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May 2009
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THE FLOW OF INTELLIGENCE

Extensive wastewater flow monitoring helps King County (Wash.) see into the future

PAGE 16

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SuperVision™ SAT crawls 300' down lines 6" and larger, and then pushes its camera 100' into laterals as small as 3.5". Its auto-leveling camera pans and tilts to capture sidewall detail, and is pushed by force-sensing wheels designed to prevent cable damage. Easy to use and maintain, the system integrates with any existing SuperVision™, adding only a small reel alongside the primary crawler reel.

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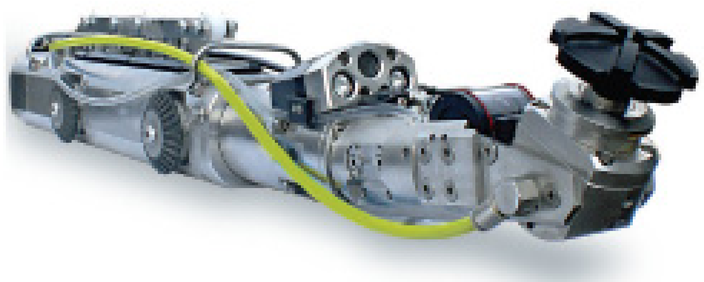

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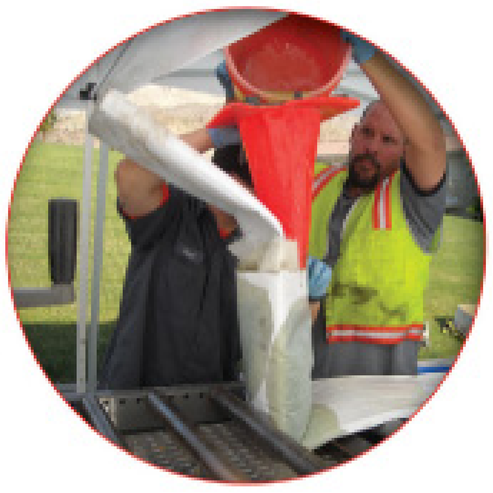

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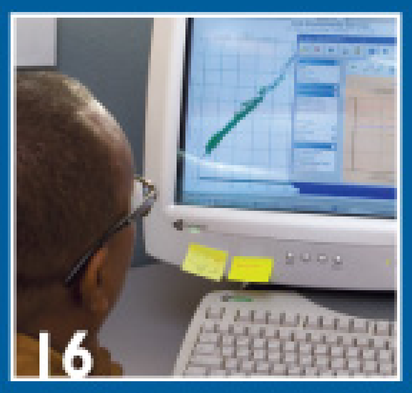
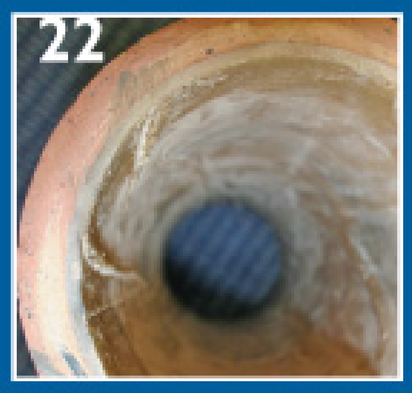
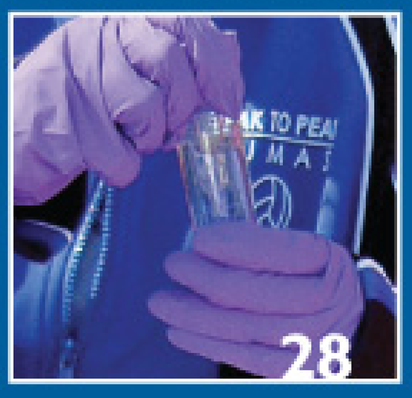
INSIDE:

FLOW CONTROL AND MONITORING, DEWATERING AND PRETREATMENT







COVER:
The King County (Wash.) Wastewater Treatment Division uses an in-house flow monitoring project to identify I&I issues, monitor industrial discharges, identify and plot salt water intrusion into the conveyance lines, and support specific pilot projects. Here, facilities inspector Michael Sands replaces a logger unit at a monitoring site. (Photography by Peter Kuhnlein)

FEATURES

COLUMNS

COMING IN JUNE 2009

Pipeline Inspection, Surveying and Mapping

- Sewer: Using GIS for planning in Fullerton, Calif.
- Sewer: In-house pipe inspection at Fairfield-Suisun (Calif.) Sewer District
- Storm: Cross-trained inspectors in Seattle, Wash.
- Better Mousetraps: Homemade sample arm in Olathe, Kan.

