplary work. Needless to say, in my role as editor, I encounter such people all the time.

Shining examples

Who do we have in this issue alone? Well, there's Scott Emerick, Public Works Department Distribution and Collection Division superintendent in Billings, Mont. He and his team have deployed pipe bursting with fusible PVC pipe to replace old cast-iron water mains and upsize the line diameters from four to eight inches to



FROM THE EDITOR

Ted J. Rulseh

improve flows for fire protection.

By using that technology, and by letting city crews do the work instead of hiring consultants and contractors as many cities do, his division is completing the upgrades at nearly 50 percent less cost than for conventional methods. In other words, city residents can thank Emerick and staff for helping to hold their water rates down while adding a measure of protection for their homes and possessions.

In Hawaii, there's Iwalani Sato, community relations specialist in stormwater management for the City and County of Honolulu. She's working diligently, one person or neighborhood at a time, to educate and enlist residents in the importance of good practices that help prevent runoff pollution. Because of Sato and her staff, the aquifers and the ocean are cleaner.

And then there's Jim Butler and his team in the Public Works Department in Killeen, Texas. Guided by a Water Conservation Plan and a Water and Wastewater Master Plan, they're upgrading metering technology, deploying new flushing devices, adding storage facilities and upsizing waterlines to help the city keep supplying high-quality, cost-effective water service in the face of rapid growth.

It takes resources

You can read their stories on these pages. They are just three of the outstanding people we have profiled in *MSW* magazine over the years, and all of those we've profiled add up to only a tiny fraction of the excellent people at work in infrastructure jobs all over the country.

When we start to chop away budgets for public services, pretty soon we start hindering the ability of people like these to be as effective as possible. Good work, after all, takes resources, and those include quality people. So let's remember that amid all the talk about fiscal austerity in government, sometimes cutting budgets for short-term conditions can be a classic case of penny wise and pound foolish. ♦



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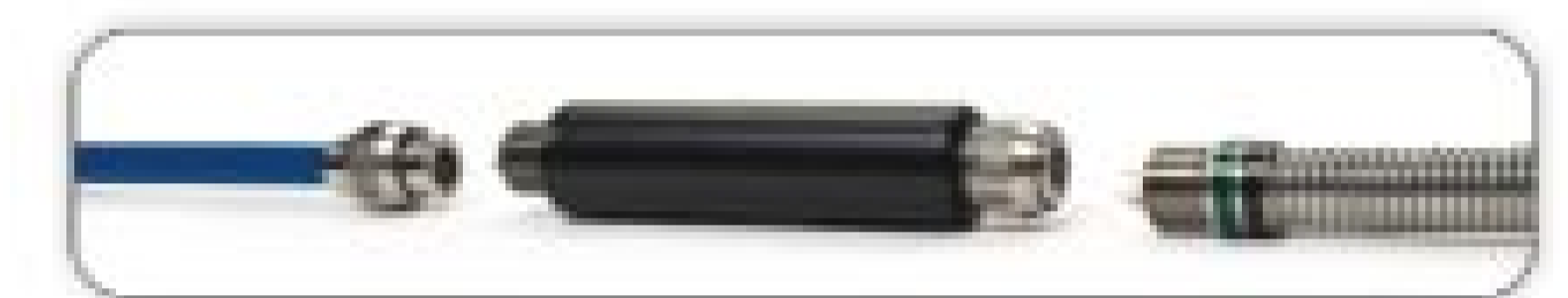
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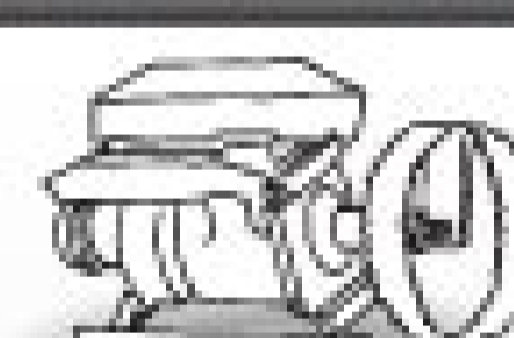
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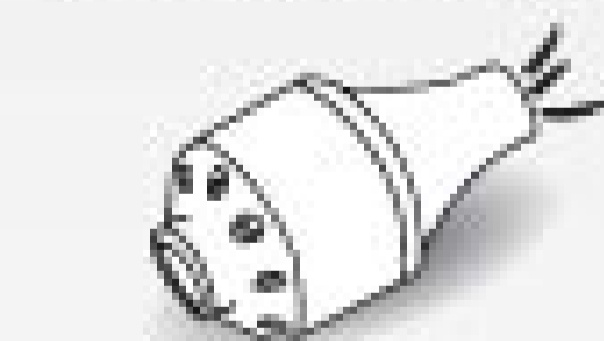
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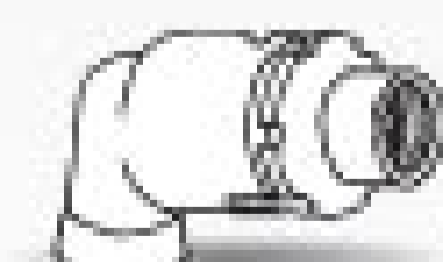
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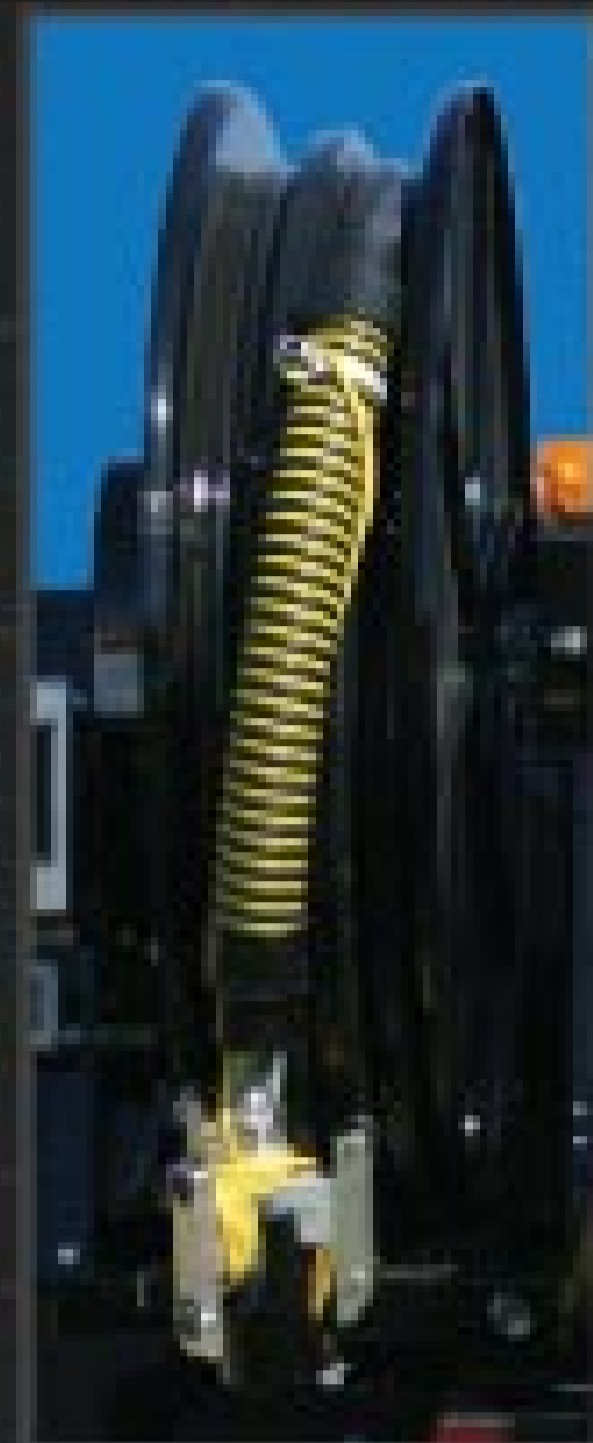
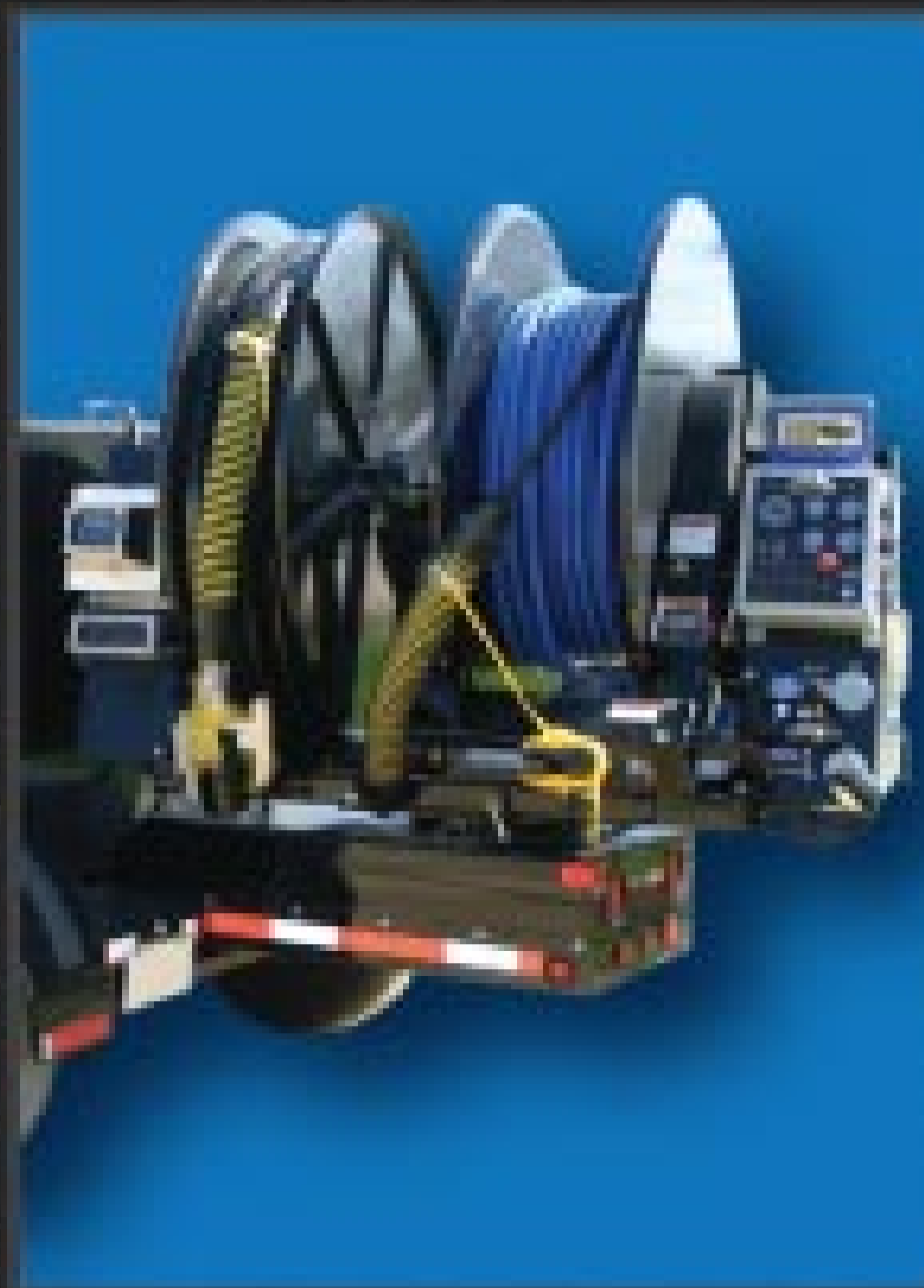


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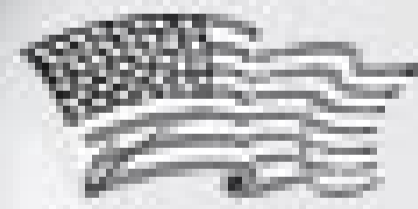
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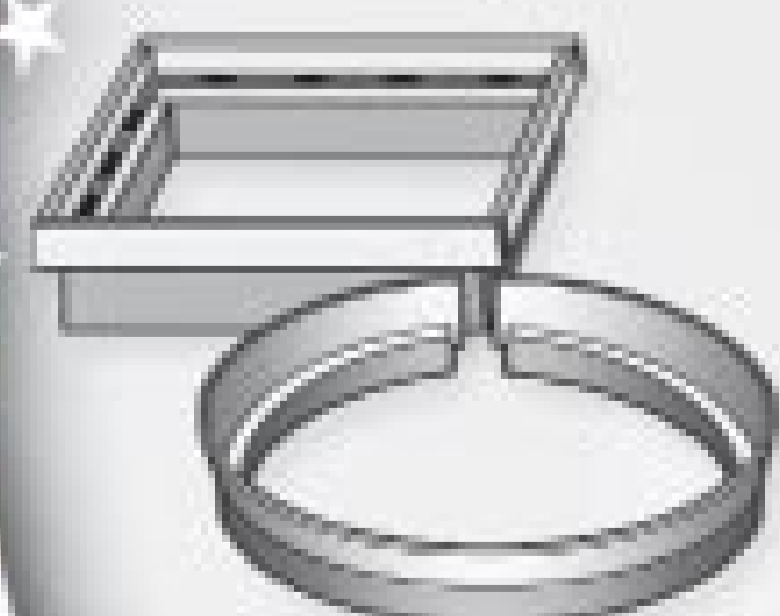
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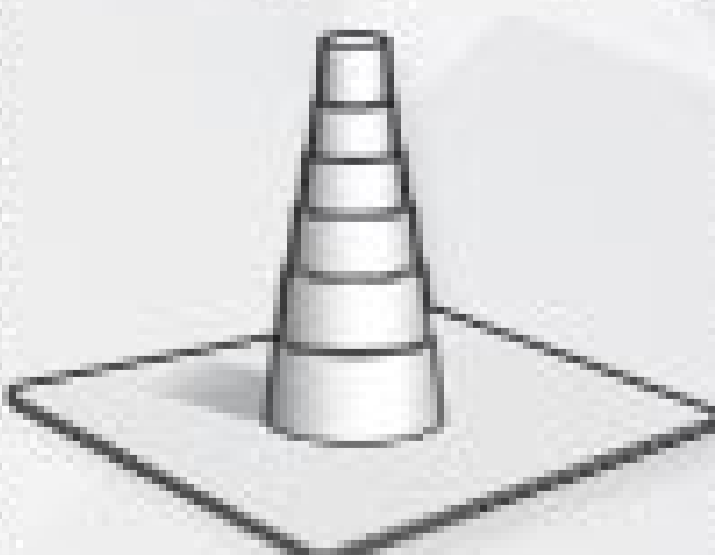
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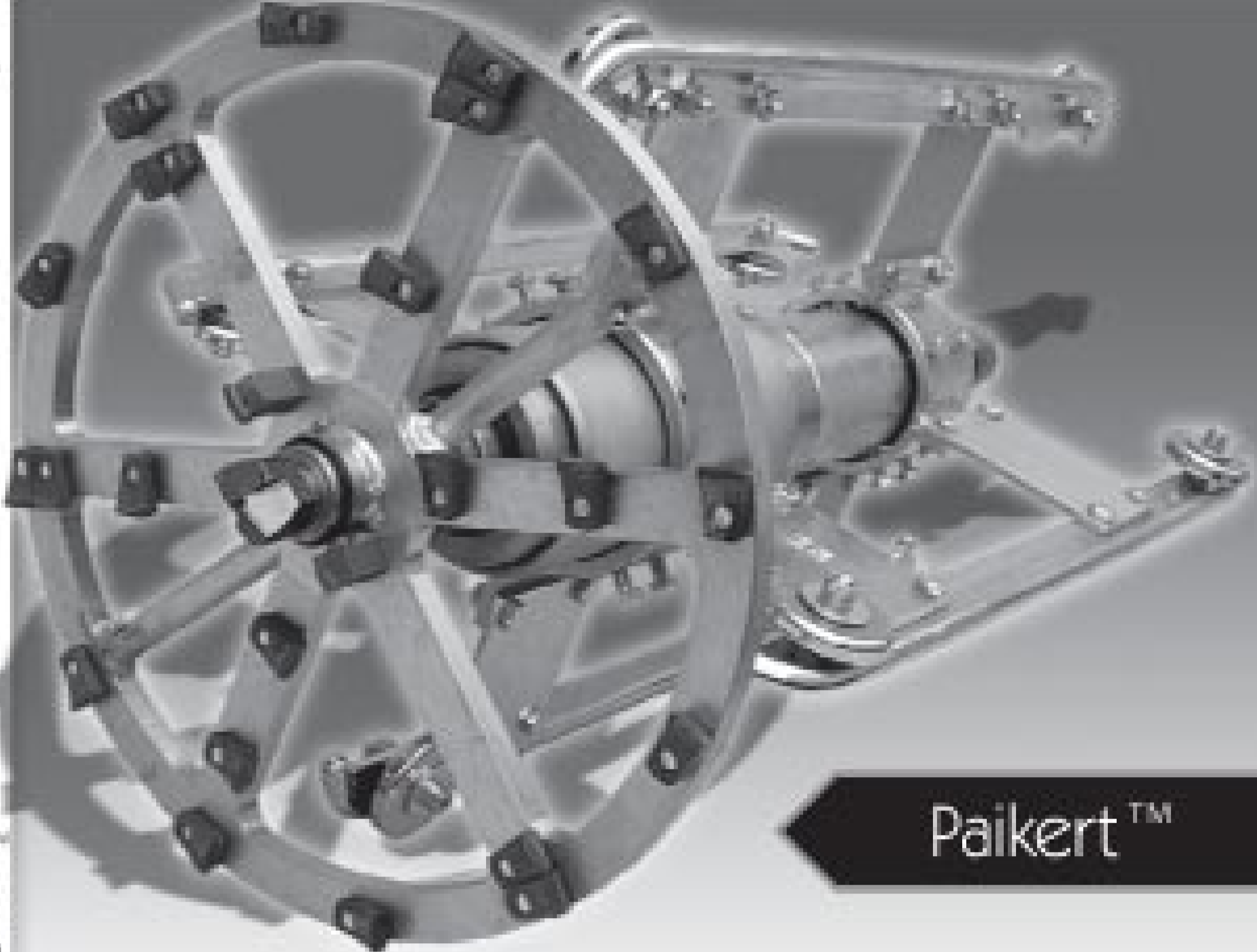


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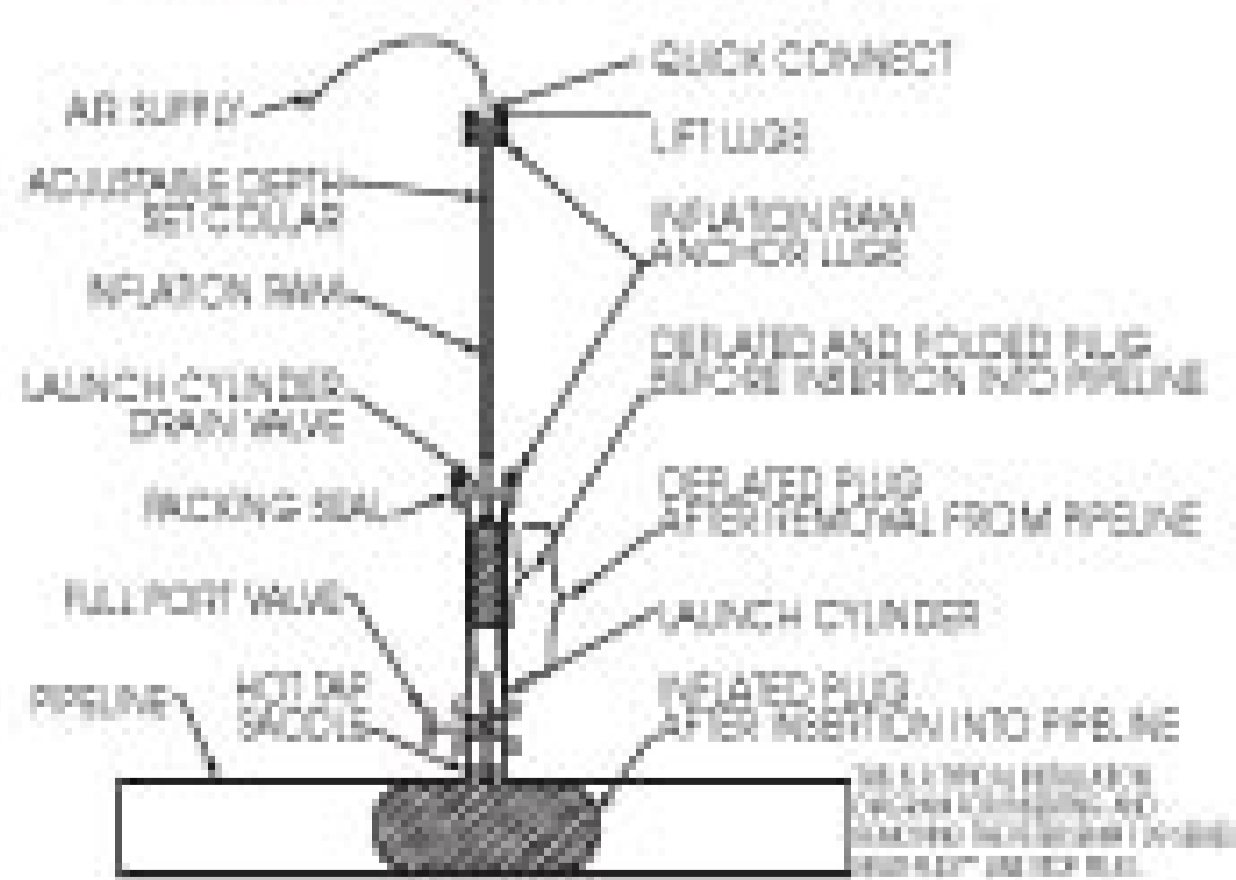
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DOUBLING UP

The City of Billings uses pipe bursting with in-house crews to repair water distribution leaks and enlarge mains to ensure adequate flow for fire protection

By Jim Force

Located on the slopes of Montana's Beartooth Mountains, Billings is a pioneer city in more ways than one. It is the only municipality in the country double-up-sizing its water distribution system, and doing most of the work itself.