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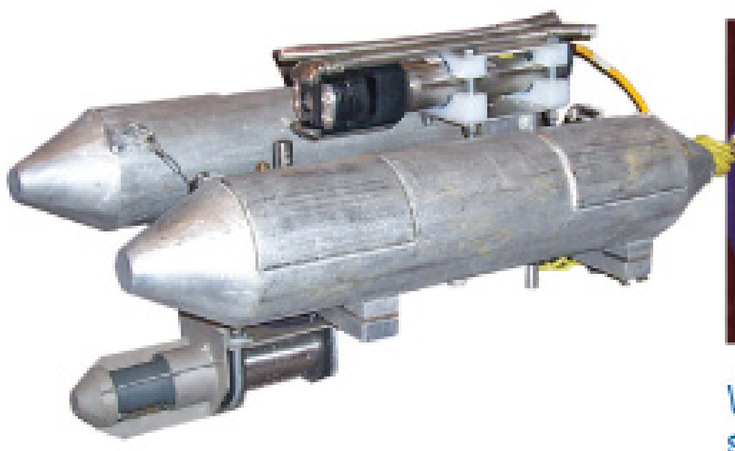
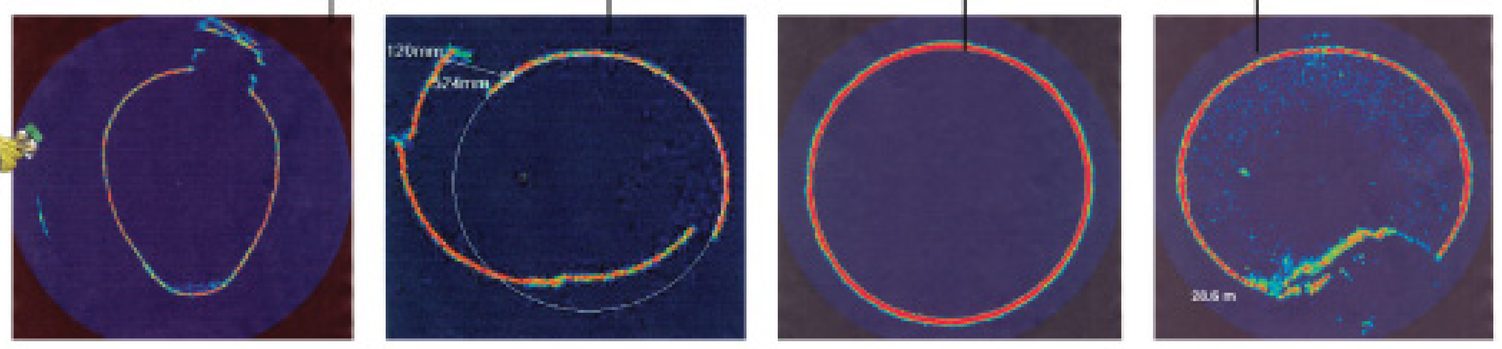
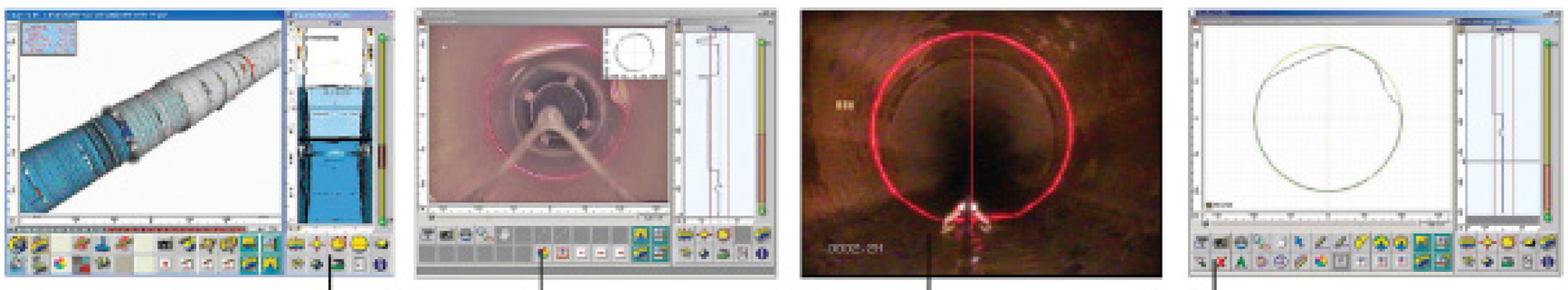
Sonar Pipe Profiler



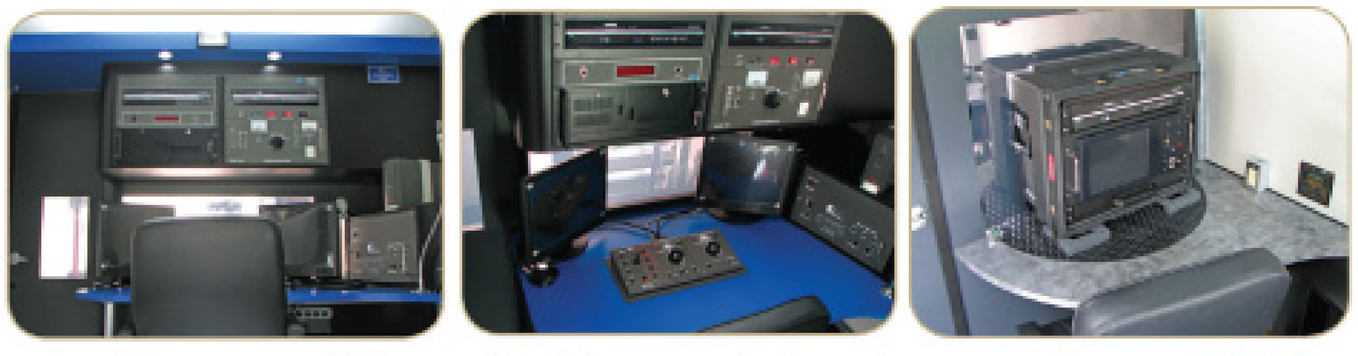


With the CUES Sonar Pipe Profiler, you can view the pipe profile, ovality, and dimension data of significant observations, such as silt level, grease accumulation, pipe deformation, offsets, etc., below the waterline.