Public Works Department Distribution and Collection Division superintendent Scott Emerick reports that his team is using pipe bursting and fusible PVC pipe to replace old cast-iron mains and upsize the line diameter from four to eight inches. By using city crews instead of consultants and contractors, his division is doing it at nearly 50 percent less cost than for conventional methods.

"If we were using open trenching, hiring a consultant and bidding out to contractors, we'd probably be seeing costs in the area of \$270 to \$300 per linear foot," he says. "Instead, our costs are about \$160 a foot. Plus, with each project, our crews are getting more and more efficient, and they're gaining confidence in what we're doing."

"As far as I know, we're the only city double-up-sizing. There's one other comparable project out there, but it's a private operation."

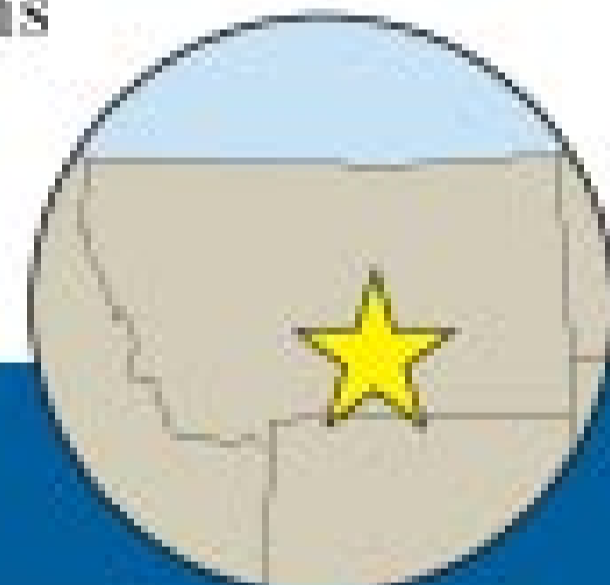
Lots of cast iron

Billings, population 104,000, maintains 433 miles of water mains throughout the 33-square-mile area of the city. A fair amount of the system consists of cast-iron pipe, some of it nearing 100 years old. Modern fire flow requirements and a plethora of leaks are driv-

ing the line upsizing project in the southern section of the city.

"We started two years ago," Emerick says. "At first, we experimented in a cul-de-sac with a type of plastic pipe and some borrowed pipe bursting equipment, but we experienced three failures involving the pipe section couplings."

Then, on a reference from Miles City, Mont., Emerick and his leadership team of engineer Kent Lustig and foreman Jim Burnham decided to use a fusible PVC pipe replacement system offered by Underground Solutions Inc. (UGSI) of Poway, Calif.



PROFILE:
City of Billings,
Mont., Public Works
Department,
Distribution and
Collection Division

INCORPORATED:
1882

POPULATION:
104,000

AREA SERVED:
33 square miles

INFRASTRUCTURE:
433 miles of water mains

ANNUAL BUDGET:
\$2 million (operations
and maintenance)

EMPLOYEES:
13

WEB SITE:
www.ci.billings.mt.us

Maintenance worker/equipment operator Scott Haynes (left) helps senior equipment operator Ryan Skillestad fuse a PVC joint on a McElroy 412 TracStar pipe fusion machine. (Photography by Kelvin Pinney)



Three of the division's employees received UGSI training to become licensed in pipe fusing, and the city purchased the necessary equipment. Billings owns:

- A pipe fusion machine from McElroy Manufacturing to heat-fuse the pipe sections.
- An HB 100 pipe bursting system from HammerHead Trenchless Equipment to slit and burst the cast-iron pipe.

“We’re learning as we go. We’re improving our speed and getting more aggressive in our scheduling. We’re learning a lot about different soil conditions, and we have developed some little tricks that make the project easier.”

Jim Burnham

- Other accessories that enable crews to upsize the old water distribution system.

“It’s working out beautifully,” says Emerick. The division has budgeted \$4 million a year for the project and has replaced and upsized about 3,000 feet of water main thus far. Another 27,000 feet of line is planned for future replacement.

“We’re learning as we go,” says Burnham. “We’re improving our speed and getting more aggressive in our scheduling. We’re learning a lot about different soil conditions, and we have developed some little tricks that make the project easier.”

An example is a second “extraction cage,” which increases the pull-in area for the new pipe and provides better access to the bursting head and associated tooling.

How they do it

Billings is tackling water main replacement one block at a time. Working in the middle of the street so that homeowners can get in and out of their driveways, crews dig a pull pit 14 by 8 feet and 6 feet deep at an intersection, and an entry trench at the other end of the block, about 400 feet away.

The entry pit can be up to 45 feet long to accommodate the length of fused pipe that will be pulled into the line. It is gradually sloped to the level of the main line so that the fused PVC pipe can follow a smooth entry and doesn’t have to be bent or twisted. “We like a 24-foot flat bottom in the entry trench at the depth of the main,” says Burnham.

Ten-foot lengths of 8-inch PVC pipe are heat-fused into a permanent butt joint with the McElroy 412 fusing machine at street level. The machine incorporates a hydraulic pipe lift to assist in loading and unloading and is mounted on tracks for easy maneuvering at the job site.

Next, the crew feeds 3-foot rod sections through the host pipe into the entry pit. The tooling and the conical-shaped HammerHead pull head are attached, and then the whole assembly, including the trailing PVC pipe, is pulled through to the next intersection. A slitter splits the host pipe, and the conical bursting head follows, breaking the pipe apart and pushing the debris into the surrounding soil.

At the exit pit, the crew inserts the extraction cage to provide the required safe access to remove the rods and bursting head, and con-

Scott Haynes (left) and Ryan Skillstad work with the fusion machine as part of the fusible PVC pipe replacement system offered by Underground Solutions.



The slitter section of the pipe bursting system.

CUTTING LEAKS IN HALF

The City of Billings has cut water system leaks by more than half through an aggressive detection program based around technology from Fluid Conservation Systems (FCS).

“We used to experience more than 200 leaks a year back in the 1980s,” says Public Works Department Distribution and Collection Division engineer Kent Lustig.

“Today, we might average 60 to 70, and that number is decreasing as we replace and upsize the old cast-iron lines.”

Billings uses FCS Permalog and Correlator units to locate leaks with acoustical technology. The Permalog units are positioned on main valves, where strong magnets hold them in place. When a unit “hears” a potential leak, the logger enters an alarm state and transmits a signal to indicate a leak condition.

The handheld Correlators, loaded with specific information on the pipe footages, pipe material, connections and other data, then point to exact leak locations. Using asphalt cutters, the crew opens the pavement and cuts a 9- by 6-foot hole for a trench box to access the pipe.

“If it’s just a corrosion scab, we will generally use a repair clamp to fix the leak,” says Lustig. “If the leak is more extensive, then we’re looking at a pipe replacement job.”

Lustig says regular valve and hydrant inspections and customer concerns are other ways of finding leaks. “Sometimes we have homeowners call and say they can hear running water,” he explains. “That’s a pretty good indication that there’s a leak somewhere nearby.”



A section of old 4-inch cast iron pipe installed in 1916.



nect the new pipe to the existing line. Lustig says it takes about an hour and a half to burst and pull the new pipe through a 400-foot section. "We generally do one block at a time," he says.

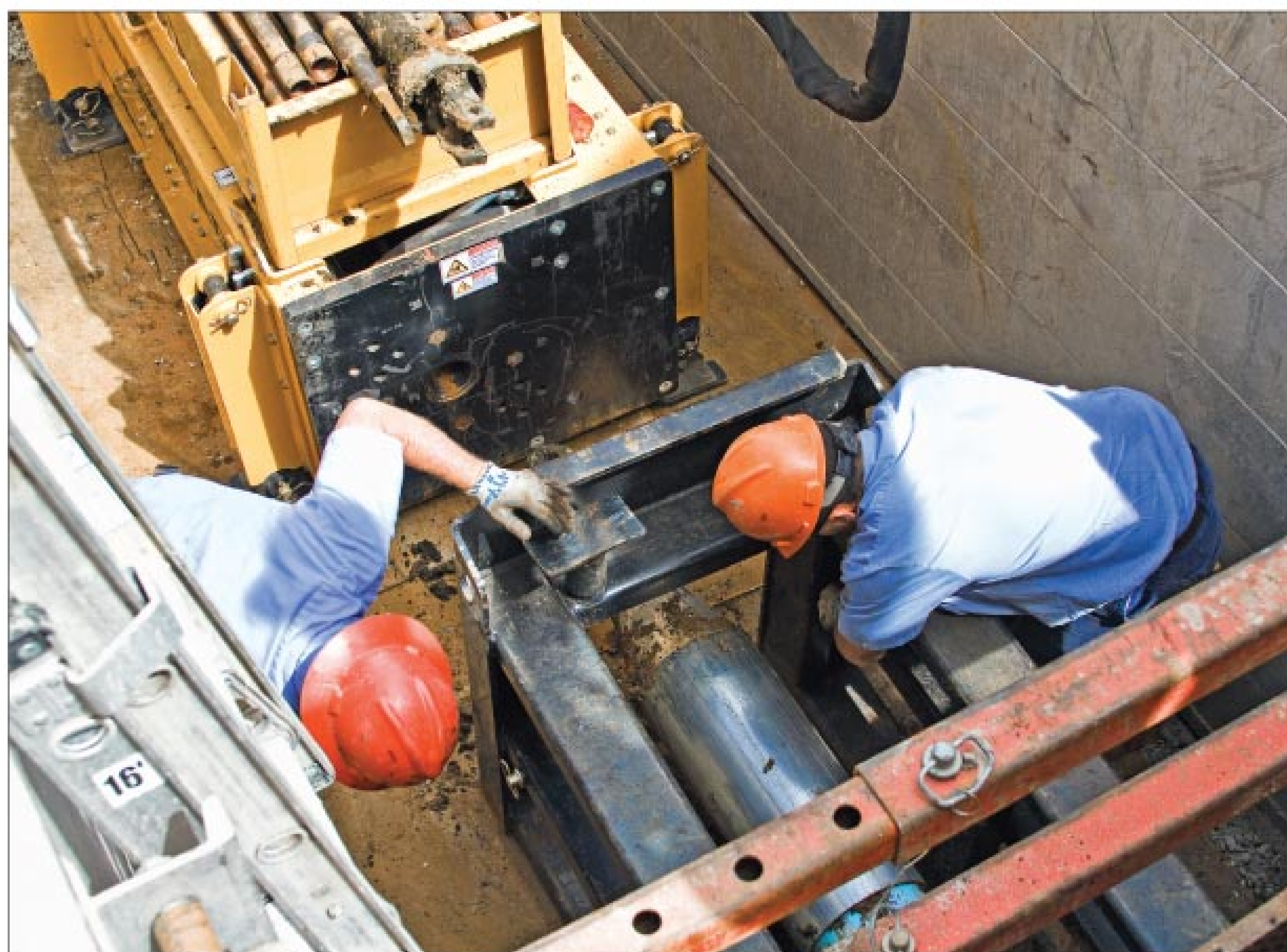
Billings finds it most practical to fuse the pipe sections the day before installation, and then pull the new pipe first thing the next morning. After a section of pipe is pulled, the crew performs a two-hour pressure test, then doses chlorine at 50 ppm and lets the pipe sit for 24 hours, maintaining a chlorine residual of 25 ppm. Then they flush the line, dechlorinate with sodium bisulfate, and take samples at 24 and 48 hours before the line is ready for use.

"We used to experience more than 200 leaks a year back in the 1980s. Today, we might average 60 to 70, and that number is decreasing as we replace and upsize the old cast-iron lines."

Kent Lustig

While the water's off

With a temporary water system, crews keep water flowing to the homes and businesses while their mains are being upsized. An outside contractor performs the work, which involves hooking up an interim water line to a hydrant that remains in service during construction. From the hydrant, a 2-inch PVC pipe carries water down the alleyways, and a connection pipe supplies water to



Senior equipment operator J.R. Fox (right) and maintenance worker/equipment operator Jim Burchell operate the HammerHead 100-ton hydraulic pulling unit.

each user along the alley, usually through an outside faucet.

The contractor supplies chlorine metering equipment to disinfect the temporary water supply and takes samples at the head and tail ends of the temporary system. The city laboratory tests the samples to make sure the required chlorine residual exists in the system.

"We've really had no issues with our customers," says Emerick. "We hook up the temporary system about two weeks ahead of the construction and leave it in place until about a week after the work. The only complaints have been about minor stuff, like running over the temporary pipe with a lawn mower."

Bottom line

The distribution and collection division and the City of Billings couldn't be happier with their program. By purchasing the equipment and investing in staff training, the division is saving



A finished fused joint between two sections of fusible PVC pipe.

substantial money. Based on his experience, Emerick says he'd like to see the city bring as many tasks in-house as possible.

While he feels fusible PVC pipe may not be the solution for every application, the Billings master plan calls for its use in all upsizing projects. "We want everything to be compatible," he says. "In addition, there are not as many parts with PVC as some other piping materials require."

"We've had good support from all our suppliers, and some good pub-



J.R. Fox (in excavation) realigns the HammerHead pulling unit while Scott Haynes (right) and Ryan Skillestad assist.

licity in the local newspaper. Our council is on board with what we're doing. It's a win-win situation." ♦

MORE INFO:

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www.fluidconservation.com

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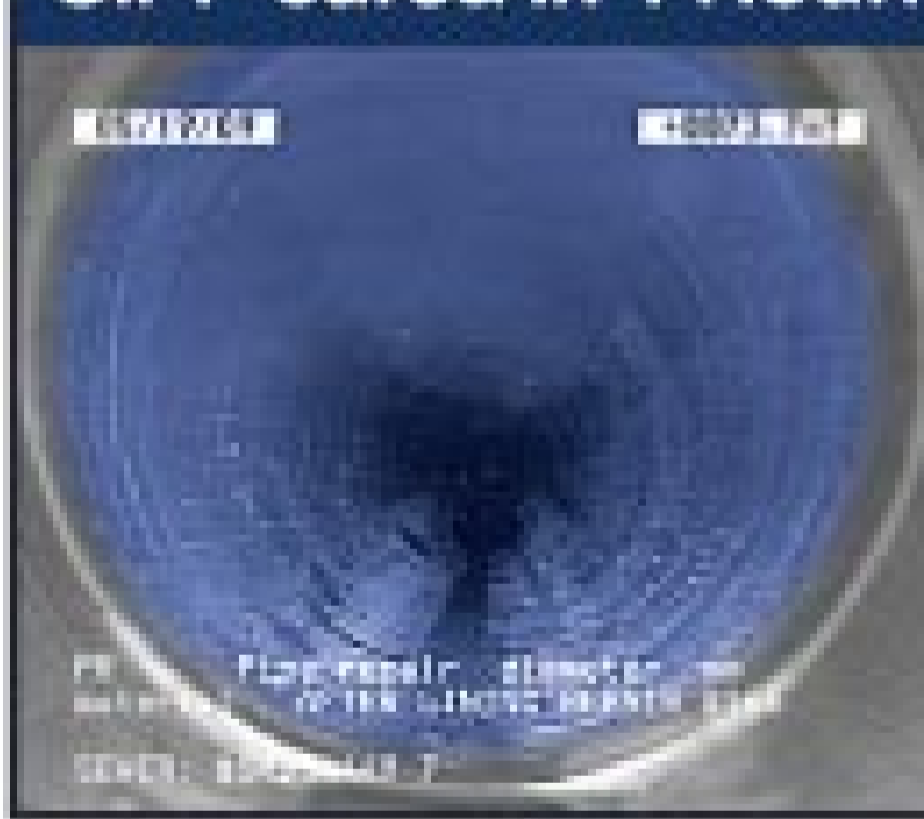
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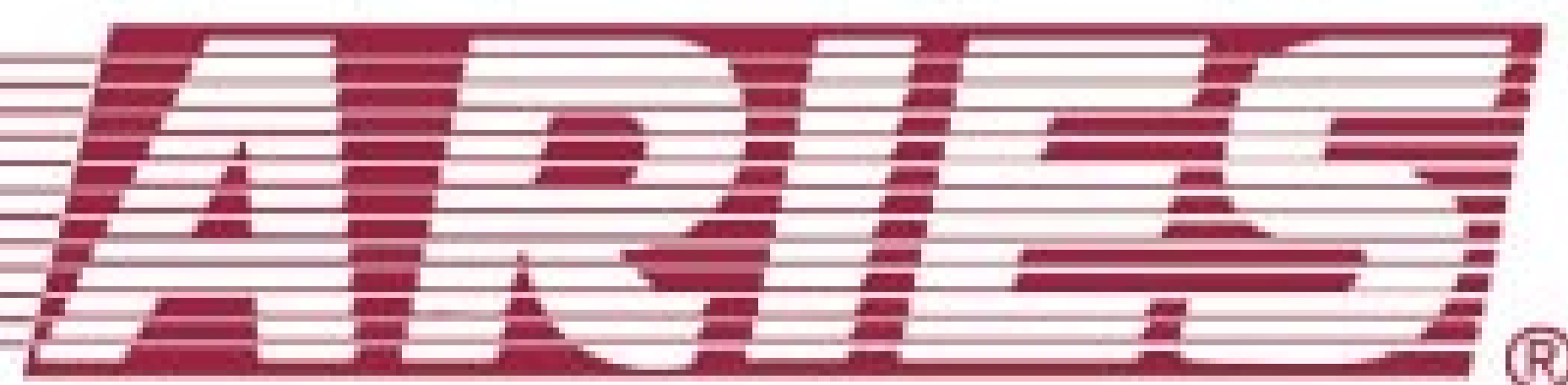
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FOCUS: STORM

WINNING WITH ALLIES



PROFILE:
 Department of Environmental Services,
 City and County of Honolulu, Hawaii

The City and County of Honolulu rely on educated volunteers to help control stormwater pollution and improve stream water quality

By *Scottie Dayton*

Living on the island of Oahu brings unique stormwater challenges to Iwalani Sato, community relations specialist in stormwater management for the City and County of Honolulu, Hawaii.

Most Hawaiian watersheds are small, and streams are short and steep with low but flashy flows. The island also has distinct weather. On the windward side of the Koolau Mountains, heavy rains create high-volume, high-velocity flows in the streams and upland areas. On the leeward side, the southwestern coastal areas are dry. The differences occur over a horizontal distance of a mile.

“The mountains are high enough to have a water cycle,” says Sato, whose Storm Water Quality Branch is within the Division on Environmental Quality under the Department of Environmental Services. “That’s important, because we need as much stormwater as possible to soak in and replenish the aquifer. Our ongoing challenge is convincing communities that minimizing polluted runoff is essential to water quality.”

Sato and her team embrace how water is tied to the Hawaiian culture as part of former mayor Mufi Hannemann’s 21st Century Ahupua’a (watershed) initiative. The initiative involves learning the sophisticated resource management system that supported Poly-

nesian ancestors almost as numerous as Honolulu residents today.

Adopt-A-Block and Adopt-A-Stream programs preserve the legacy through education, while less traditional strategies attract and inspire new generations to protect Hawaii’s water resources from mauka to makai (mountain to sea).