Laser Pipe Profiler



The Laser Profiler simply attaches to your existing CCTV camera and the resultant output from the laser is analyzed using innovative machine vision software to collect survey data for analysis of pipe deformation, ovality, true pipe diameter, corrosion, capacity, and verification of liner installation.



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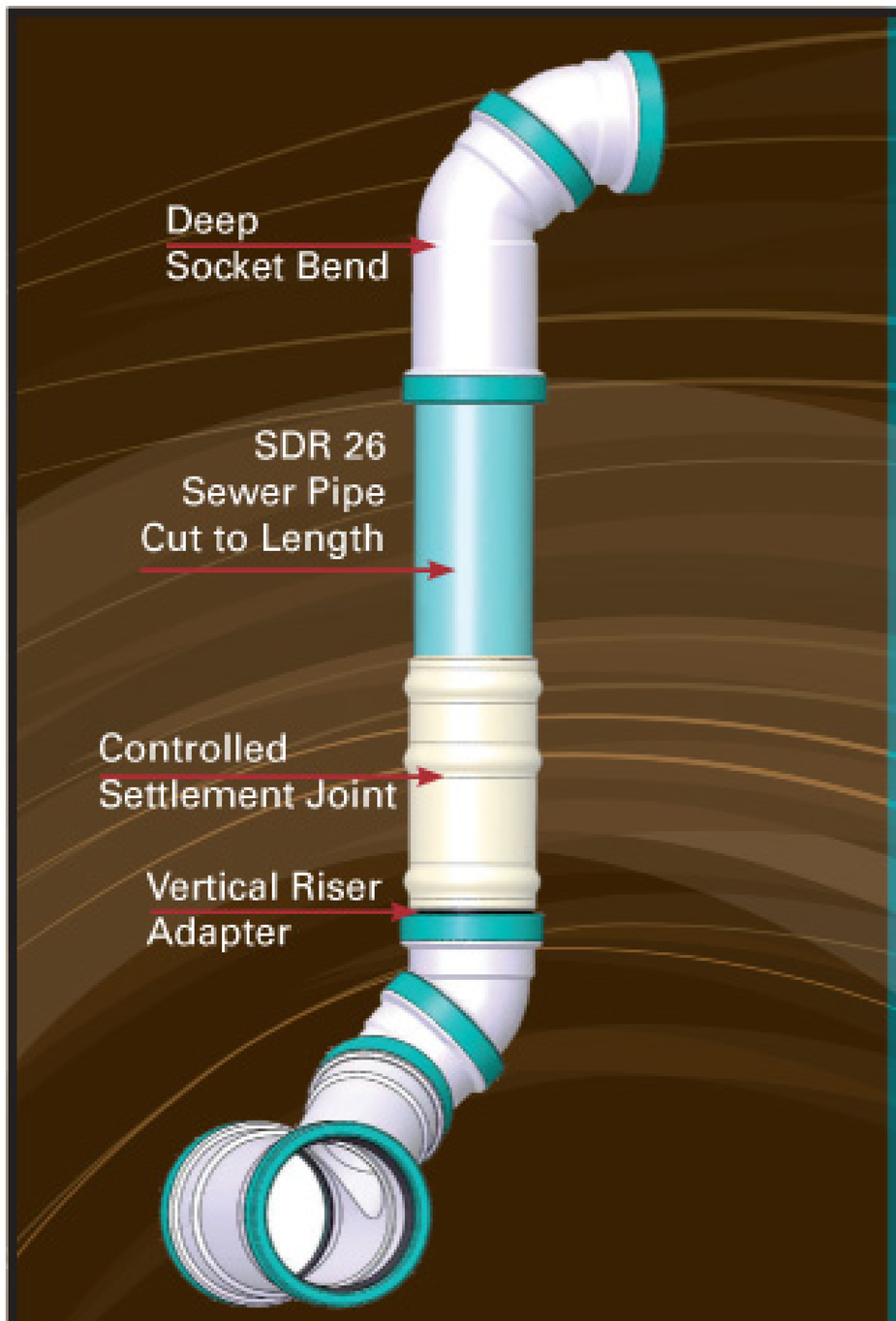

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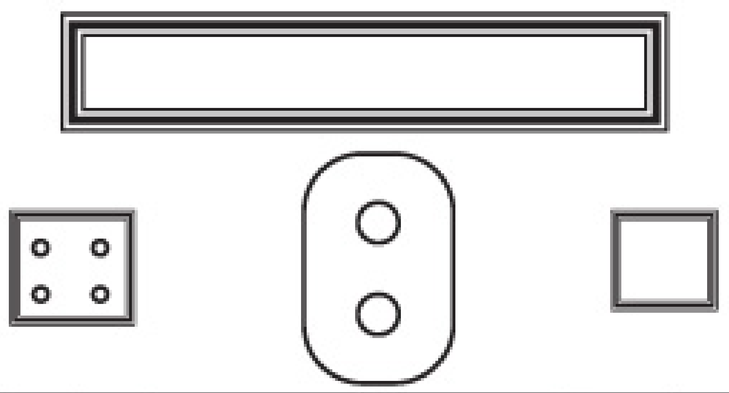

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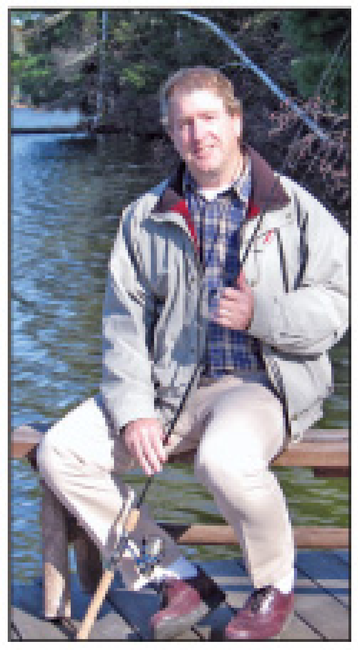
A LUXURY NO LONGER

Computers have long since come of age as basic household and business tools. Their power is steadily making life more efficient for infrastructure managers.

By Ted J. Rulseh



FROM THE EDITOR

Ted J. Rulseh

> *"Any sufficiently advanced technology is indistinguishable from magic."*
> **Arthur C. Clarke**

I am old enough (easily) to remember when home computers were widely considered "a solution in search of a problem."

Around the time IBM and Apple released their first desktop models, about all anyone could think to use them for was balancing the checkbook and installing recipes. And who would pay what was then a hefty price for a machine to do those things? Very few people, as it turned out.

We all know what has happened since. Computers got steadily more powerful and less expensive. Printers improved. The Internet came into existence. Digital cameras were invented. Software tools emerged by the bushel. Video games arrived. Music went electronic. In short order, the world went digital.

Now a home computer is not only useful — it is about as essential as electricity, central heating and indoor plumbing. And how much more essential for business — including the business of managing underground infrastructure?

More examples

This issue of *Municipal Sewer & Water* contains two more examples of how municipalities and utility agencies are using electronics to keep tabs on their infrastructure better and more efficiently than ever before.

The experience of St. Paul, Minn., shows that paper maps and paper drawings are quickly going the way of vinyl record albums and typewriters. Dan Bartholic, a civil engineer in the city Public Works department, observes, "Accurate records of the sewer network are critical for the efficient day-to-day operation of our system.

Drop a line to editor@mswmag.com and tell us about your adventures with the latest in time- and labor-saving electronic tools. We'll report on your successes in future issues of the magazine.

"However, in a time when our staff is shrinking and demand for information is growing, it is a big challenge to keep those records up to date. Improved technology and processes have made the task much easier."

That pretty well sums it up. It's not just big cities that are adopting technology. This magazine has carried numerous stories about small communities taking innovative approaches with digital storage of pipe inspection data, GIS mapping, and much more.

Meanwhile, in Washington state, the King County Wastewater Treatment Division uses computer technology in a sophisticated flow-monitoring program that helps identify infiltration and inflow issues, plot salt water intrusion, support specific pilot projects, and more.

What's your story?

Two decades ago, who could have imagined the difference computers and software would make in the management of public facilities? In this respect, the quotation above from science fiction writer Arthur C. Clarke holds strikingly true.

Given the unquestioned benefits of technology, it would seem the wise course for communities and utilities of every size is to embrace it to the fullest. Don't settle for the excuses that "times are tight" and "there's no money." If ever an investment can be justified, it is an investment in tools that, once deployed, can increase productivity, save time, and save dollars every day thereafter, as far as the eye can see.

How far has your community climbed on the technology ladder? Are you pushing the limits of today's tools? Just starting to make inroads against the paper-based world? *Municipal Sewer & Water* would like to share your experiences with your peers in other communities and utility districts.

Drop a line to editor@mswmag.com and tell us about your adventures with the latest in time- and labor-saving electronic tools. We'll report on your successes in future issues of the magazine.

The experiences of communities we profile show that it pays to go digital. For one thing, technology makes work a lot more satisfying for your professional staff members. There was a time, before the advent of electronic calculators, when a large share of the work time of professional engineers was spent doing computation, manually or on a crude device such as a slide rule.

If you are forcing your professional staff to do tedious work with paper maps, paper forms, and other relics of an earlier age, then you are keeping them from delivering the full value of their education, training and experience.

The other key reason to deploy technology is to help you deliver the highest-quality, most cost-effective service to the residents and businesses who depend on you. ✦