Environmental stewardship

The stormwater programs balance ambitious MS4 permit goals against realistic neighborhood improvements. By breaking polluted runoff into controllable, simple processes in and around homes, the team guides citizens and then empowers them to make a difference.

For example, illegal trash dumps

FOUNDED:
1998

POPULATION:
900,000

SERVICE AREA:
600 square miles

EMPLOYEES:
900

ANNUAL RAINFALL:
70 inches

INFRASTRUCTURE:
700 miles of stormwater collection and conveyance; 26,000 catch basins; 14 detention ponds; 13 vegetated swales; 2,559 outfalls; 13,000 storm manholes

OPERATING BUDGET:
\$64 million (stormwater and flood control)

WEB SITE:
www.cleanwaterhonolulu.com

Opposite page: City and County of Honolulu stormwater team members and volunteers include, back row, from left, Justin Kruse, Al Deleon, James Traylor and Jeff Tarabochia; middle row, Marck Olaes, Lt. Ben Abney, Iwalani Sato, Alice Kudo, Paul Kudo, Jerry Nagatani, John Gephart, Arlene Hajime, and Ron Hajime; kneeling, Lawrence Lapenia and Kevin Chon. (Photography by Anthony Consillio)



Iwalani Sato, community relations specialist in stormwater management for the City and County of Honolulu, inspects an Ahuawa plant donated by a local nursery.

remain a key problem. Residents who complained the loudest about them found an opportunity to act by volunteering in the Adopt-A-Block or Adopt-A-Stream programs. "By keeping monitoring units small — a block or two — volunteers can quickly assess improvement potentials," says Sato. "These

"We want volunteers and residents to see prompt action at the municipal level. Our investigators then identify and control the source of the pollution."

Iwalani Sato

are rapid-response projects that accomplish results within months."

Volunteers select two pollutants. Most pick trash and nutrients or sediments, then walk their blocks reporting hot spots. When Sato receives a call about a clogged catch basin, she immediately alerts the Department of Facility Maintenance, which sends a crew to clear the obstruction.

"We want volunteers and residents to see prompt action at the municipal level," she says. "Our investigators then identify and control the source of the pollution."

Modifying behavior is trickier, since volunteers find it difficult to confront residents who display poor neighborhood housekeeping habits. Instead, Sato recommends that volunteers invite the people to a cleanup event. The softer approach often achieves voluntary compliance and a sense of stewardship.

Aquatic detectives

The Adopt-A-Stream program requires basic observation skills.



Environmental services director Timothy Steinberger, P.E., with 'O'opu, the stormwater department's mascot.

FISH STORY

'O'opu, a native fish found nowhere in the world outside Hawaii, is also the mascot of the City and County of Honolulu Department of Environmental Services and the Hawaii Department of Health.

What makes this unique and sensitive creature the perfect symbol for the Storm Water Quality Branch is that it requires cool, clear-flowing water to thrive. Consequently, it has become a biological indicator of water quality.

"The two runs of 'o'opu life cycle — downstream to the ocean as larvae and upstream to freshwater as juveniles — emphasizes the importance of maintaining the mauka (mountain) to makai (ocean) connection," says Iwalani Sato, community relations specialist for the branch. The distribution of the fish in upper stream reaches is based on its climbing ability. It scales waterfalls by using a suction disk on the belly to anchor to wet rocks, and pectoral fins to pull itself up.

Apoa, the 'O'opu mascot — a man in a fish costume — helps attract visitors to the stormwater information booth during community outreach events. He entertains the crowd while raising awareness about the island's unique native stream species and polluted stormwater runoff issues, then poses for pictures with children and adults.

"He's a big hit with the community and is well received when he visits elementary schools to teach pupils about neighborhood source control and how to solve the problems," says Sato.

His visits coincide with children reading the activity book, *The Journey Home*, with their parents and stenciling storm drains with the "Dump No Waste" message. Also part of the program is a simple visual neighborhood assessment that includes peeking into the nearest catch basin.

To assess general water quality, volunteers look for flows leading to storm drains on dry days and check for water that is milky or soapy, has an oil sheen, or has an odor.

"Taking action on nutrients and sediment moves us into more sophisticated stewardship practices in the home, yard, and work-

place," says Sato. "Usually, our more sophisticated neighborhoods also do the chemical or biological assessments." Volunteers receive Adopt-A-Block or Adopt-A-Stream T-shirts.

Children have their own water-quality education program. During World Water Monitoring Day in September, Sato partners with

Washington Middle School, Waipahu High School, and other agencies to teach students in grades 8-10 how to collect water samples and measure water quality using indicators such as pH, dissolved oxygen, temperature, turbidity, nitrate, phosphate and conductivity.

By learning more about neighborhood source control, they learn how their activities at home affect storm drains and downstream waters. "The basic idea is to create an active group of Adopt-A-Stream

"The basic idea is to create an active group of Adopt-A-Stream and Adopt-A-Block volunteers to share clean water stewardship information with their neighborhood peers."

Iwalani Sato

Jeff Tarabochia, volunteer Jerry Nagatani, and City and County of Honolulu team members Al Deleon and Justin Kruse work together to load a dump truck with debris collected from the Kapakahi stream after a cleanup project.

ward coast, where trash is a major issue. Workshops taught the students about the problem and showed them solutions. "We wanted a 30-second public service announcement that motivated people to act," says Sato.

The schools submitted 37 entries in four categories: erosion control, nutrients, recycling and community action. Tied for first place were Our Waters by Desiree Agngarayngay of Campbell High School; and Keep Trash in the Can by Susan Bowyer, Hokulani Matutino, and Kiana Bersamin of Waianae Intermediate School.

The videos were broadcast on major TV stations and posted on



Iwalani Sato shows the Lions Club and Waipahu recycling volunteers the proper way to re-plant the native plants at Kapakahi Stream.

and Adopt-A-Block volunteers to share clean water stewardship information with their neighborhood peers," says Sato.

"When they begin to understand the range of homeowner behaviors that contribute to polluted runoff, they can encourage positive actions, such as picking up litter, sweeping sidewalks and gutters, mulching, composting, and planting to prevent polluted stormwater runoff."

In 2007, the department developed a Teen Video Contest as part of Earth Month in April. The team worked with video specialists from eight high schools on the lee-

YouTube under the Clean Water Honolulu account. Scott Williams, president of Lex Brodie's Tire and Service Centers, and Troy Ogasawara, president of Geotech Solutions Inc. in Waipahu, donated computers and digital cameras to the two schools. They will sponsor the contest again when it returns in 2011.

Environmental partnerships

The department also has an industrial-commercial pollution prevention program, emphasizing businesses that excel in best management practices and are active community members. Lex Bro-

die's, Geotech, and Hui Ku Maoli Ola Nursery head the good business neighbor roster.

Williams partnered with Sato to develop fact sheets on BMPs for the auto repair industry and for people changing their own motor oil. Ogasawara donates and installs geotextile fabric, erosion-control matting, and fiber rolls for Adopt-A-Stream demonstration sites in Waimanalo and Kaneohe.

Nursery owners Rick Kaponowaiwaiola Barboza and Matt Kapaliku Schirman helped Sato develop information for homeowners interested in natural landscaping and using native plants to control erosion. Besides holding workshops at the nursery, the men take part in stream restorations.

"Our biggest multiple partnership success story is Kapakahi Stream," says Sato. That 280-acre impaired watershed passes through 70-acre Pouhala Marsh, the largest remaining wetland habitat in Pearl Harbor and a crucial resource for endangered native plants and animals.

No dump here

Tim Steinberger, environmental services director, recalls that at one time the city considered using the area for a dump. Instead, the city built the Waipahu Convenience Center next to Kapakahi Stream. Residents are restricted to



Iwalani Sato stencils a sewer drain.

two loads of trash per day, and they often dump illegally in the stream after hours. Bulky items range from mattresses and furniture to chicken cages, automotive parts and appliances.

"Since 2005, sophomores from Waipahu High School, one of our partners, have assisted in cleanup and monitored water quality," says Sato. Another partner, the Hawaii Nature Center, developed a third-grade wetland education unit ending in a field trip to the marsh. The nature center also sponsors community service days.

Meanwhile, the City and County of Honolulu upgraded 2,364 feet of 10-inch concrete sewer line with 12-inch PVC pipe. The old line was a point source for excess nutrients, and root intrusion caused blockages. The Department of Facility Maintenance changed its roadside weed management from



From left, Gerald Takayesu, P.E., Stormwater Quality Branch head; Timothy Steinberger, P.E., environmental services director; and Scott Williams, president of Lex Brodie's Tire and Service Centers and a contributor to the stormwater program.

minimal chemical applications to mowing.

The Department of Land and Natural Resources, Division of Forestry and Wildlife, U.S. Fish and Wildlife, and personnel from the Naval Station at Pearl Harbor erected a fence around the watershed, removed 66,000 cubic yards of landfill in eight acres, and built

pilot project to evaluate four types of manufactured inlet filters for ease of installation, overall costs, performance and maintenance. The study concluded in 2006. Since then, the city has retrofitted more than 200 catch basins with basket filters from Bio Clean Environmental Services, and 100 more will be added.

Sato believes that controlling nonpoint source pollution will be the island's greatest stormwater challenge for the next 30 years or

"I can identify progress in some areas, then turn around and still see chickens in streams beside diapers and television sets."

Iwalani Sato

a quarter-mile-long boardwalk with interpretive stops. Today, the area has returned to a functioning wetland ecosystem.

Getting there

Only 200 of the island's 2,559 outfalls are coastal. The Road Maintenance Division maintains the stormwater conveyance system but works closely with Sato and the Refuse Division to identify and monitor illicit stormwater discharges and bulky-item hot spots in city channels, streams and roadways.

The city retrofits storm drains with separators, mounts filter traps in catch basins, and installs litter booms in channels or streams.

In 2003, the city initiated a

more. "I can identify progress in some areas, then turn around and still see chickens in streams beside diapers and television sets," she says. "These projects are not one-shot deals. We're in it for the long haul, but if we do our jobs properly, the next generation will carry on the mission." ♦

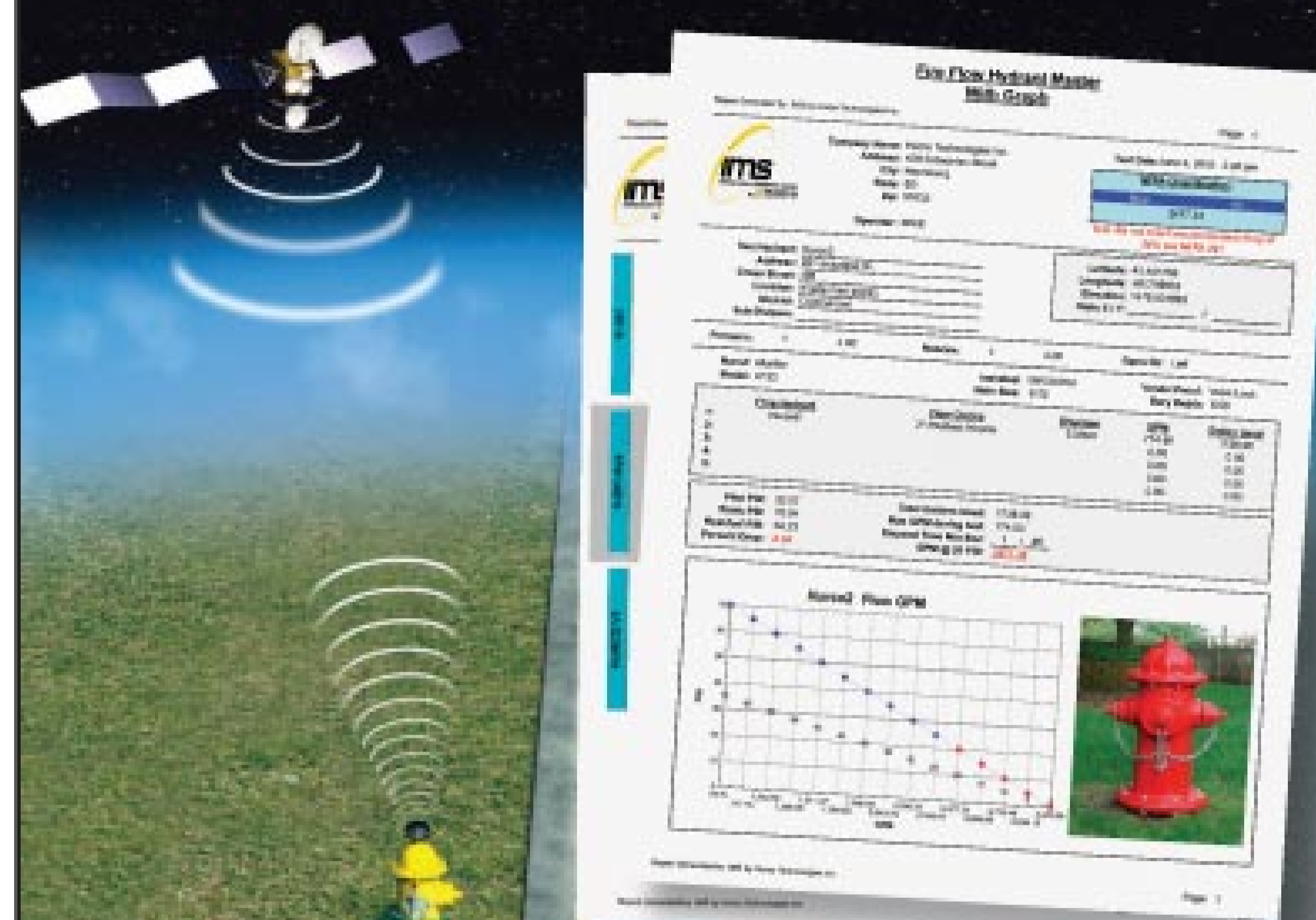
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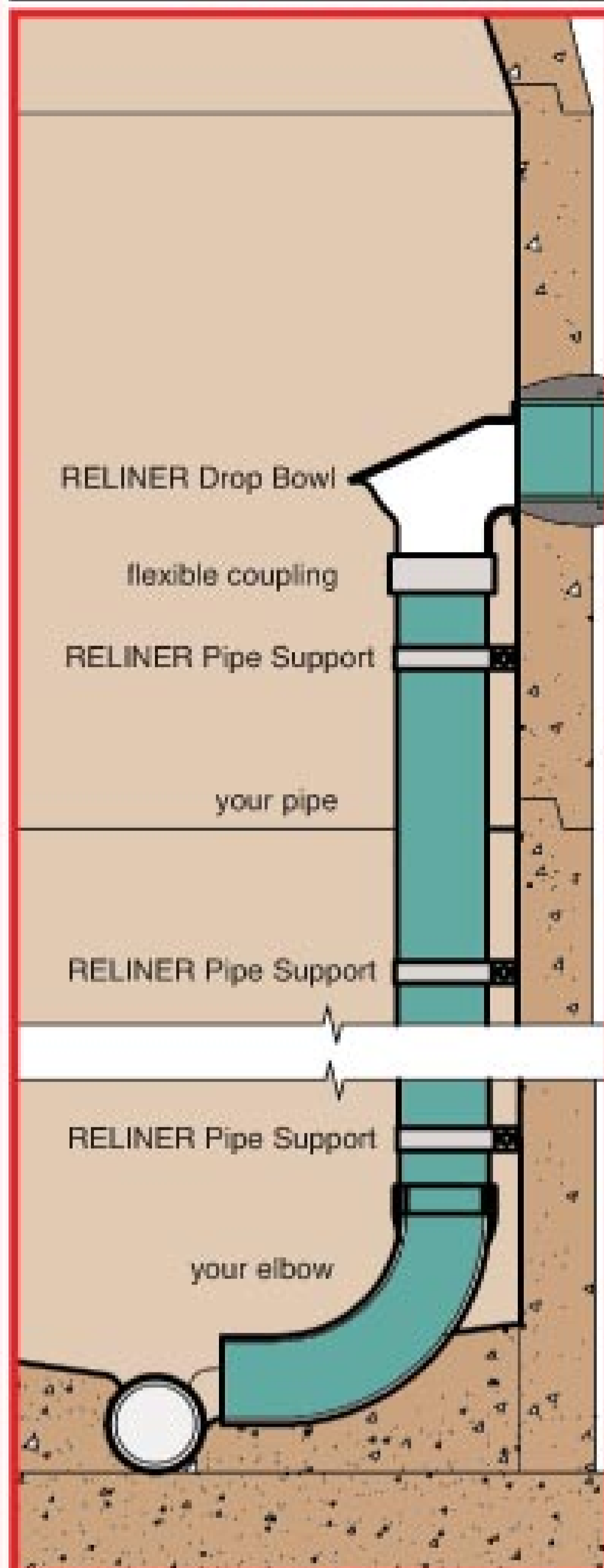
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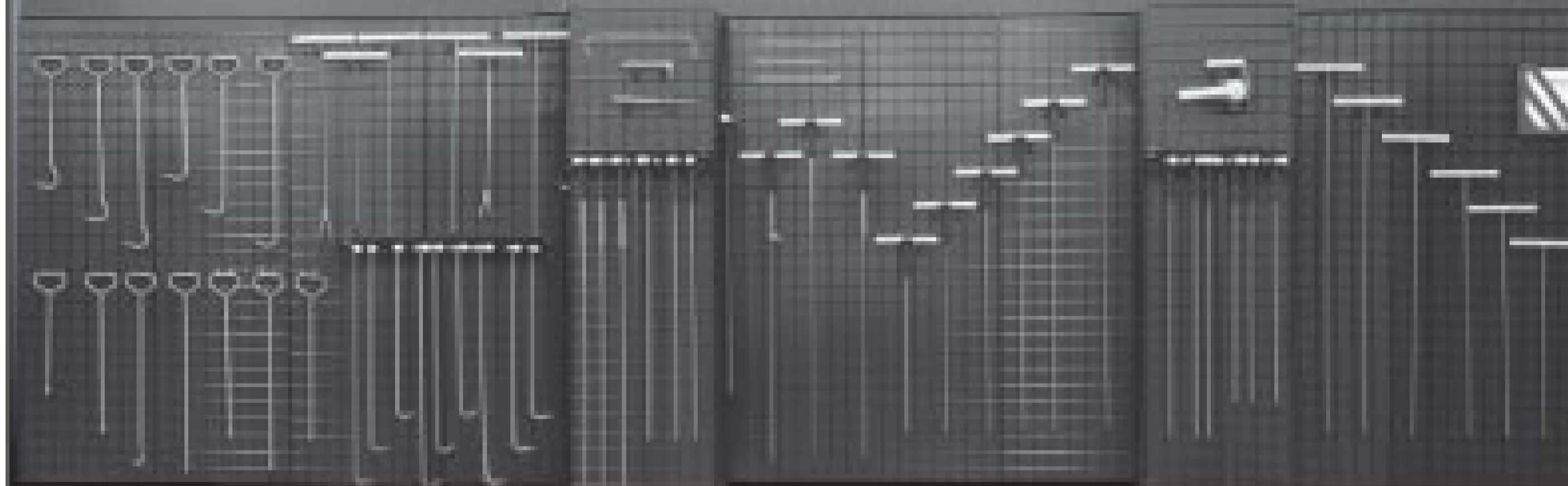