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

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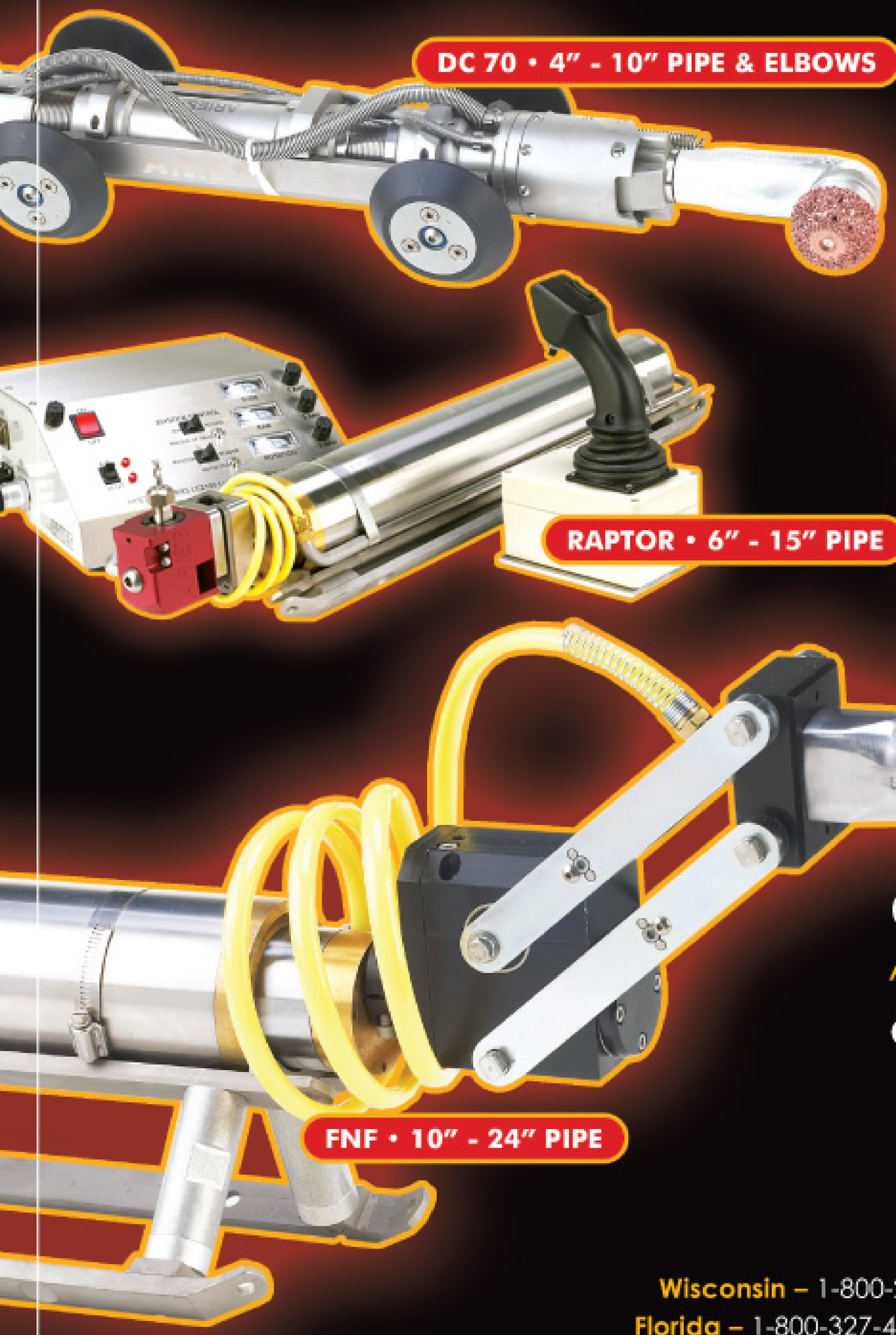

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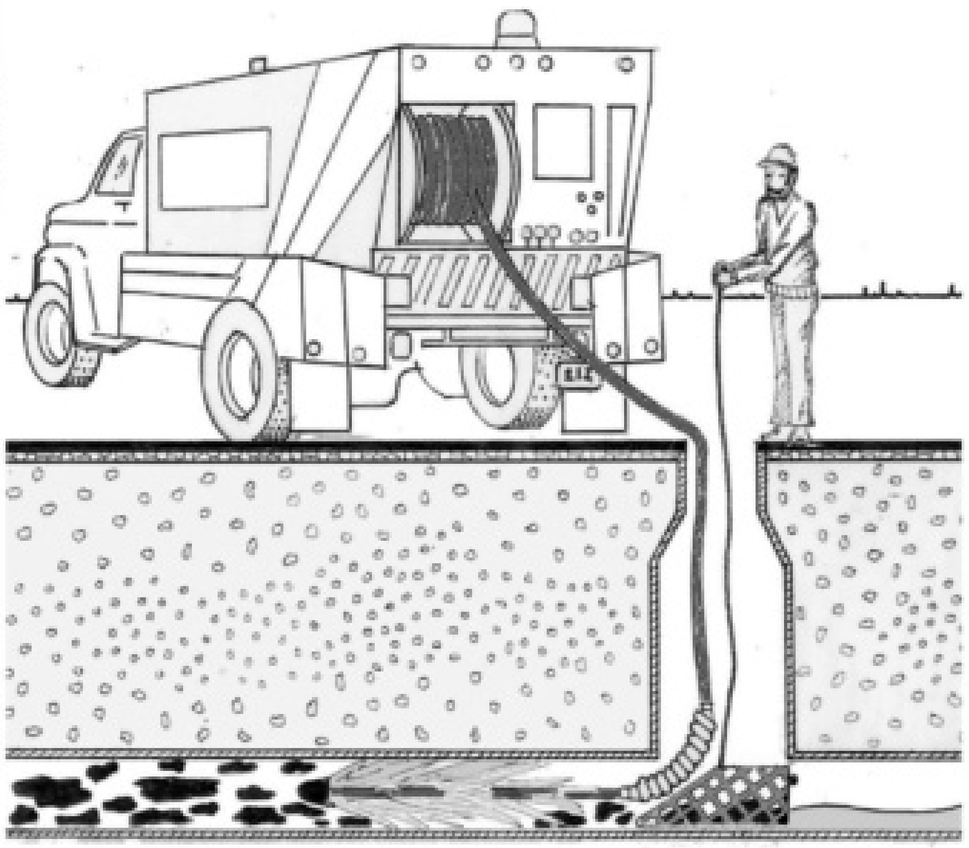
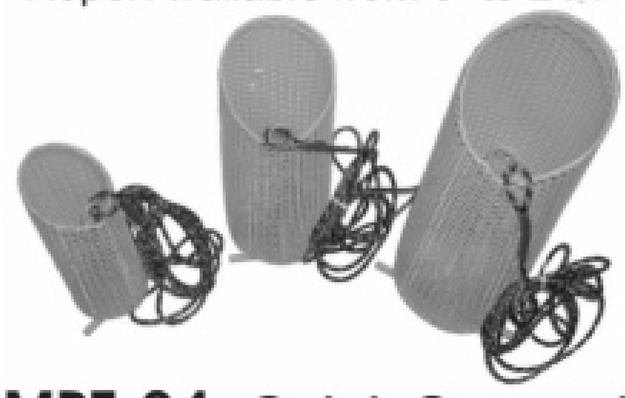


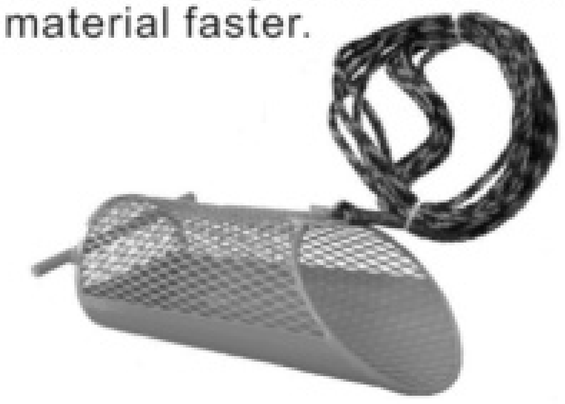
Debris Catchers

Use Debris Catchers with Jet instead of Combo. Ideal where small amounts of debris are expected. Standard **MDC-6** model Comes with 20' of Poly Rope. Available from 6" to 24".



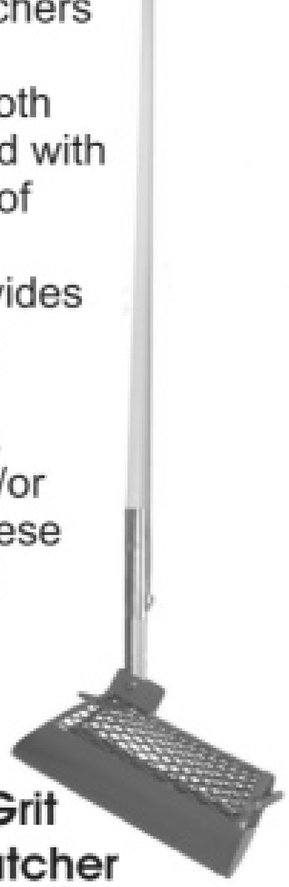
Grit Catchers

MDC-6CW are similar but have half moon bottom around sides and back to stop finer grit and black sand from Flowing thru. Fills with material faster.



Debris Catchers and Grit Catchers both can be used with any length of Fiberglass Poles. Provides for positive action of positioning, raising and/or lowering these catchers in manholes.

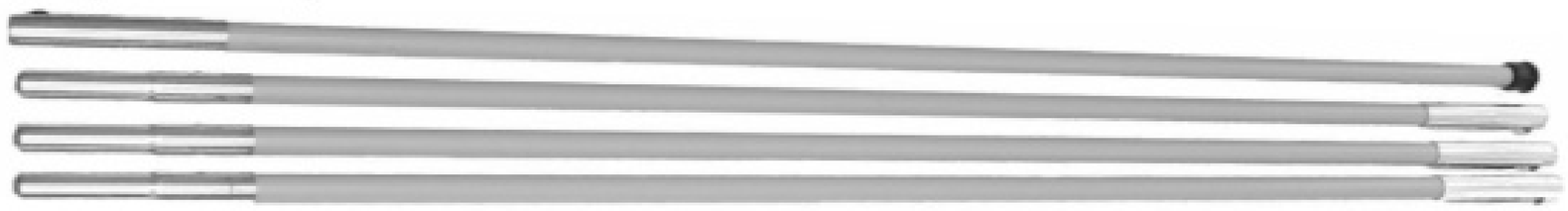
Debris Catcher



Grit Catcher

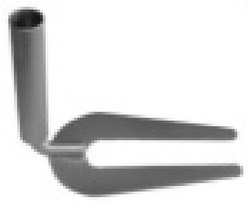
MPF-24 Quick Connect Fiberglass Poles

24' pole set used with above Tools and Debris Catchers. Each set Includes 3 ea. 6' male x female and 1 x 6' end pole. These are Light, Strong durable poles with positive lock Aluminum quick couplings. Other lengths available. Use with Debris and Grit Catchers and assortment of tools below.



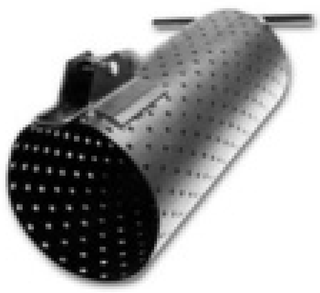
MGLC-1
Grease Log Chopper. Blade cuts thru heavy pieces.

M3PG-1
Three Prong Grabber. Great for Rocks and Roots.



MHG-2
Horse-Shoe Grabber. Great guiding hose in and out of sewer lines.