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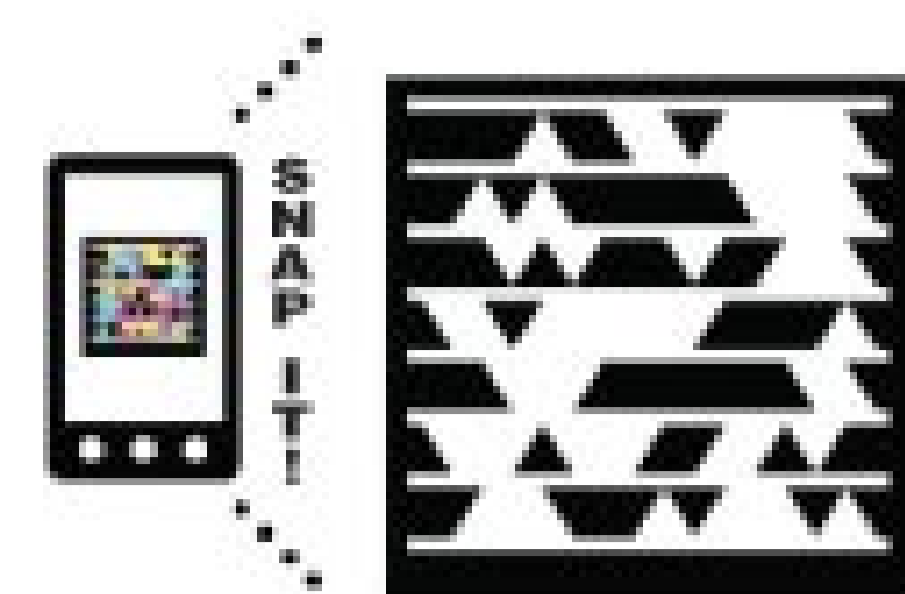
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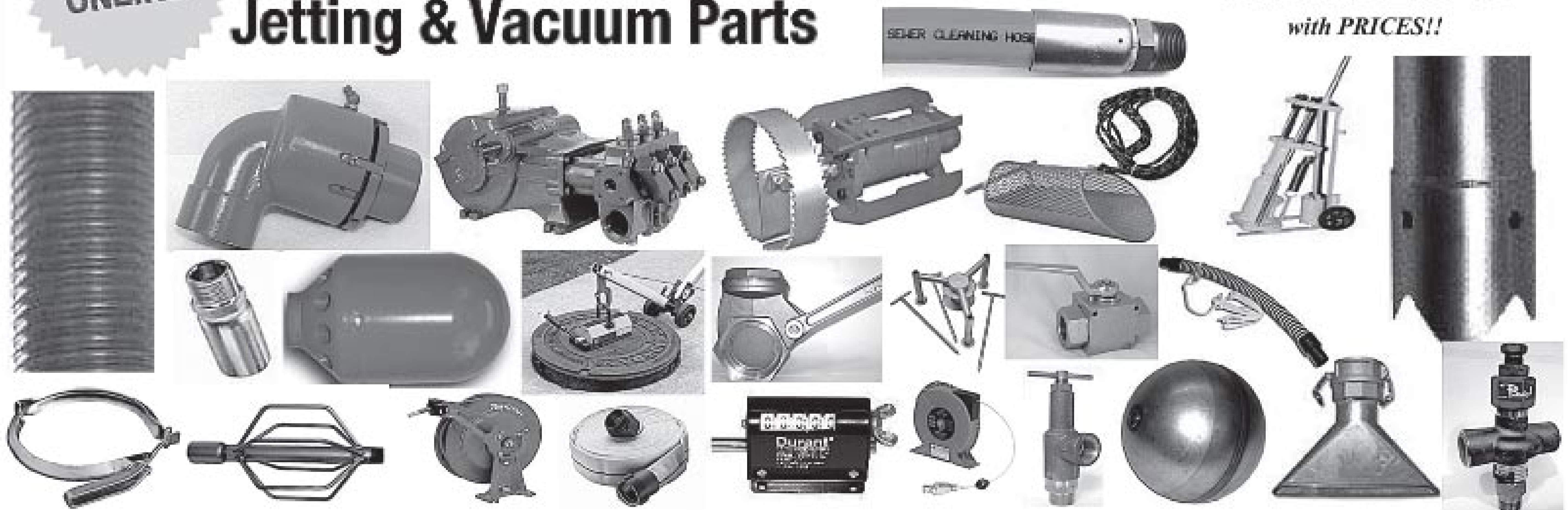


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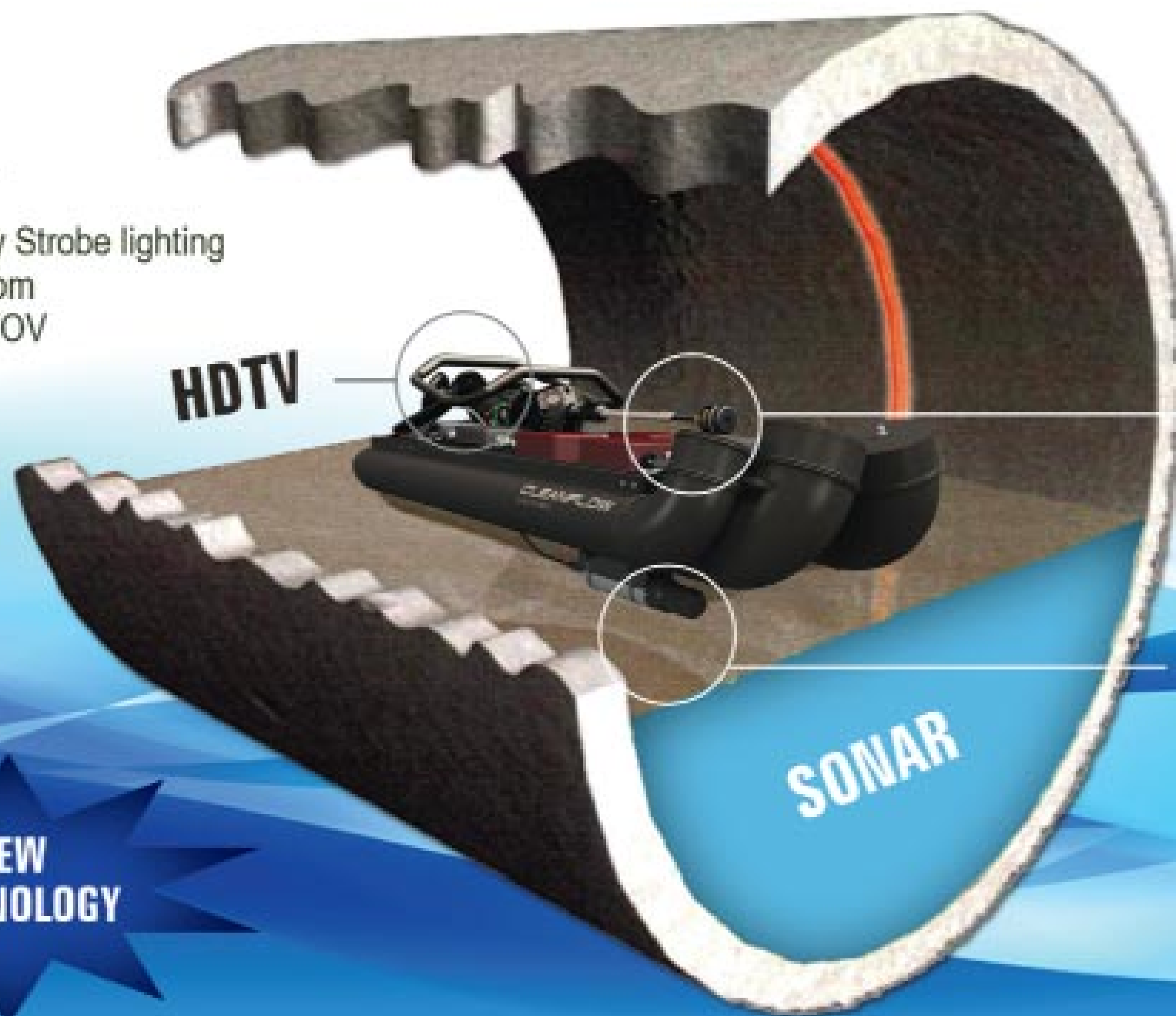
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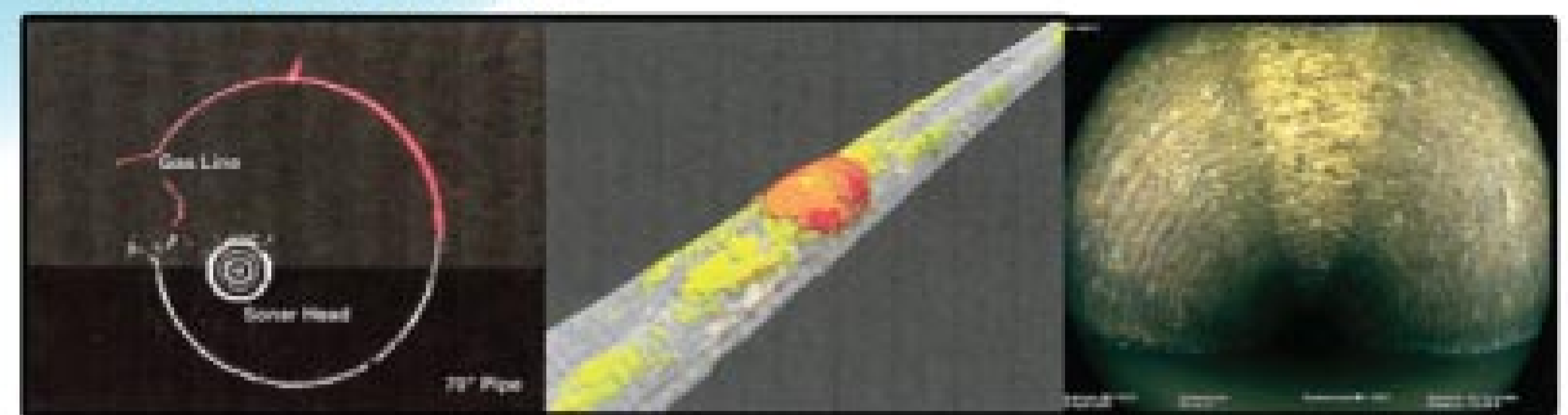
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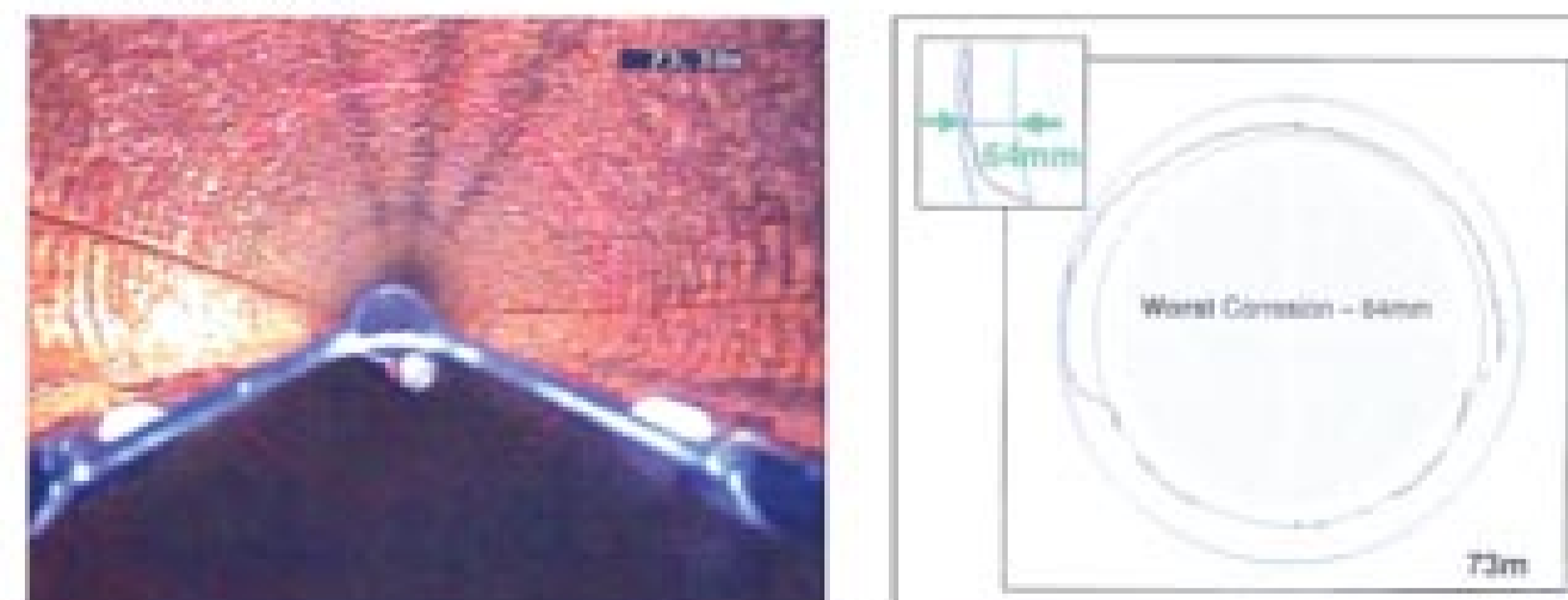
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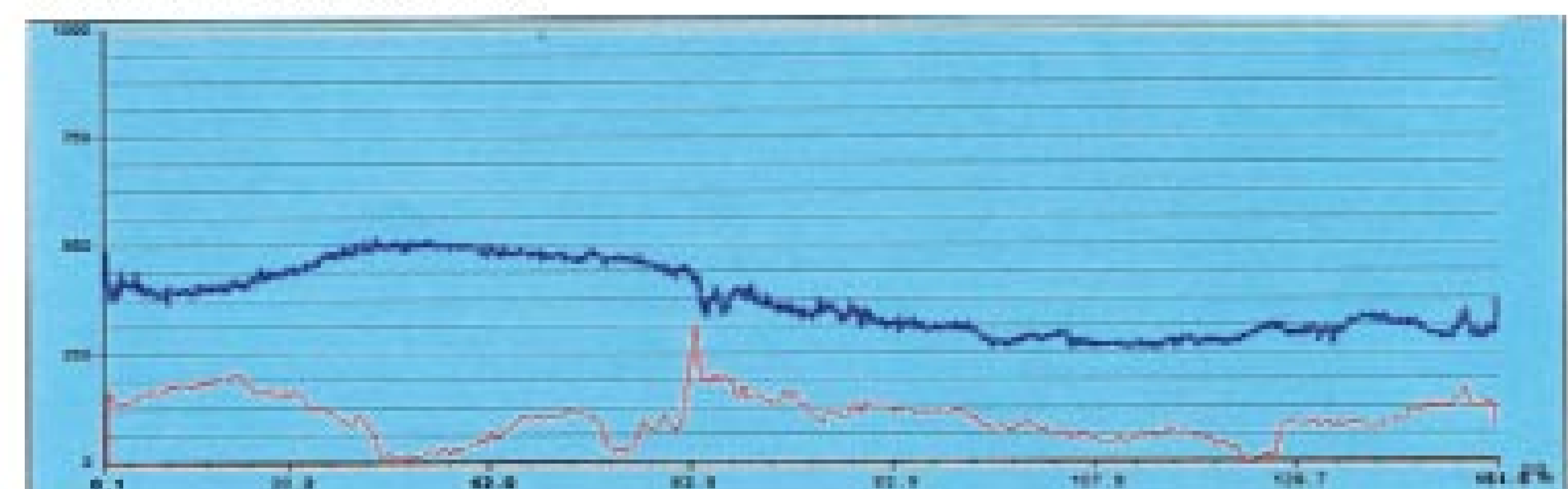
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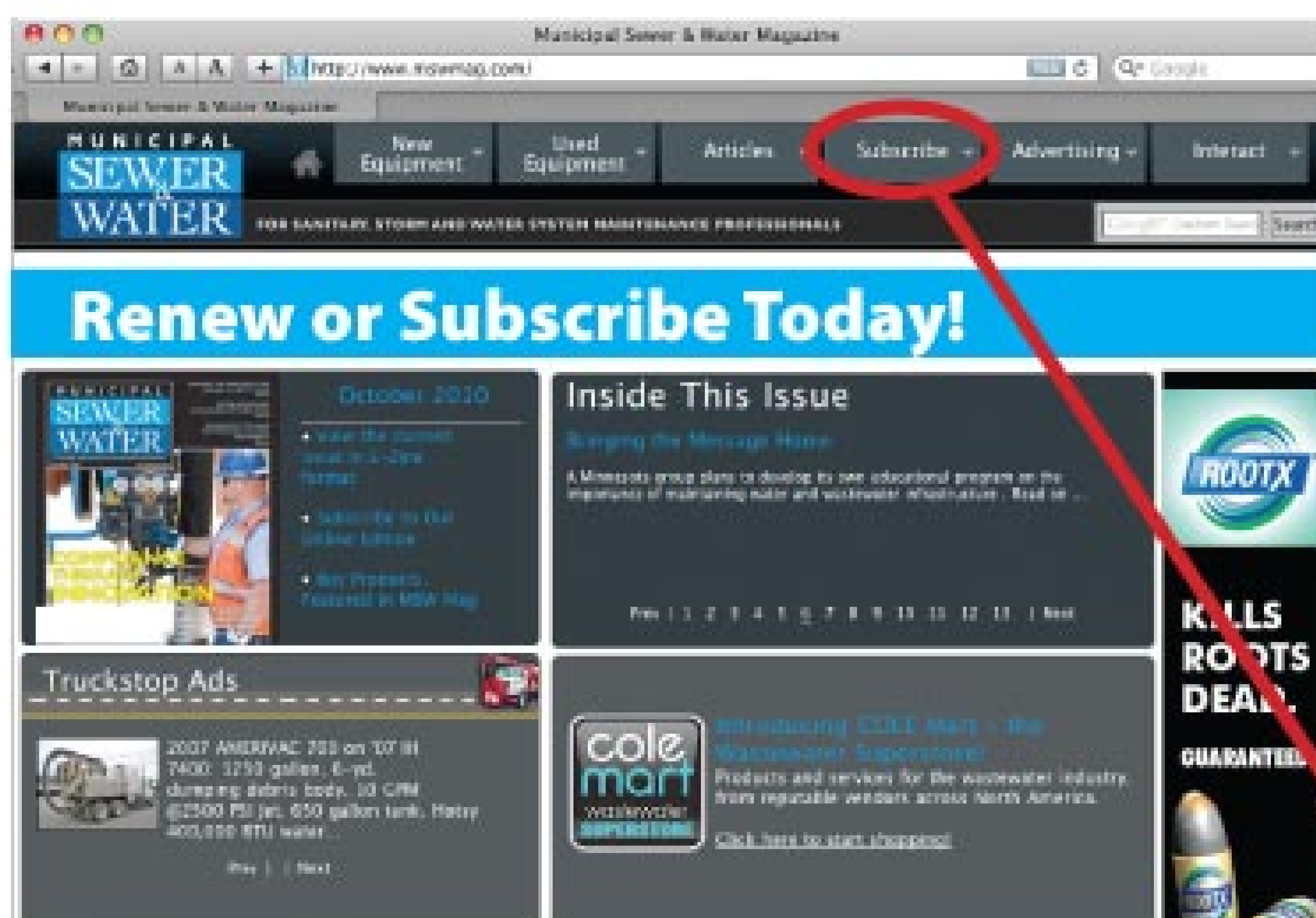
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FOCUS: WATER

PLANNING TO GROW

Water conservation and a regularly updated master plan help a Texas military town keep up with growth and deliver efficient, high-quality service

By Suzan Marie Chin

While other areas are struggling in a down economy, the City of Killeen, Texas, has seen record economic growth, border expansion and a population boom.

All this growth has put Killeen's water and wastewater infrastructure to the test. To meet growing demand, the city has implemented two key plans — a four-stage Water Conservation Plan and a Water and Wastewater Master Plan — that map out present and future actions.

“Our crews are pretty creative and we listen to their suggestions. We’re also given enough freedom within the rules to choose the best equipment for the job.”

Dane Smith

As part of the master plan, items like meter replacements, new flushing devices and techniques, new storage facilities and upsizing of existing water lines are helping keep the city on track and ahead of demand from the thriving community.

Keeping pace

A lot has changed in Killeen since its inception more than 100 years ago as a small railroad town.

In 1941, the U.S. Army established a training site there, Camp Hood, to prepare soldiers for war. Today, Fort Hood is one of the largest military installations in the world, home to 50,000 soldiers and their families.

Because of its low cost of living, many retiring military personnel choose to stay in Killeen. Fort Hood offers these families a strong base of support, and many new businesses have sprung up to serve them. In addition, firms that do business with the military have located in the area to draw on the

experience of retired officers and senior enlisted people. In the last 20 years, Killeen has grown from 63,000 residents to nearly 120,000.

The city maintains some 524 miles of sanitary sewer collection mains and 581 miles of water distribution mains, as well as eight in-ground water storage tanks holding 25.1 million gallons and six elevated storage tanks holding 7.25 million gallons. Water conservation and the master plan are



Operators Mike Smith (left) and Chris Zeitner adjust the packing on a 2,400 gpm pump. (Photography by Kay Taylor)

critical to maintaining the city's ability to deliver water.

Killeen's Water Conservation Plan is in keeping with mandates of the Texas Water Development Board, requiring all municipalities to have a plan geared toward demand-based triggers. “The plan is very formulaic, based on guidelines established by the Water Board,” explains John Nett, city engineer. “We’ve established four stages, triggered or escalated by usage during our peak points from May through September. These determine how our residents can use water resources during those time frames.”

Killeen is now at Stage 1: Vol-



PROFILE:

**City of Killeen,
Texas, Department
of Public Works**

CUSTOMERS:
54,000 active accounts

INFRASTRUCTURE:
581 miles of water main,
524 miles of sewer main

EMPLOYEES:
271

ANNUAL BUDGET:
\$21.8 million
(water and sewer)

WEB SITE:
www.ci.killeen.tx.us



Assistant supervisor of water Clay Culver checks a Sensus radio-readable meter installed at the new Killeen Police Department.

untary Conservation, which encourages residents to limit water usage to what is essential for health, business, normal irrigation and reasonable recreation. Stage 2: Mandatory Water Use, primarily controls the time of outdoor irrigation and prohibits use of water for activities like charity car washes, ornamental fountains and washing of impervious surfaces.

Stage 3: Emergency Water Use, encompasses all Stage 1 and 2 controls but adds scheduled water use days for irrigation, prohibits new landscaping installations and sets pool maintenance levels. Stage 4 escalates to no irrigation of any kind that uses permanently installed irrigation systems or hose-end or drip-style units.

Course for the future

The more critical component is the master plan, which charts out the city's sewer- and water-related operations, expansion, maintenance and rehabilitation. Established in 1997, the plan has been revised every three years and is due for another update.

"We plan on updating and improving some of our pump stations and adding transmission mains as part of the latest plan version," says Nett. "We will ulti-

mately change points of potable water delivery with the addition of more storage tanks and other facilities to deal with the radical shift in need we've seen in the last two years. As we see the city expand more and more to the south, we have to push water much further than ever before. Major updates are needed in order to accomplish that transmission efficiently."

For instance, pump stations are huge users of energy. "By increasing the capability of our pump stations to move that water directly to the tanks and transmission lines in the new areas, we create a tremendous reduction in electrical, maintenance and repair costs on the pumps, as well as repairs on valves on the mains and dealing with line breaks," says Mike Meadows, project engineer, water and sewer.

"You need to use your pump stations to their maximum beneficial capacity. The same goes for your lines. We had one station that had plenty of capacity, but the lines coming out of it were not adequate in size to handle what it could produce. All these new initiatives in our master plan — new mains and transmission lines, and connectivity to more pump stations — have helped us move water

much more efficiently throughout the entire city, not just the new areas."

Little steps, big gains

Capital improvements help keep supply and demand in balance, but other changes help over the long haul, as well. A case in point: improving meter capabilities to reduce water losses.

Killeen is gradually replacing its water utility customers' meters systemwide. Instead of traditional analog meters, the new or replacement meters can be converted to radio read. This means:

- Less manpower to manually open valve boxes, take read-

ings and enter data to the billing system.

- Real-time reading on demand.
- Energy savings because fewer vehicles are deployed to take readings.
- Greater billing accuracy.
- The ability to monitor accounts more frequently.

Two types of radio meters are being considered: a drive-by style and a system that transmits data to a receiver or accumulator. Either way, the information will be beamed back to the billing department.

"The good thing about these radio systems is the ability to see what's happening in real time in the system," says Jim Butler, execu-



Looking over system GIS maps are Killeen sewer and water team members, from left, Robert White, director of water and sewer services; James Butler, executive director of Public Works; and John Nett, city engineer.

MAP IT TO MANAGE IT

To keep up with growing demands for water, the City of Killeen relies heavily on its Master Sewer and Water Plan to chart new construction, refurbishment, upgrades and replacements within the system.

City officials saw that for the master plan to be truly helpful, it needed to be built on accurate data incorporated in a computerized geographic information system. "Instead of guessing or assuming something like 'We need bigger lines over here,' GIS gives us something to base our decision upon," says Mike Meadows, project engineer, water and sewer. "It's the true model or picture of our system. The model tells you exactly where you need to make improvements. Having good GIS data and a solid model is crucial for our expansion plans."

Killeen has compiled all its data into an ArcView GIS system from ESRI. To help fast-track the most comprehensive GIS database possible, the city is combining the resources of its field staff doing routine maintenance and outside consultants providing specific information on new and existing sections.

The staff compiles spreadsheets, manual reports and subdivision planning documents into the database, which will eventually be a central reference repository to draw upon when updating the master plan. It may also be used in the future for operations and maintenance scheduling.



Clay Culver flushes a line using a new automated flushing device from Kupferle Foundry.

tive director of Public Works. “For instance, if someone has a leak in their house, perhaps while they are on vacation, we would be flagged that an unusually high amount of water is being used at that location. We can then send crews out to investigate and resolve any potential problems quickly, or rule them out, because perhaps the owner is filling a swimming pool or doing a major landscaping project.”

The first conversions are planned for the larger customers. The city expects to start installation of the radio-read meters within the next year to 18 months. Being able to track water is key to reducing losses, improving service and keeping costs down. The new meter program will also help the city compare how much water it purchases from its regional provider with the amount actually sold.

New flow meters are also being installed at pump stations to track how much water is being pumped through the system. “Each pump station services a particular area, which will have a typical established demand level,” says Steve Kana, project manager, water and sewer.

“Once we know how much water

we’re actually pumping into an area, we’ll be able to compare water use records and pinpoint areas where we may have more water going out than what we’re accounting for.” Armed with that information, the city can deploy leak detection sounding devices or take other investigative measures.

Another big water saver has been automated flushing technology. Traditional hydrant flushing

uses up to 15,000 gallons of water per event. With more than 6,000 hydrants, the city can’t install the automatic devices (Kupferle Foundry) on every unit. But by installing them in key positions where frequent flushing has been required to maintain good water quality, the city is seeing large savings. The automatic devices require just 500 gallons of water per cycle.

Timing is everything

Killeen is also using the new meters to gather data to analyze the performance of its systems. Gathering data is especially critical during high-use months. “We want to get our high-use months in, especially because that’s when you get some of the better data,” says Richard Macchi, assistant director of Public Works. “A lot of meters are more accurate when there is greater flow through them. If you go through low-use months, you tend to have a loss of accuracy.”

With new meters scheduled for installation before the peak period is in full swing, data collection during July through October of 2010 will provide with a good baseline. The city will also take pressure readings to monitor pump efficiency and usage and stay ahead of pump station maintenance issues.

“Our annual reporting to the Texas Water Development Board requires targets on water loss reduction, and that’s why we’re working really hard on the universal metering and meter replacement aspects of our plan,” says Butler. “Having accurate data makes the job of deciding where to place our efforts and budget easier and clearer.”

Always fluid

As Killeen has seen firsthand,



Among those responsible for the Killeen sewer and water system are, from left, James Butler, executive director of Public Works; Ginny Phinney, executive assistant; John Nett, city engineer; Steve Kana, water and sewer project manager; Robert White, director of water and sewer services; and Richard Macchi, assistant director of Public Works.

Robert White looks at the new FLEXIM flow meter readout at a pump station.



the only thing that remains the same is change. As the targets and objectives shift, the master plan does, too. All its initiatives to date, big and small, have helped the city deliver supply in line with constantly growing demand.

Still, city staff members know they can't stop looking for ways to keep providing better service and creating a healthy, sustainable system. Rapid growth presents special challenges, but also good lessons for managing an evolving system: a fluid approach works best.

Butler sums it up simply, "Your Water and Wastewater Master Plan has to be a living document. We don't put infrastructure in the ground before it is needed. That is a waste of money and creates additional unnecessary operational issues. Adopting a just-in-time delivery model has served us well to date, and we expect it will continue to do so as our community follows its anticipated future growth pattern." ♦

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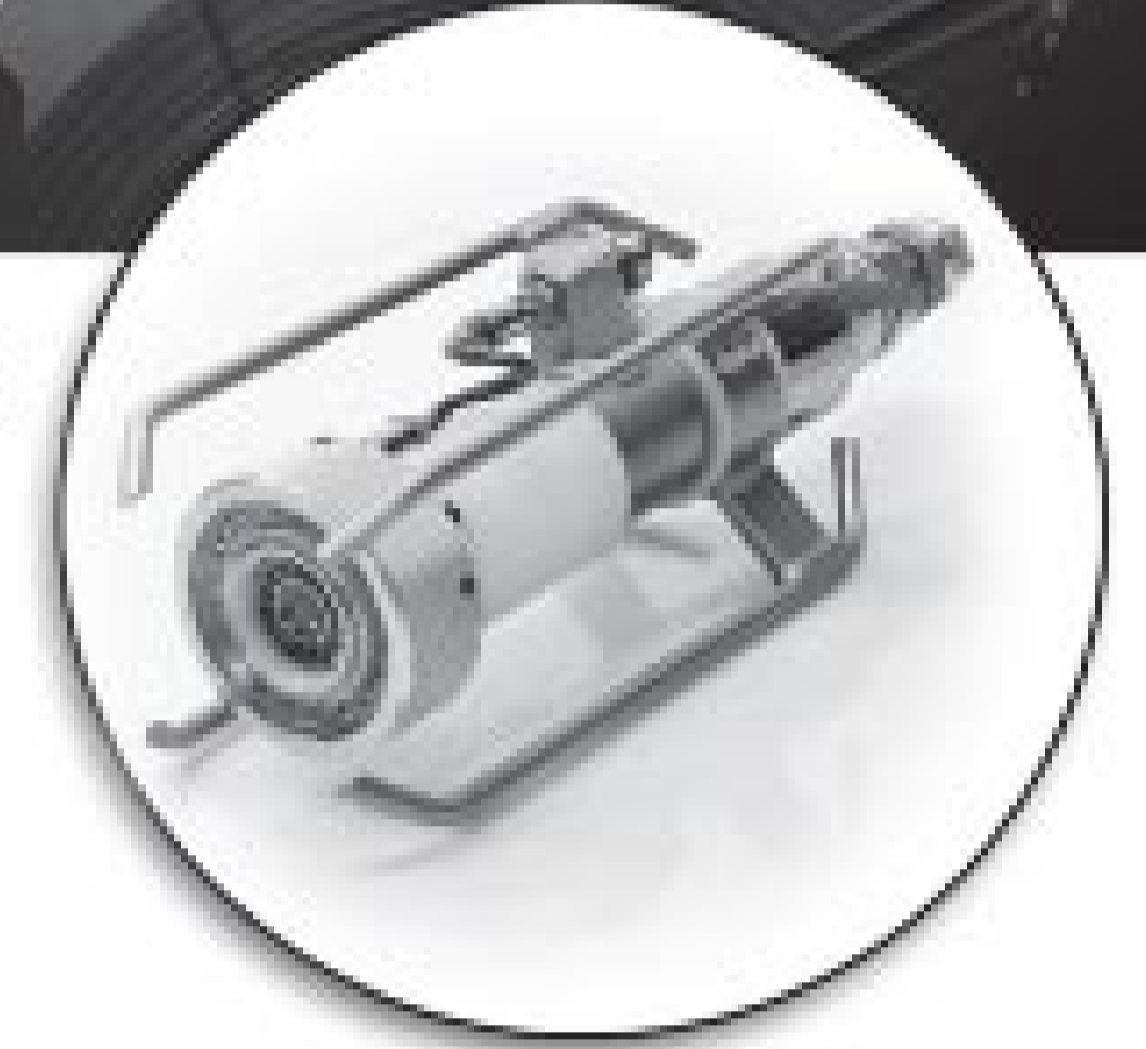
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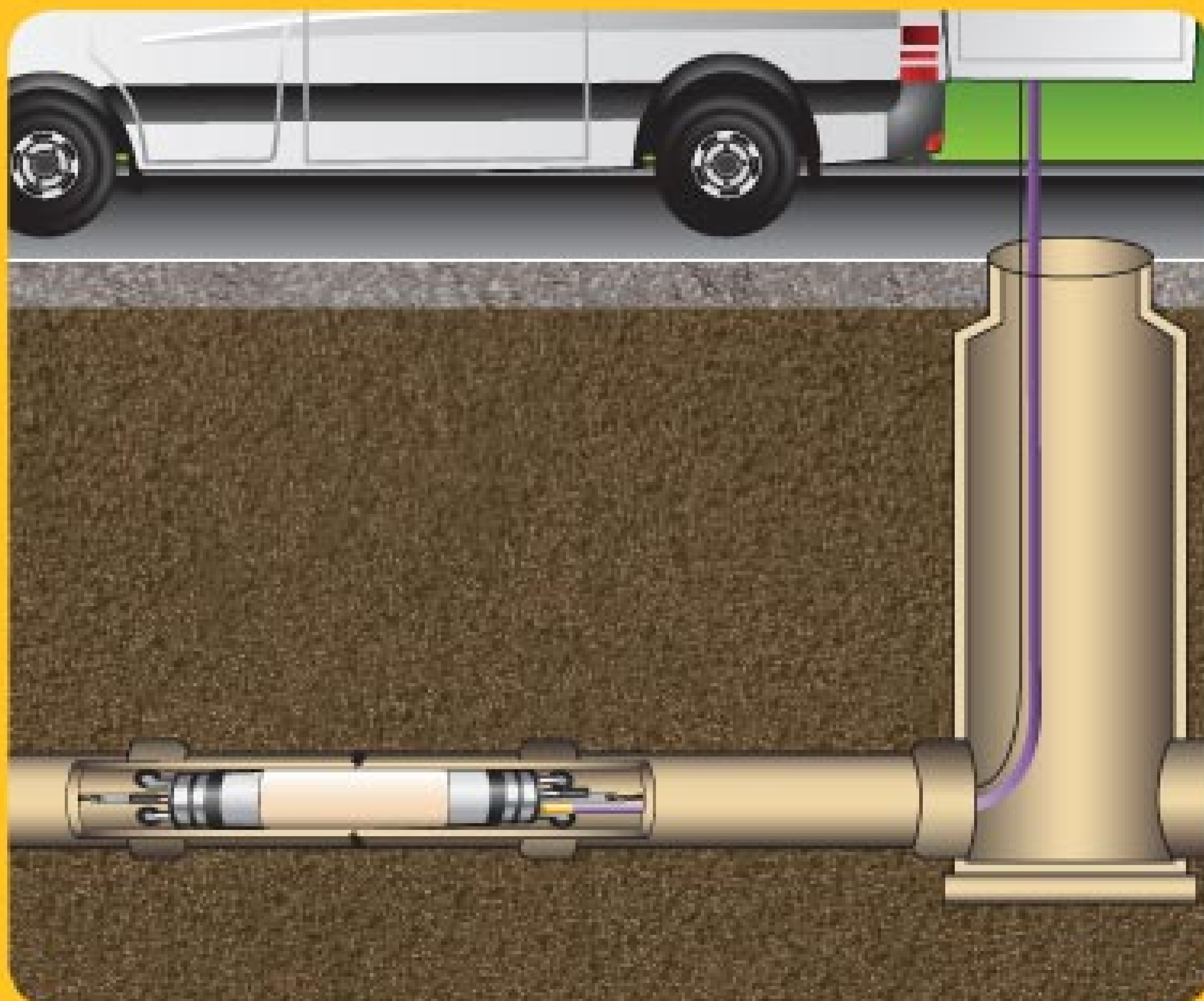


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PEOPLE / AWARDS

Amanda Martin, a graduate student at Virginia Polytechnic Institute and State University (Blacksburg, Va.), received the American Water Works Association 2010 American Water Scholarship.

The American Water Works Association announced two award winners. **Jeanne LeJeune**, business development manager for the water business group in HDR's office in Portland, Ore., received the Kenneth J. Miller Founders Award. **Glenn Dostal**, senior water project manager in HDR's office in Omaha, Neb., received the George Warren Fuller Award.

The **City of Los Angeles' Stormwater Program** received a National Environmental Achievement Agency Award from the National Association of Clean Water Agencies.

The Florida Stormwater Association elected officers: **Michael Bateman**, president; **Theresa Connor**, vice-president; **Brett Cunningham**, secretary-treasurer.

MSW welcomes your contribution to this listing. To recognize members of your team, please send notices of new hires, promotions, service milestones, certifications or achievements to editor@mswmag.com.

LEARNING OPPORTUNITIES

APWA

The American Public Works Association is offering these audio/webcast courses:

- Nov. 4 – Gray Water Reuse and Rainwater Harvesting
 - Dec. 16 – ADA – Do You Have a Plan and Have You Updated It?
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CALENDAR

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Nov. 14-17

Green Streets & Highways Conference, Renaissance Denver Hotel, Denver. Visit www.asce.org.

Nov. 14-18

Water Quality Technology Conference and Expo, Savannah, Ga. Visit www.awwa.org.

Dec. 1-3

Florida Stormwater Association Winter Conference, Hyatt Regency, Tampa, Fla. Visit www.florida-stormwater.org.

March 2-5

Pumper & Cleaner Environmental Expo International, Kentucky Exposition Center, Louisville, Ky. Call 800/257-7222 or visit www.pumpershow.com.

AWWA

The American Water Works Association is offering these webcasts:

- Nov. 10 – Tools & Technologies for Meeting Stage 2 DBP Regulations
- Dec. 8 – Sustainability

Visit www.awwa.org.

Wisconsin

The University of Wisconsin Department of Engineering-Professional Development is offering these courses in Madison:

- Nov. 15-16 – Advanced Steady Flow Modeling Using HEC-RAS L682
- Nov. 17-19 – Modeling Unsteady Flow Using HEC-RAS L683

Visit www.epdweb.engr.wisc.edu.

The Wisconsin Department of Natural Resources is offering:

- Nov. 1 – Advanced Water Treatment Strategies, Janesville
- Nov. 9 – Basic Waterworks Math, Madison
- Nov. 10 – Security and Emergency Planning for Utilities, Madison
- Nov. 10 – Water Supply Safety, Fond du Lac
- Dec. 1 – Advanced Water Treatment Strategies, Green Bay
- Dec. 7-8 – Utility Management, Madison

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ON THEIR OWN

A robotic pipe inspection system enables a western Pennsylvania municipal authority to complete an assessment and avoid a consent order and fine

By *Scottie Dayton*

Inflow and infiltration, a sequencing batch reactor unable to handle peak flows, and high BOD levels from two schools and a bakery caused effluent from the Rimersburg Borough (Pa.) Municipal Authority wastewater treatment plant to exceed permit levels.

The result was a proposed consent order and agreement from the state Department of Environmental Protection. Even though the authority had reduced I&I by 35 percent and flow monitors showed that the facility was handling the load, the DEP insisted that two adjacent communities build a pretreatment plant.

The authority agreed that would solve organic and system issues, but officials objected to what the expansion would cost its 500 customers. "Constructing a \$3 million facility would be worse than a fine to a community this small," says Roger Crick, authority chairman.

Crick, determined to have more control of the process and agree-

ments, called borough engineering consultant, Ken Orie, P.E., project engineer for Gibson-Thomas Engineering Co. Inc., in Latrobe, Pa. Crick suggested televising all 26,000 feet of the collection system to prove the authority's willingness to manage its assets. It was only three weeks before the final negotiation meeting with the DEP.

Orie recommended leasing a Solo robotic pipe inspection system from RedZone Robotics. In five days crews began launching the units, and the inspection was completed. The results enabled the authority to avoid a consent order and fine.

Expedited benefits

For years, budget constraints had limited the authority's efforts to maintain its sewers and develop a rehabilitation program. When Gibson-Thomas Engineering first monitored I&I flows, they averaged 0.108 mgd, including a maximum daily level of 0.6 mgd during 2.75 inches of rain. "We reduced I&I through lateral replacement



A Solo inspection unit from RedZone Robotics was part of a system inspection for the Rimersburg Borough (Pa.) Municipal Authority.

and other structural measures, but we still lacked enough system knowledge to understand its effects on plant performance," says Crick.

The treatment plant, embedded into a hillside, has no headworks. Most sewers are 8- to 12-inch lines, and distances between the 200 manholes often exceed 500 feet. "The best footage a five-man crew can get with conventional inspection systems is 1,000 feet per day, and we didn't have 26 days," says Orie. "With Solo, one technician can operate four battery-powered robots simultaneously, increasing throughput three to five times."

Sam Cancilla, regional sales vice president for RedZone, and Orie taught public works foreman Frank McNaughton and his assistant how to operate the system. It includes fully autonomous robotic crawlers, camera platform, image capture, data storage, interpretation, comprehensive condition reports, and access to interactive online asset management tools. Cancilla also provided coding and

BETTER MOUSETRAPS

- PRODUCT:**
Solo robotic inspection system
- MANUFACTURER:**
RedZone Robotics
- APPLICATION:**
Sewer pipe inspection
- BENEFITS:**
Increased inspection productivity
- USER:**
Rimersburg Borough Municipal Authority, Pa.
- WEB SITE:**
www.redzone.com

characterization services according to NASSCO Pipeline Assessment and Certification Program (PACP) standards.

The package

The fore-and-aft cameras have a 360-degree field of view with LED light arrays around the lenses. The panoramic view ensures a thorough

inspection. "When technicians push past something using conventional technology, they can't look back," says Orie. "The rear camera solves that problem and produces symmetrical data capture."