MDS-6
Debris Scoopers Heavy duty construction For 6", 8" and 10" Pipe sizes.



MCG-6
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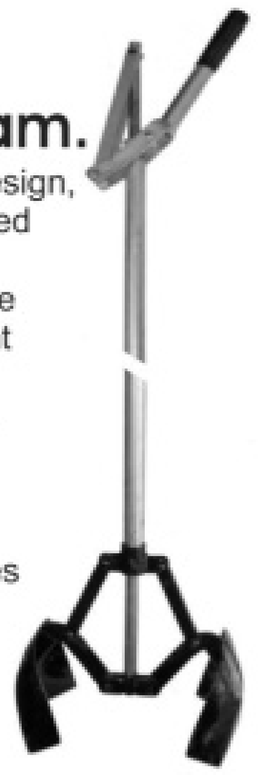

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FOCUS: SEWER

THE FLOW OF INTELLIGENCE

A carefully designed monitoring program helps King County, Wash., keep a close eye on system performance and understand future needs

By Jim Force

Trying to meet wastewater conveyance and treatment needs without accurate flow monitoring is a little like trying to find your way in the dark without a flashlight.

The King County Wastewater Treatment Division (KCWTD), based in Seattle, Wash., is embarking on an extensive in-house flow monitoring project to help the utility see clearly into the future, but also:

- Identify infiltration and inflow issues.
- Monitor industrial discharges.
- Identify and plot salt water intrusion into the conveyance lines.
- Support specific pilot projects.

"The more you know about your system, the better off you are," says Janice Johnson, wastewater engineer. The KCWTD is the largest wastewater utility in its state and acts as a wholesaler of collection and treatment services to 17 cities and 17 local sewerage utilities, known as component agencies. These include the cities of Seattle and Renton and the Muckleshoot Indian Tribe. Population served is more than 1.4 million, and the service area covers 420 square miles.

The utility maintains more than 350 miles of sewer pipe, 19 regulator stations, 42 pump stations, and 38 combined sewer overflow (CSO) outfalls. Two large wastewater processing facilities and two smaller plants treat about 200 mgd. A third regional plant, Brightwater, is under construction and scheduled for startup in 2011. The division also operates four CSO treatment facilities and one community septage system.

Need to know

In 2000-2002, the division implemented an infiltration and inflow (I&I)

King County crew members collect data from the logging unit of a flow monitor as part of the county's extensive flow monitoring program. A Sto-Away Power Crane is used for supporting personnel in the manhole. (Photography by Peter Kuhnlein)

PROFILE:
King County (Wash.) Wastewater Treatment Division

CUSTOMERS:
34 cities and local sewerage utilities

SERVICE AREA:
420 square miles

EMPLOYEES:
598 FTE

INFRASTRUCTURE:
350 miles of pipe, 19 regulator stations, 42 pump stations, 38 CSO outfalls

ANNUAL BUDGET:
Capital $525.8 million; operating $103.6 million (2009)

WASTEWATER FLOW:
178 mgd (average)

WEB SITE:
www.kingcounty.gov/environment

Above, technician Michael Sands fills out a safety checklist as he prepares to enter a manhole to inspect a flow monitor. Right, Sands and Matt Charles prepare to download data from the logger attached to a flow monitor. At this site, a laptop computer is hardwired to the logger for data collection.

"Our flexibility allows us to perform emergency troubleshooting and maintenance activities during data collection periods. We perform field verifications regularly and on an as-needed basis, and also do on-site data review."

Abraham Araya

study as part of a mandated comprehensive plan. It hired an outside consultant to conduct flow monitoring to determine what was happening in its sewers, and to help plan for future conveyance and treatment needs.

Portable flow meters monitored more than 700 sites around the system for ten weeks each during the wet seasons of both years. The county got more than just data from the consultant's work.

"The flow monitoring experience the county gained from the study really helped us to take a very close look at how we select and install flow meters, collect data, perform quality assessments, and interact with our internal and external clients," says Abraham Araya, flow monitoring project manager. "After that first phase, the utility brought the project in-house, reduced the number of monitors in the system, and has continued the flow monitoring project to the present time."

KCWTD has installed 106 portable flow meters (ADS Environmental Inc., Marsh-McBirney, and Telog Instruments) at critical points around the system — 42

TRAINING IS KEY

Some organizations pay lip service to the importance of training. Not so at the King County Wastewater Treatment Division (KCWTD). There, it's a key to success.