The crawler has a pair of 2-inch-wide orange treads and a back plate with a small-diameter cord tied in a loop. The cord is part of the control and retrieval

just below the hanger bar."

After retrieving the crawlers, the men used their laptops to verify the camera views and captured images. Then they cleaned the robots using a garden-type sprayer and specified degreaser. The unit's rechargeable batteries can power two 400- to 500-foot runs at up to 30 feet per minute before needing replacement.

"When technicians push past something using conventional technology, they can't look back. The rear camera solves that problem and produces symmetrical data capture."

Ken Orie, P.E.

system. Working independently, McNaughton and his assistant launched the crawlers by positioning a telescoping compression-secured hanger bar at the top of the manhole just below the lid-supporting lip. Then they slipped the short cord through a lightweight anti-chafing guide on the hanger bar before lowering the units, using a telescoping deployment pole with hook.

They deployed a robot per line entering the manhole, transmitting location and pipe information to each unit's onboard computer using an armored laptop computer with WiFi. Once the manhole lid was replaced, the hanger bar became the reference point from which the units measured their surroundings and interpreted their situation.

Once in the flow, the crawlers were free of human interaction until they were retrieved. Sensors in the pressurized bodies kept them centered in the channel and stopped them upon detecting the open space of the next manhole.

A reel in the back of the body maintained slight tension on the cord as part of the condition-sensing system. "The cameras photograph the manhole chimney before the robot returns to the insertion manhole," says Orie. "The treads disengage and the unit hoists itself up the cord until it is suspended

A redundant mass data storage unit, called the Vault, automatically downloaded the data and images using Ethernet cable connections. The system has 16 GB of onboard data storage capacity, enough for about 10,000 feet of inspections. Data from the Vault was stored on a palm-sized hard drive, then sent to the RedZone Robotics office, where reporting technicians did condition assessments.

Mission accomplished

By avoiding the typical setup of cleaning and televising, the authority saved money and time. The crew completed the inspection in five days. "The portable units eliminated easement access issues and minimized public disruption," says Crick. "The virtual video allowed us to review the entire inspection off-line as if we were operating a camera in real time."

After DEP officials reviewed the authority's efforts to improve its collection system management, they removed the consent order and canceled the requirement to construct a \$3 million pretreatment plant. ♦

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BREAKING NEW GROUND UNDERGROUND

SAFE AND EFFECTIVE PIPE CLEANING

NASSCO aims to supplement its *Jetter Code of Practice Manual* with a video that explains and demonstrates proper cleaning methods

By Ted DeBoda, P.E.

Blockages, root intrusion and other issues can cause major problems for water, wastewater and stormwater pipes. Proper and effective cleaning can improve system hydraulics and reclaiming lost capacity.

Proper cleaning also extends the life of the system by removing roots, grease and other materials that accelerate pipe deterioration. The concern, however, is that the process can be complicated. Without proper training and understanding, the process can fail and can even cause serious injury.

In our mission to set industry standards for the rehabilitation of underground pipelines, NASSCO has identified education on pipe cleaning techniques, and especially the use of jetter equipment, as a critical need for the industry. This is not learn-as-you-go technology.

The availability of a comprehensive step-by-step cleaning reference is critical to an effective sewer maintenance program and to successfully mentoring newer employees.

Through the years, NASSCO has provided a variety of resources on this subject. To ensure that information about cleaning techniques is of the highest quality and integrity, we offer resources that go beyond guidelines provided by manufacturers. The resources we publish are developed by industry experts and then reviewed by a peer committee to ensure impartiality.

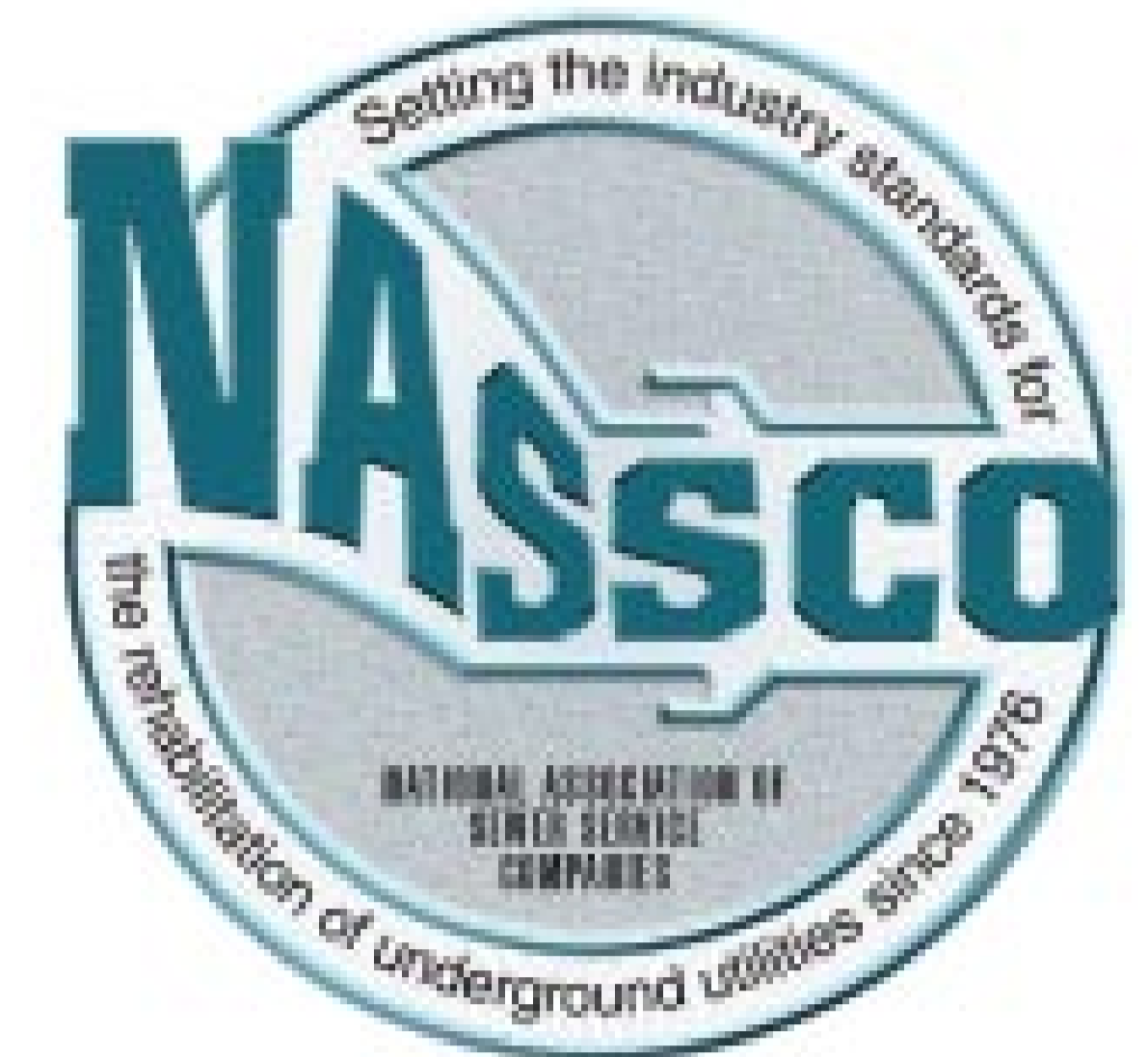
It all began in 2006 when NASSCO made sewer cleaning and safety a priority by introducing the original *Jetter Code of Practice Manual*. Designed to help anyone who operates or supervises the use of a jetter trailer or truck, the manual provides a thorough understanding of cleaning techniques, equip-

ment selection and sewer and stormwater operational improvements.

Since its introduction, the manual has evolved to include new and updated information gained from practical, in-the-field experience. The latest evolution has been the recent introduction of the *Jetter Code of Practice Manual* in Spanish.

While these manuals are an important and reliable go-to source, we realized that some people learn better by seeing. Given the critical importance of proper cleaning techniques, NASSCO and industry leaders and experts are developing a video that offers information on equipment and tools, step-by-step instructions, and safety tips for successfully cleaning pipes.

The video will cover basic information and benefits of pipe cleaning, followed by an overview of jetter and vacuum units, components, and their capabilities. It will



conclude with a demonstration of sewer cleaning from start to finish, highlighting machinery, tools, and technology.

The video will be a valuable supplement to the *Jetter Code of Practice Manual* and will leave operators, supervisors, and managers with a clear understanding of safe and efficient use of sewer cleaning and jetting equipment. We plan to release the video in early 2011. ♦

Ted DeBoda is executive director of NASSCO. He can be reached at director@nassco.org. NASSCO is located at 11521 Cronridge Drive, Suite J, Owings Mills, MD 21117.


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THE WHOLE BIG PICTURE

A combined laser, sonar and video inspection technology from CUES helps users cost-effectively assess conditions in large sewer pipes without interrupting service

By Ted J. Rulseh

Inspecting large sewers can be inconvenient and costly, in part because taking an interceptor line out of service for traditional crawler-based inspection requires extensive bypassing.

Furthermore, major interceptors commonly have access points spaced at 1,500- to 3,000-foot intervals, too long to inspect with camera vehicles pulling heavy video cable. Many access points are also off-road.



Photo courtesy of Hydromax USA

The FlyEye system from CUES, shown ready for insertion. The system can be deployed through a standard manhole.

TECHNOLOGY TEST DRIVE

PRODUCT:
FlyEye large-pipe inspection system

MANUFACTURER:
CUES Inc.

LOCATION OF DEMO:
Via telephone and Internet

DEMONSTRATED BY:
Ed Diggs, manager of business development, CUES Inc.

LIST PRICE:
\$385,000

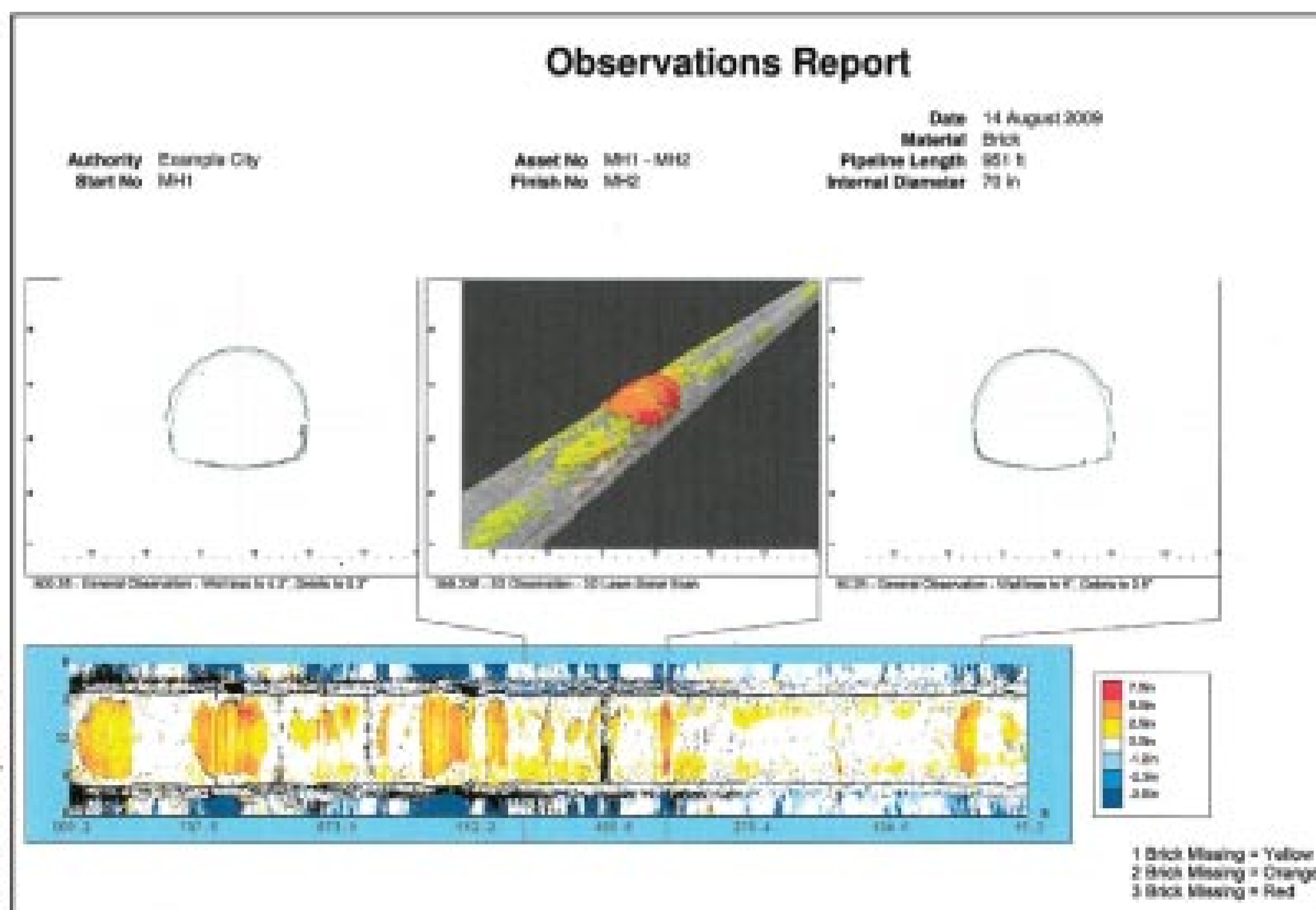


Figure 1. This example report from the FlyEye system shows data on a 70-inch brick sewer inspected with high-definition video and laser and sonar profiling. The red area on the pipe profile at the center shows a section with up to three layers of bricks missing.

Large sewers can be inspected while in service using cameras on floats, but because a video camera can't see below the waterline, the inspection is inevitably incomplete. In such cases, other tools can be used to assess pipe conditions both above and below the waterline.

Laser profiling looks above the waterline and accurately determines pipe ovality and alignment. Sonar profiling, meanwhile, looks below the water to measure structural dimensions as well as debris levels, grease accumulation and pipe capacity.

CUES Inc. has combined three technologies — digital high-definition video, laser and sonar — in its FlyEye inspection and evaluation system. All the inspection tools are mounted on a single float that can be used for continuous inspections up to 4,500 feet, or even longer. With this combination of technologies, the system can collect and process data on a complete range of pipe conditions.

The inspection provides a true 360-degree report on conditions

regardless of flow level. Digital reports with digital images provide a complete package to help identify defects and rank their severity. The data can be used to help plan pipe cleaning and rehabilitation programs.

Ed Diggs, manager of business development for CUES, gave a demonstration of the FlyEye data and its analysis software in an Internet-based presentation on Aug. 13.

Walk-around

The FlyEye inspection device

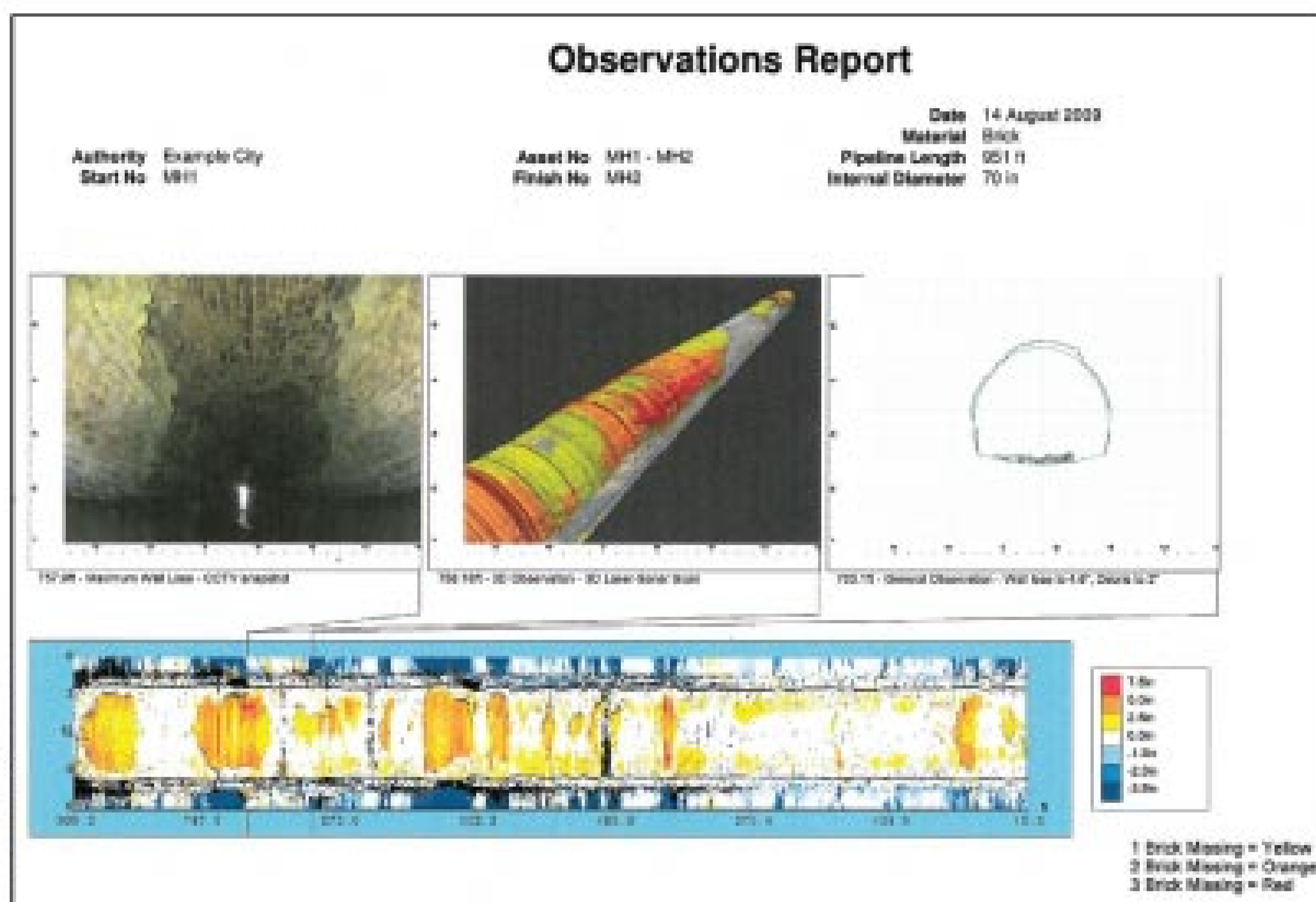


Figure 2. The high-definition video image (upper left) on this report on a 70-inch brick sewer clearly shows an area with bricks missing.

travels on a pontoon float. It is deployed into the pipe from an access point and travels downstream, typically pulled by a drift sock that keeps the float centered

in the pipe. It is tethered to non-stretch polyethylene marine rope (usually 5/32-inch in diameter) wound on a reel. The rope runs through a footage counter. The reel can be used to regulate travel speed and add stability.

For deployment through a standard manhole opening, the side pontoons are removed, then reattached once the unit is inside the manhole. The unit weighs about 120 pounds and requires a winch for deployment.

The sonar unit is attached below the pontoons and the laser profiler, with four analog cameras, sits on top, along with the video camera, which looks back (upstream).

The system uses no video cable. Instead, the camera, laser profiler and sonar profiler operate off separate battery packs, sized for 3.5 hours of operation, and record to separate 15 GB hard drives, creating a fully self-contained package.

The video camera captures images six times per second in resolution about eight times greater than for conventional pipeline video. Laser data is collected 12 times per second and sonar readings are taken once per second.

At the end of an inspection run, a grapple lowered into the endpoint manhole is used to catch the unit and lift it out of the sewer.

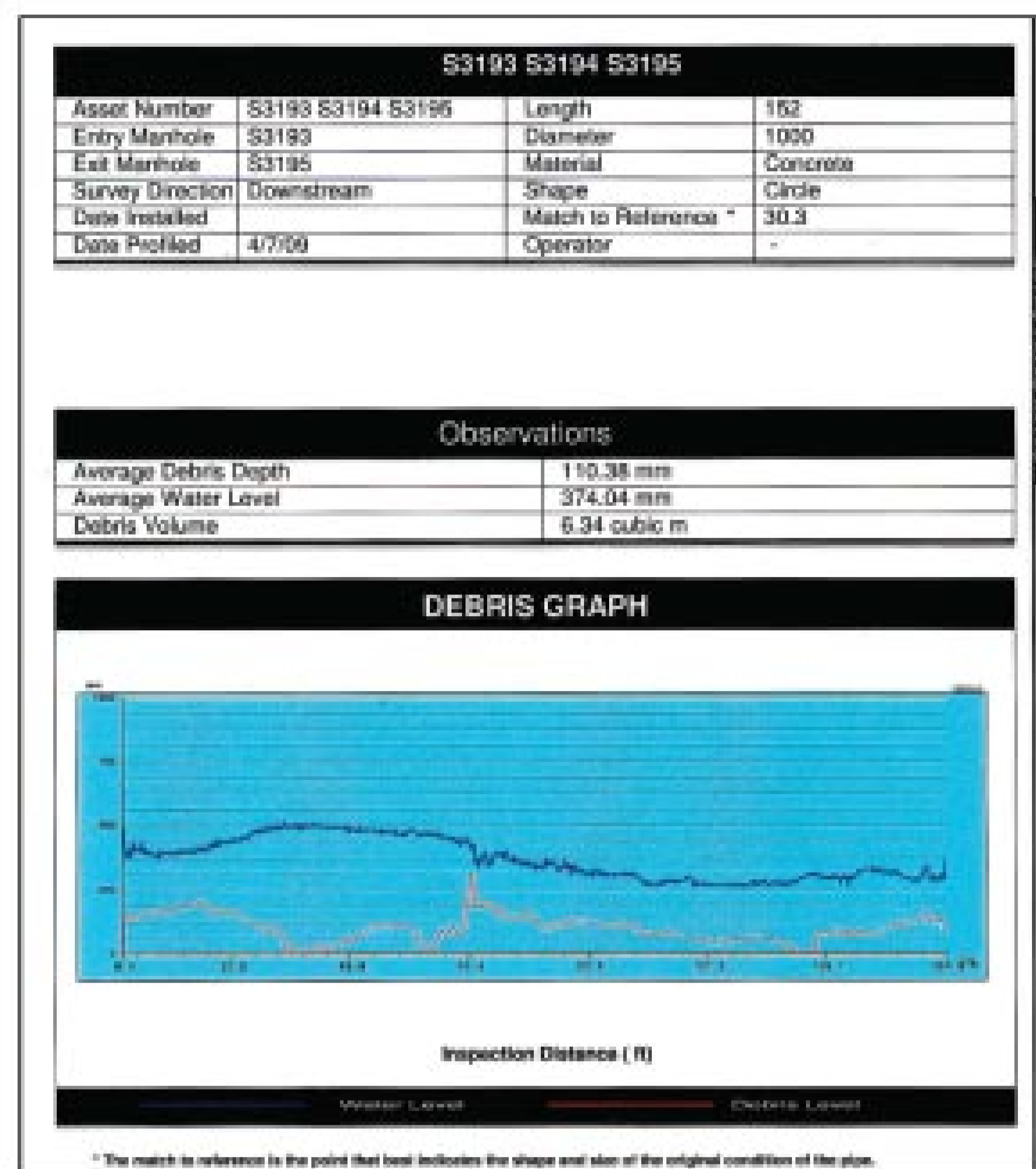
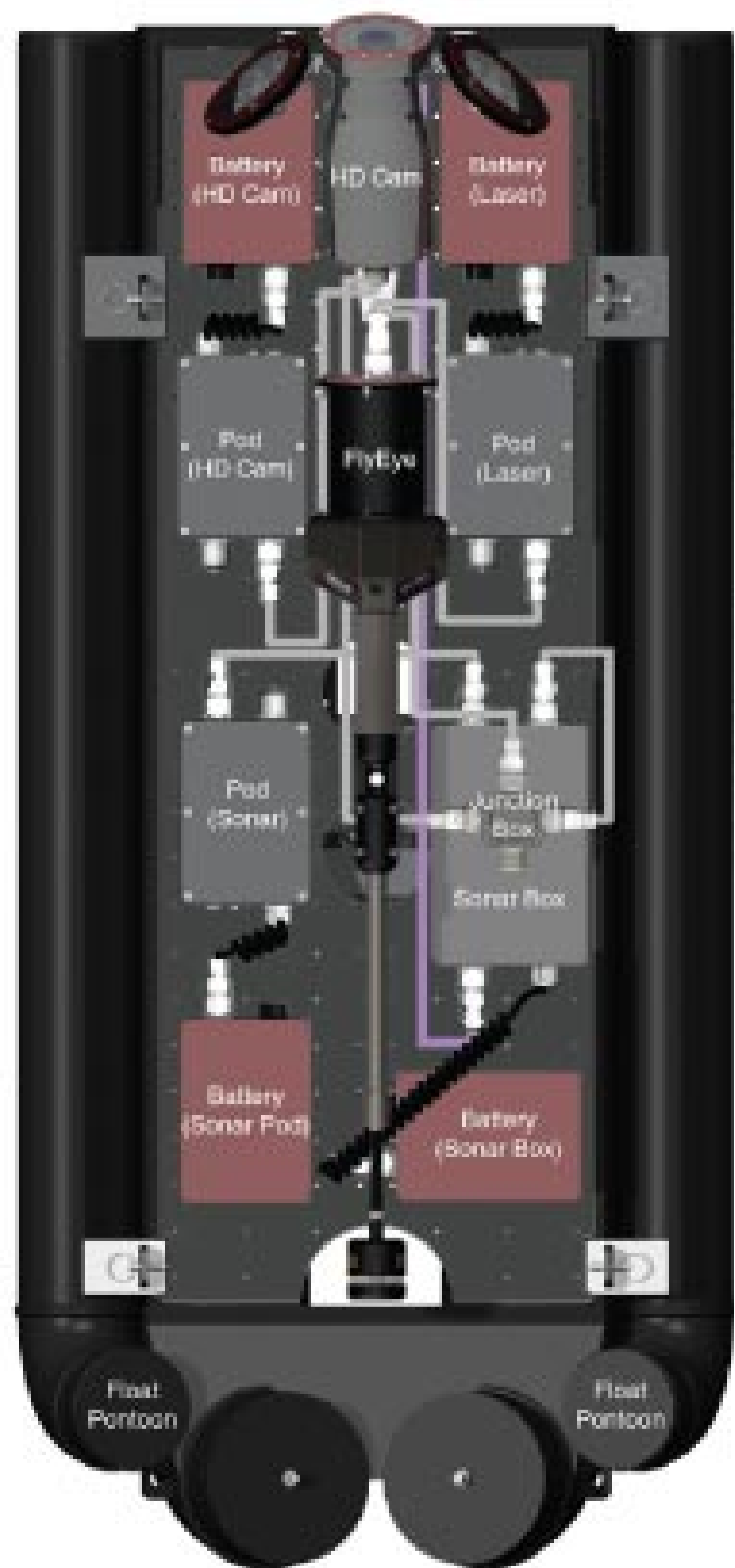


Figure 3. The FlyEye system produces a sonar debris report that depicts the actual locations of debris in the pipe as well as the amounts.



An overhead view of the FlyEye system mounted in its float shows the various components and their locations.

After an inspection, data from the hard drives is downloaded and reports are created using sophisticated software that integrates all three types of images. Reports, typically provided within a week after completion of the field work, provide pipe cross-section images every 50 feet, and at all problem areas as identified by CUES engineers.

Operation

The demonstration did not include observation of system deployment and data recording. Instead, it focused on the system software and the reports and integrated 3D images the customer receives.

Reports include a summary table showing an overview of the inspection and basic observations and comments (Figure 1). Individual report pages on specific observations (Figure 2) show:

- A high-definition image of the actual pipe at the point of the observation.
- A 3D color-coded laser-sonar scan image showing the entire pipe interior, including the water level and the debris at the pipe bottom.
- A laser-sonar profile scan showing the pipe profile as measured versus the original shape of the pipe.
- A graph of the pipe as if split

down the middle and laid out flat with the 12 o'clock position in the center and the 6 o'clock position at the top and bottom.

The individual images are correlated with the point on the flat graph to which they correspond, delineated in footage from the inspection entry manhole.

Color-coding on the laser-sonar images lets reviewers see at a glance the condition of the pipe. For example, red areas signify significant wall loss, such as from hydrogen sulfide erosion, and blue indicates significant debris buildup in the pipe.

The laser profile image shows quickly how far the pipe deviates from its original shape at the point in question. For this illustration to be meaningful, the customer must supply an accurate representation of the pipe profile as installed for entry to the software.

Reports also include a debris diagram (Figure 3) that shows the depth of debris (as identified by the sonar profile) versus the water level along the entire length of the pipe section inspected. Also included is a calculation of the average debris depth and the total debris volume in the pipe.

"This tells them how many cubic yards of debris the pipe con-



A technician in the field readies the FlyEye system for an inspection of an interceptor.

All the inspection tools are mounted on a single float that can be used for continuous inspections up to 4,500 feet, or even longer. With this combination of technologies, the system can collect and process data on a complete range of pipe conditions.

ains,” says Diggs. “If they know they have 40 cubic yards of debris in a pipe, and if their normal vacuum truck load is eight cubic yards decanted, they know they’re dealing with five truckloads,” says Diggs. “Or, if they simply want to knock down the debris in some of the higher spots, they can identify those spots and jet across the top. It makes the cleaning process much more efficient.”

Finally, the report includes a video called the Four-In-One. A single screen displays the pipe video, laser and sonar images running together as the float proceeds through the pipe. Below those images is the color-coded flat graph with a marker that indicates the float’s position at any time during the video.

Observer comments

The FlyEye system provides information in formats that appear easy to understand even for a relatively untrained eye, and especially for experienced engineers or pipeline maintenance technicians. It offers a holistic view of interceptor condition that could not be obtained with any one inspection technology by itself.

Manufacturer comments

Diggs notes that the FlyEye sys-

tem is designed to give communities data that helps them thoroughly understand the condition of large sewer pipes. That includes an assessment of system integrity as well as pipe capacity and debris levels.

“It provides all the tools they need to make informed decisions effectively and efficiently,” says Diggs. “We created it to be operator-friendly and easy to use.”

Diggs notes that the long pipe runs enabled by the self-contained, battery-driven system enable users to avoid taking heavy equipment to access points in environmentally sensitive areas.

A key attribute of the system, he says, is that it provides a report on which utility engineers can see sonar, laser, video, and a flat graph of the inspected pipe on a single screen, without having to toggle back and forth between views. “They get it all at once in a format that makes it easier to see the whole condition of the system,” Diggs says. ♦

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AVOIDING THE POWER TRIP

Power is valuable, but it can do damage if abused. Here are seven principles you can apply to keep your power as a leader in perspective

By Danita Johnson Hughes, Ph.D.

Leaders are found in almost every stratum of life: in companies, in governments, and in social organizations such as families and groups of friends. Leaders are powerful people because they can sway the attitudes, opinions, and actions of others. Leaders inspire, influence and achieve results.

Everyone has the capacity to lead, because everyone has the ability to influence others. Developing the right leadership strategy for the people you lead is crucial to getting the results you desire. Therefore, it is important to strengthen your skills to better influence, motivate, communicate and coach your people.

Contrary to what many might think, few people are born as leaders. Leadership is a skill developed over time, through practice and hard work. Too often, being a leader and owning power can trip you up. Power in such cases can be misused or abused.

Refining skills

Being on a “power trip” is usually viewed negatively, and it can cause others to lose respect and appreciation for you as their leader. Therefore, it is wise to recognize, develop, and refine the personal characteristics that mark truly effective leaders. Here are Seven Cs for gaining and maintaining power and for keeping power in its proper place:

Character. As a leader, you will be confronted with competing demands from time to time. The ability to manage those demands

with integrity, honesty and selflessness is crucial. Being willing to sacrifice your success and your fortune takes guts. Being unwilling to sacrifice your integrity takes character.

Courage. Martin Luther King, Jr. said, “The ultimate measure of a man is not where he stands in moments of comfort and convenience, but where he stands at times of challenge and controversy.” Courageous people take calculated risks. They hope for the best possible outcome but are prepared for a loss.

Commitment. Every day of your life you may face challenges. But commitment is the will and strength to keep forging ahead no matter how many times you are knocked to your knees. It’s the ability to accept setbacks as temporary inconveniences that get in the way and try to steer you off course. In the long run, unwavering perseverance gets you through.

Cautious attentiveness. A good leader needs to be accurately informed. Be sure you have all the available facts before deciding anything. Carefully consider all options and their possible results before acting. Thinking through the potential consequences of your decisions often prevents problems down the road. Having enough information is only part of the equation. When you have all the information available, use your intuition to fill in what is missing.

Connectability. The ability to develop meaningful relationships with others is the most important quality a leader can possess. You

gain power through relationships. Understanding and connecting with others is a key component of positive relationships. Developing relationships with key people will expand your sphere of influence, your access to resources, and your capacity to make things happen.

Contribution to the welfare of others. One of the greatest attributes of a good leader is willingness to serve. Many times, people enjoy being in positions of power because of what they gain personally. Genuine service comes from the heart. The willingness to put other people’s needs and desires before your own is reflected in the attitude and actions of a good leader.

**Leadership is about having self-confidence
and being passionate about your values and beliefs.
A good value system can help you to stay on course
when the ship gets tossed in the storm.**

Creative perception. Often referred to as vision, creative perception is essential to leadership. Leaders have a passion for change. They are preoccupied with future possibilities. As a leader, you must be able to articulate your vision if you want to inspire and motivate others. Employees who are excited about the leader’s vision and the direction of the organization become much more productive and willing to participate.

Forms of power

Popular literature on leadership is rife with contrasts between leadership and power. But to be an effective leader you have to exer-

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 Ted Rulseh at 800/257-7222, or e-mail editor@mswmag.com.

cise power to realize the results you are striving to achieve.

Because everyone has the capacity to lead, each person is powerful in his or her own way. Simply defined, leadership is the ability to influence others to act and to motivate them to get things done. Inherent in leadership is the ability to bring others along, through the power of persuasion, erudition or position.

Persuasive power is your ability to make an emotional connection with others, and through this connection persuade their actions. Persuasive power reflects your

charisma — the ability to draw people to you.

Erudite power is gained through extensive knowledge of a subject or area of expertise. It is usually based on acknowledgement of your intellect or accomplishments.

Positional power is based on your ability to control and have authority over others by virtue of hierarchical order. It is most often observed in employment situations where there are levels of employees from line staff through senior management, and in politics where a person ascends to a position of authority by election or appointment.

In most cases, you may ascend

to leadership through a combination of these factors. No matter how you reach a leadership role, it will involve influencing others.

Knowing who you are is the most critical element in becoming an effective leader. It requires looking through the lens of critical analysis. You must be in control of yourself before you can expect others to follow your lead.

Leadership is about having self-confidence and being passionate about your values and beliefs. A good value system can help you to

stay on course when the ship gets tossed in the storm. ♦

Danita Johnson Hughes, Ph.D. is a health care industry executive, public speaker, and author of the book, *Turnaround*. She inspires people to dream big and understand the role of personal responsibility in personal and professional success. In her first book, *Power from Within*, she shared the principles that helped her overcome meager beginnings and achieve success. Visit www.danitajohnsonhughes.com.

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Product Spotlight

Netting System Captures Debris from Stormwater Runoff

By Ed Wodalski

The StormX full-capture netting system from Storm Water Systems collects trash, litter and debris from runoff. Available in sizes from 18 to 60 inches in diameter (custom sizes available), the system uses easily detached and emptied HDPE netting designed to stop floatable and non-floatable trash and debris down to 5 mm.

"According to stormwater engineers, floating litter and debris constitutes about 15 to 20 percent of the litter out there," says Gary Hopkins, company president. "There's probably another 75 to 80 percent of non-floatables that are going into our waterways, and that's what we hope to go after with this product."

The collection system has stainless steel hubs anchored in concrete for a weir configuration, or it can be attached to existing pipe ends or outfalls. Weir configurations best serve outfalls larger than 70 inches.

"The concept is to catch all litter as it comes out of an outfall line before it enters the stream," Hopkins says. "California has enacted some laws that require everything to be captured down to the size of a cigarette butt, and StormX is that kind of product."

Hopkins recommends inspecting the commercial-grade fishing nets with UV stabilization after each rain event to see if they need changing. Built-in overflow mechanisms allow heavy runoff to flow unimpeded. System overflow capacity can be calculated with a downloadable calculator at www.stormwatersystems.com/stormx.html.

The product was developed in Australia and has been used there for 15 years. The first United States installation took place in Los Angeles 10 years ago, and those nets are still being used, Hopkins says. The nets are typically five feet long, and extended lengths are available. Nets can be detached and emptied by a two-man crew and truck crane. **For more information, call 888/730-5819 or visit www.stormwatersystems.com.**



StormX from Storm Water Systems

Brooks Introduces Gas, Water Meter Security Products

A locking pipe plug, wing-type valve protector and water union nut locks are among the latest gas and water meter security products from Brooks Utility Products.

Secured with a barrel lock, the steel locking pipe plug prevents unauthorized use of service during meter or service piping change-outs. Made of diecast zinc alloy, the wing-type valve protector encloses the barrel lock, protecting it from physical attack, including hacksaws and hammer blows. The three-component water union nut lock is designed to encapsulate union nuts to secure gas and water meters. The entire assembly is secured with a barrel lock. **888/687-3008; www.brooksutility.com.**



Bilco Offers BIL-Guard Hatch Railing System

The BIL-Guard hatching railing system from The Bilco Co. is designed to satisfy OSHA standard CFR 1910.23, which requires the exposed sides of roof openings to have guardrail protection. The fixed railing system provides a permanent

means of fall protection and mounts directly to the capflashing of any brand of roof hatch. The safety yellow railing is made from a durable fiber reinforced polymer. **203/934-6363; www.bilco.com.**

MWH Soft Releases InfoSWMM Version 10

InfoSWMM Generation V10 urban drainage modeling and design software for ArcGIS 10 from MWH Soft is designed for managing urban runoff and wet-weather water quality problems in combined sanitary and storm sewers. The software features all operations of a typical sewer system – from analysis and design to management functions such as water quality assessment, pollution prediction, sediment transportation and deposition, urban flooding, real-time control and recordkeeping — in a single, fully integrated geoengineering environment. **626/568-6868; www.mwhsoft.com.**

General Offers Gasoline-Powered Ventilator

The GP8/GP8H portable gasoline air ventilation blower from General Equipment is designed for most confined work space requirements. The unit is made to supply fresh air to construction sites, remove toxic and noxious atmospheres from confined work spaces, aid in detecting sewer line leaks and provide fresh air for workers inside tanks and vaults. The 56-pound ventilator is available with a 3.5 hp Briggs & Stratton, 3,600 rpm engine (GP8) or 3.5 hp Honda engine (GP8H). The blower housing is fabricated from cast aluminum. An adjustable governor with manual speed control allows the operator to vary the blower volume as needed. **877/344-4365; www.generalequip.com.**



Super Products
Introduces
Mud Dog 650
Hydroexcavator

The Mud Dog 650 hydroexcavator from Super Products LLC is designed for easy maneuverability and safe, effective digging in confined urban settings, rough compact terrain and remote, hard-to-reach locations. The unit features a 6.5-cubic-yard debris dump body and 500-gallon freshwater tank that offers water pressures up to 10 gpm at 2,500 psi. The 8-inch positive displacement vacuum system provides airflow of 3,600 cfm at 18 Hg. 800/837-9711; www.superproducts.com.



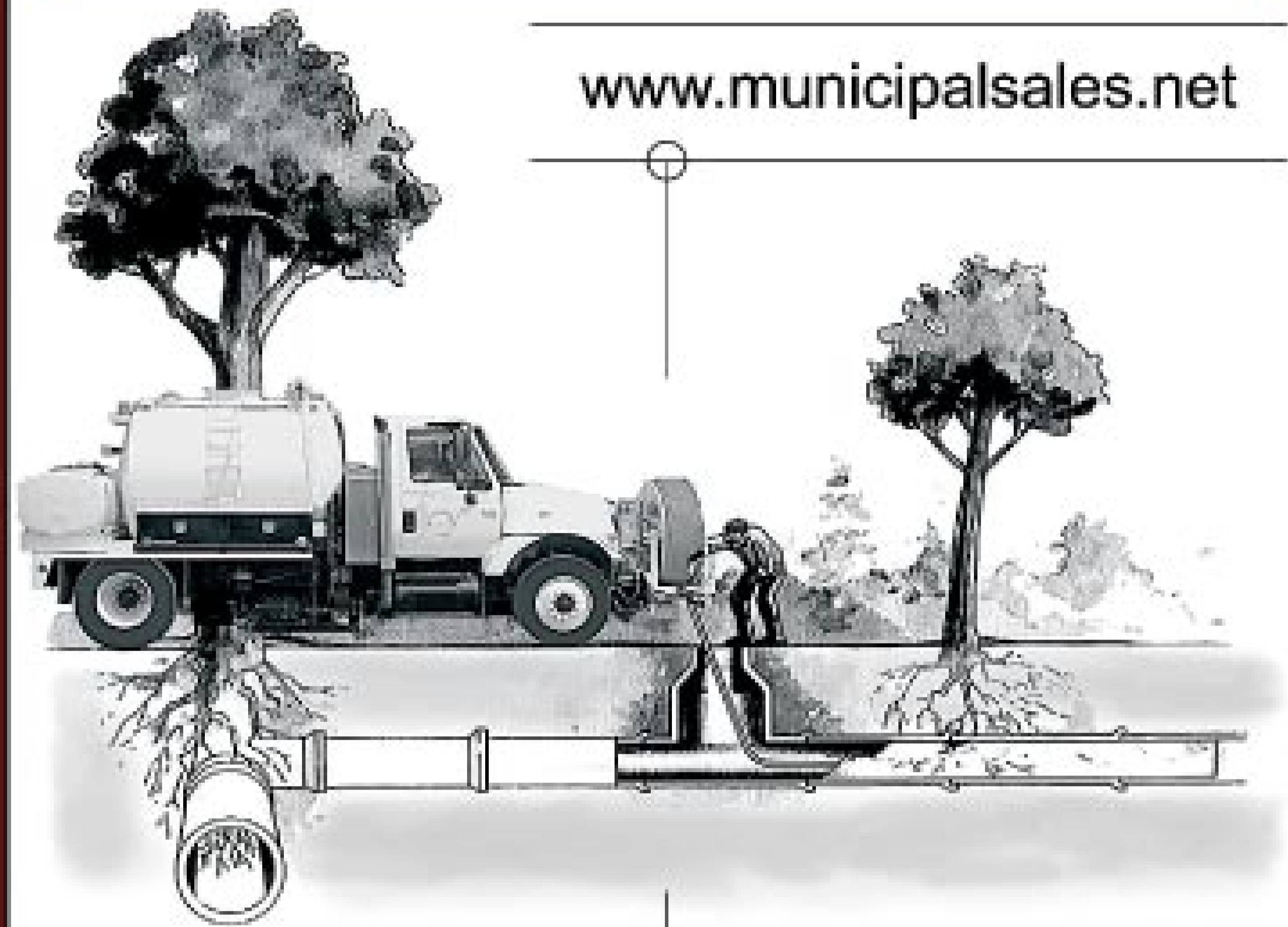
AbTech Offers Smart Sponge Stormwater Filtration

Smart Sponge Plus stormwater filtration technology from AbTech Industries is designed to remove oil and other pollutants from stormwater runoff. The system contains an antimicrobial agent made to reduce coliform bacteria in stormwater and industrial and municipal wastewater. 800/545-8999; www.abtechindustries.com. ♦

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ISCO Launches Pipe Products Web Site

ISCO Industries launched a new pipe products Web site, www.isco-pipe.com. The interactive site features a technical library, products and services information, and animation of various pipe fusion and installation procedures. Other features include a newsroom, image gallery, market information and Frequently Asked Questions section.

Sewer Equipment Co. Builds 5,000th Machine

Sewer Equipment Co. of America produced its 5,000th sewer cleaner in August. The 800-HPR truck jet was built at the company's Chadwick, Ill., production facility and sold by Jack Doheny Supplies of Michigan to the Oakland County Water Resources Commission in Pontiac, Mich. The fully enclosed and heated truck jet features an extendable/retractable hose reel.



Sewer Equipment Co. of America employees celebrate production of the company's 5,000th sewer cleaner in August at its Chadwick, Ill., production facility.

I.T. Awarded WSSC Pipeline Inspection Software Contract

Infrastructure Technologies was awarded a CCTV inspection software contract in June for the Washington Suburban Sanitary Commission in Laurel, Md. I.T. will provide infrastructure support for implementation of the new application, including hardware, software installation, configuration and training.

AbTech's Smart Sponge Receives EPA Approval

AbTech Industries' Smart Sponge Plus technology has received approval from the U.S. Environmental Protection Agency for the reduction of harmful coliform bacteria in stormwater runoff.

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Pure Technologies Purchases PPIC

Pure Technologies Ltd. of Calgary, Alberta, Canada, concluded the purchase of The Pressure Pipe Inspection Co. in August for \$34.9 million (Canadian) and common stock. PPIC is a privately held pipeline condition assessment company headquartered in Mississauga, Ontario, with revenues of \$14.6 million in fiscal year 2009. Dr. Brian Mergelas, former PPIC chief executive officer, has been named Pure's senior vice president, corporate strategy and development.



Pictured (from left) are Brian Mergelas, Pure Technologies senior vice president of corporate strategy and development, Mark Holley, president of Pure Technologies U.S. Inc., and Jack Elliott, president and COO of Pure Technologies Ltd.

Wastewater Organizations Produce Management Document

The National Association of Clean Water Agencies, the Water Environment Federation, the American Society of Civil Engineers and the American Public Works Association have collaborated to produce the Core Attributes of Effectively Managed Wastewater Collection Systems. The 34-page document promotes good engineering practices to managing and operating separate sanitary collection systems. The document can be downloaded at www.nacwa.org/coreattributes.

Joy Purchases EasyCAM Sewer Inspection Equipment

Rick Joy has purchased EasyCAM Sewer Inspection Equipment and will be headquartered in Naples, Fla.


RS Technik Launches Web Site

RS Technik has launched a new product, training and services Web site, www.rstechnik.com, for trenchless pipe rehabilitation and repair. The English and German language site will soon include Spanish, French and Italian versions.



Schier Products Moves to Kansas

Schier Products in July moved its drain line production and shipping operations to 9500 Woodend Road, Edwardsville, Kan., near Kansas City. The producer of grease and solids interceptors had been located in Wisconsin the past 40 years. ♦



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EDUCATION DAY

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SSCSC Southern Section Collection Systems Committee

- 8 a.m. Sewer Collection System History & the Evaluation of Pipeline Materials and Problems
- 9:30 a.m. Combo Vacuuming, a Forgotten Art
- 11 a.m. Keeping your Standard CCTV Inspection Program Relevant
- 1 p.m. Growing Your Business by Building Your Company Image
- 2:30 p.m. Pump and Lift Station Fundamentals: How to Achieve Maximum Service and Reliability
- 4 p.m. Making Sense out of Nozzle Nonsense

NAWT National Association of Wastewater Transporters

- 8 a.m. So You Think You Want to Own a Waste Treatment Facility?
- 9:30 a.m. Grease as a Resource
- 11 a.m. Resource Recovery - Methane and Septage
- 1 p.m. O & M Problems on Drip Distribution Systems
- 2:30 p.m. O & M Problems We Have Seen
- 4 p.m. O & M Problems with Media Filters

NASSCO National Association of Sewer Service Companies

- 8 a.m. Grout: Its Use and Application for the Total Collection System
- 9:30 a.m. Cured-In-Place Pipe
- 11 a.m. Pipe Bursting Tools for Everyday Utility Installations
- 1 p.m. How Will You Know if You Need to do a Sewer System Evaluation Survey (SSES)?
- 2:30 p.m. Laser Profiling Applications for Documenting Piping System Conditions
- 4 p.m. Advancements in UV Technology for Curing CIPP

WJTA WaterJet Technology Association

- 8 a.m. Estimating the Vacuum Job for Fun and Profit
- 9:30 a.m. How to Maximize the Power of Your Waterjetter
- 11 a.m. Waterjetting - Financial Startup Considerations and Real-World Application

PSAI Portable Sanitation Association International

- 1 p.m. Understanding Your True Cost per Service for Special Events - Part 1
- 2:30 p.m. Understanding Your True Cost per Service for Special Events - Part 2

NARC National Association of Regulated Carriers

- 4 p.m. Avoiding Violation Fines and Tickets with DOT Safety Compliance

NOWRA National Onsite Wastewater Recycling Association

- 8 a.m. Troubleshooting Our Modern Waste Stream
- 9:30 a.m. Pumps - A Basic Understanding
- 11 a.m. System Remediation - Why, What, When, Where and How?
- 1 p.m. Selling the System to Site Conditions
- 2:30 p.m. Sampling Sewage Treatment Systems
- 4 p.m. Effluent Dispersal and Water Management

NEHA National Environmental Health Association

- 8 a.m. The Qualified O & M Service Provider
- 9:30 a.m. Effluent Screens and Filters for Onsite Applications
- 11 a.m. Develop Champions for Your Decentralized Wastewater Projects
- 1 p.m. The Business of Management
- 2:30 p.m. Developing O & M Inspection Actions
- 4 p.m. Working with Regulators, Regulations & Industry

SCOTT HUNTER Business Track

- 8 a.m. Creating an Extraordinary Organization - The Mindset of Leadership (Part 1)
- 9:30 a.m. The Mindset of Leadership (Part 2)
- 11 a.m. The Mindset of Leadership (Part 3)
- 2:30 p.m. Creating an Outrageously Successful Organization (Part 1)
- 4 p.m. Creating an Outrageously Successful Organization (Part 2)

LRN Leaders Resource Network

- 8 a.m. The Disciplines and Art of Business Success
- 10 a.m. Developing a "Fantastic" Team
- 1 p.m. Diversifying or Specializing Your Services
- 3 p.m. Succession Planning

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THURSDAY SESSIONS

March 3, 2011

BUSINESS TRACK

- 8 a.m. 45 Marketing Tips in 45 Minutes
Lenzyme Inc. - Jerard Nighorn
- 9:30 a.m. The Benefits of Vehicle Routing Software in Today's Economy
RouteOptix Inc. - Ron Davey
- 11 a.m. Unleashing the Power to Profit and Freedom
Nexstar Inc. - Kenny Chapman

LIQUID WASTE TRACK

- 8 a.m. The Evolution of Effluent Filters
Bear Onsite LLC - Theo Terry
- 9:30 a.m. "Life Cycle" From Waste to Windfall
Big Fish Environmental - John Campbell
- 11 a.m. Take Confined Space Seriously - A Matter of Life and Death
M Tech Co. - Chris Cira

NEW BUSINESS OPPORTUNITY TRACK

- 8 a.m. Centripipe (Centrifugally Cast Concrete Pipe)
AP/M Permaform - Steve Henning
- 9:30 a.m. Valve Exercising and Fire Flow Testing for a Reliable Water Distribution System
Hurco Technologies Inc. - Lynn Hurley
- 11 a.m. The Basics of Buying and Selling a Septic or Sewer Business
COLE Publishing - Jeff Bruss

MUNICIPAL TRACK

- 8 a.m. Think Like Grout... For Better Point Repair of Below Grade Structures
Prime Resins Inc. - Scott Kelly
- 9:30 a.m. CCTV Inspections Evolve to Unparalleled Heights
Aries Industries Inc. - George Rada
- 11 a.m. Manhole Chimney Section Rebuilds
Mr. Manhole Systems - Michael Crites

INSTALLER TRACK

- 8 a.m. Membrane Bioreactor (MBR) Technology for Decentralized Wastewater Systems
Bio-Microbics Inc. - Dr. Reza Shams
- 9:30 a.m. Shallow Pressurized Drainfields for Soil-Based Effluent Dispersal
Orenco Systems Inc. - Mark Gross
- 11 a.m. Onsite System Solutions for Shallow Installations
Infiltrator Systems Inc. - Dennis Hallahan

CLASES EN ESPAÑOL

- 8 a.m. Técnicas Corrientes de Limpieza de Tuberías
Innerline Engineering - Jim Aanderud
- 9:30 a.m. Avances en la Evaluación de Tuberías y Tecnologías sin Zanja para Rehabilitación de Tuberías
CDM - Luis Roberto León
- 11 a.m. La Elección de Boquillas en la Limpieza de Drenajes
Innerline Engineering - Jim Aanderud

FRIDAY SESSIONS

March 4, 2011

MUNICIPAL TRACK

- 8 a.m. Large Pipe Inspection
QUES Inc. - N.H. Doc Bennett
- 9:30 a.m. Chemical Grouts & Grouting Methods
Avanti International - Jim Gentry
- 11 a.m. Sectional CIPP Repairs Per ASTM F2599
LMK Enterprises Inc. - Rick Gage

BUSINESS TRACK

- 8 a.m. Save Money - Go Paperless
Clear Computing Inc. - Joel Smith
- 9:30 a.m. Marketing Your Septic/Drain Service Business
COLE Publishing Inc. - Jeff Bruss

CLASES EN ESPAÑOL

- 8 a.m. Anúnciate exitosamente y económicamente, Cuidando tu negocio con atención
Armal Inc. - Angel Romero
- 9:30 a.m. Eficiente las operaciones de limpieza de cualquier red de alcantarillado de América Latina
Hi-Vac Corp. - Gerardo Ramirez

LIQUID WASTE/INSTALLER TRACK

- 8 a.m. Grease Interceptor 101
Schier Products - Charlie Ismert, Ben Ismert
- 9:30 a.m. Datalogging for Onsite Septic System Diagnosis
SJE Rhombus - Scott Rietsema
- 11 a.m. Belt Press Performance Optimization
BDP Industries Inc. - Kelly Brown

SEWER & DRAIN CLEANING TRACK

- 8 a.m. Inline Cutting Tools - Taking Science to the Sewer!
NozzTeq Inc. - Scott Paquet
- 9:30 a.m. Waterjetting! Impact on Drain Cleaning
US Jetting - Nick Woodhea, Ken Bryson
- 11 a.m. Don't underestimate your cable machines?
MyTana Manufacturing - Jack Donaldson

PORTABLE RESTROOM TRACK

- 9:30 a.m. Give Me 3 Reasons Why I Should Advertise My Portable Restroom Company
Satellite Industries Inc. - Mitch Moores
- 11 a.m. How to Start a Business in South America, Marketing and Importing/Exporting
Armal Inc. - Angel Romero



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Advanced Drainage Systems
Advanced Infrastructure Technologies
Advanced Pressure Systems
Advanced Tank Systems
Advanced Treatment Inc.
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Aqua Mole Technologies
Aqua-Zyme Disposal Systems Inc.
Arcan Enterprises Inc.
Aries Industries Inc.
Armal, Inc.
Arthur Products
Ashland Trap Distribution, Co.
Atlanta Rubber & Hydraulics Inc.
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Bad Dog Tools
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BDP Industries
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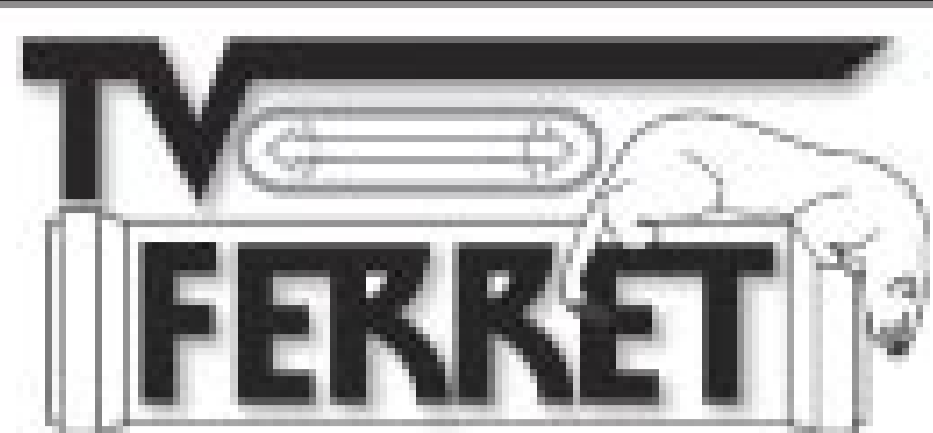


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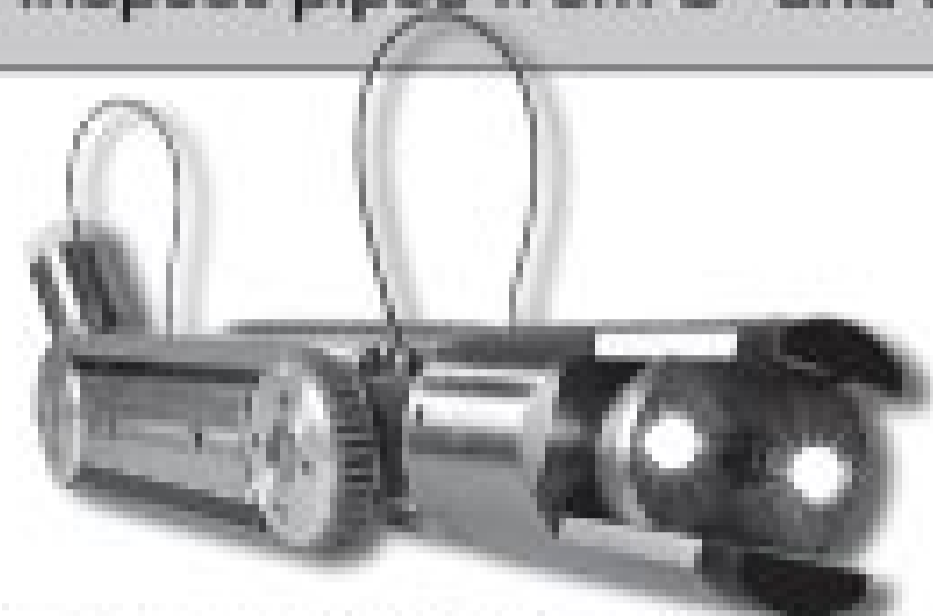
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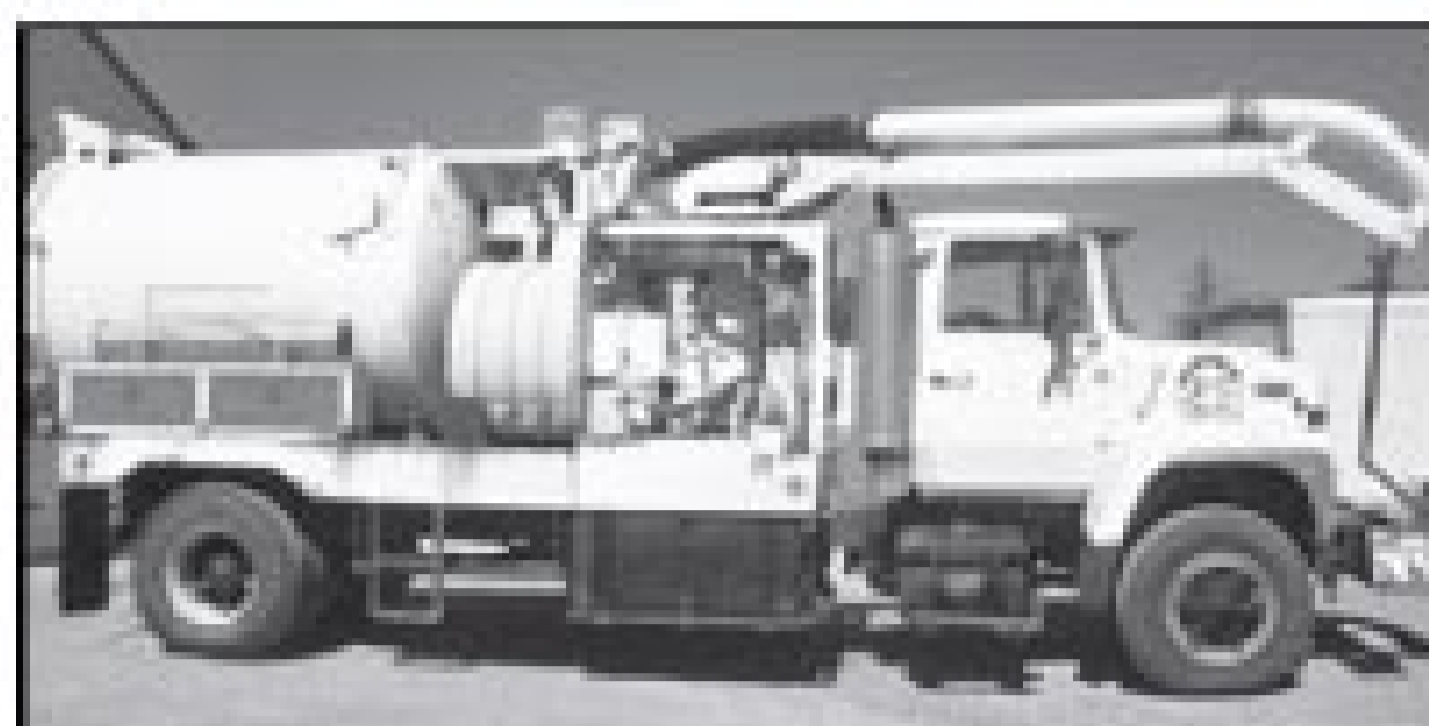
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