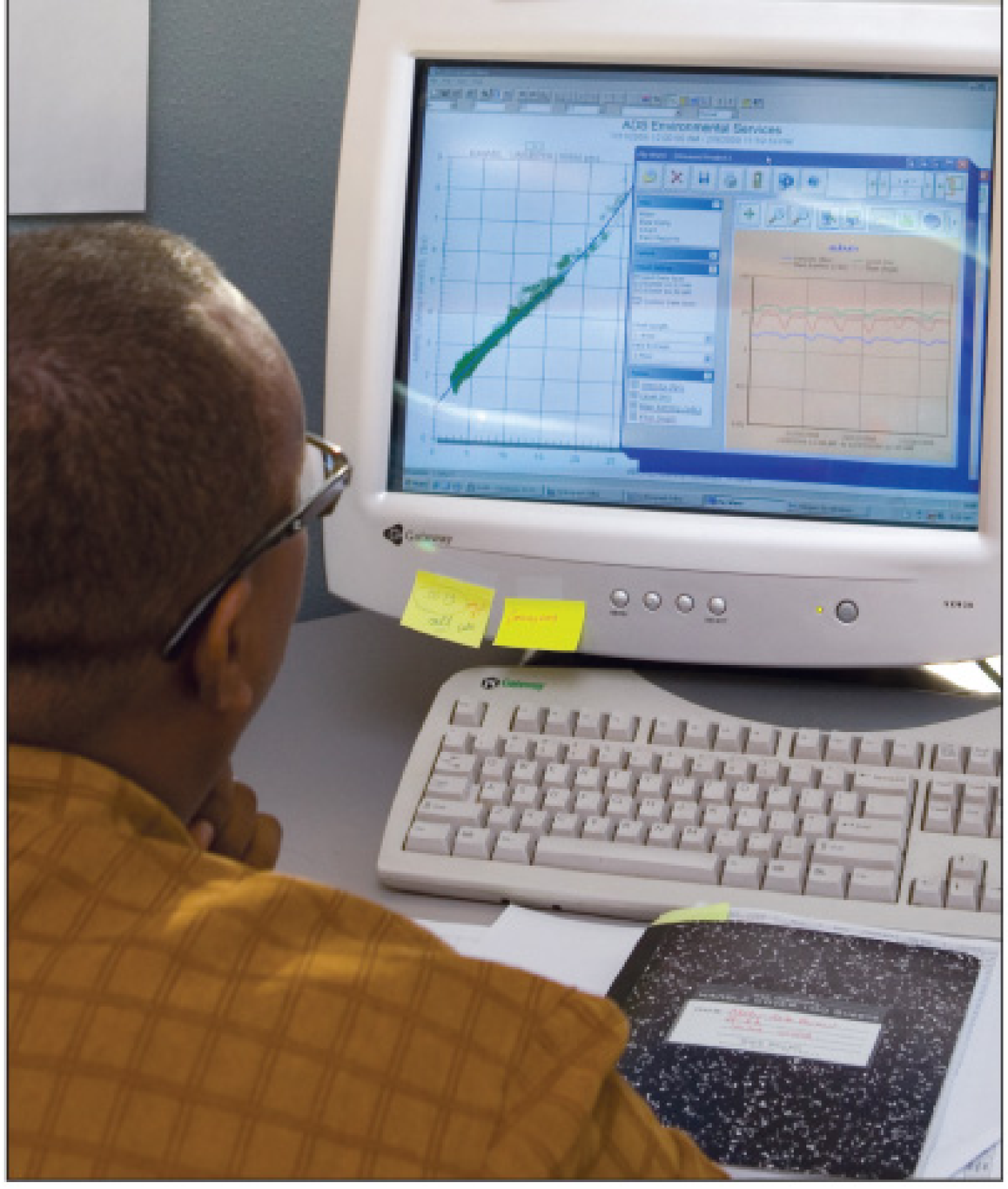
"In-house training in site inspection and selection, monitor installation, field verification, and on-site data QA/QC has really helped us focus our efforts in minimizing data loss and increasing data quality," explains Abraham Araya, project manager for flow monitoring. "Having a dedicated flow monitoring staff and a good working relationship with our vendors enables us to share knowledge and train our staff on data QA/QC, field verification, meter installation, and troubleshooting techniques."

He says field crews who can detect poor-quality data and perform on-site maintenance deliver increased reliability and less downtime around the system.

Wherever possible, the division conducts training under real-life conditions. An example is a training manhole the utility constructed to train staff in flow meter installation and field verification techniques, as well as to gain experience in confined-space safety procedures. "This way," says Araya, "we can train more people at the same time in relative safety and in various weather conditions."

The division also provides training in live sewers and includes the data analysts who are responsible for analyzing the flow data. This helps office personnel understand the difficulties and limitations the field staff faces every day. "They can see what it takes to perform requested field tasks and why some of the tasks may be difficult to perform under certain conditions," Araya says.

Site investigation is another important part of the training, since it's critical for flow monitoring staffs to know how to monitor site and meter selection, sensor placement, and the method of data collection. Flow monitoring staffs receive training in these aspects from more experienced staff members, "rain or shine."



Abraham Araya, flow monitoring project manager, analyzes data collected by the flow monitors in King County.

monitors in the combined system and 64 in the separated system. A tandem of two-man field crews monitors flows. One covers the northern section of the county, the other the southern section.

Forty-nine meters require crews to collect data manually by serially connecting to the flow meters. Fifty-seven other meters transmit data via telemetry to a computer system in the collection center. The data is later backed up to the main server at KCWTD for further data review and processing.

Fully documented

Field crews are required to document all field-related activities and observations and record them in site-visit and maintenance logs. "We have found out that the few additional minutes taken during field visits to fill out the logs save us hours of investigative work to determine what may have happened at a site," says Araya.

"Another tool is the implementation of weekly meetings to discuss issues from the previous week, plan for the current week, and discuss any budget matters or procurement requests," he says. Araya feels these one-hour meetings create a positive work environment where all staff members understand the importance of their work, communicate openly, and contribute to the success of the program.

It works. "Before the I&I flow monitoring study, there were some data issues, including the lack of proper QA/QC procedures, limited on-site data reviews, and lack of proper and detailed field verifications," explains Araya. These issues often resulted in lower-quality data as well as data losses.

Now, with the system of regular data collection, maintenance issues are addressed immediately. "Our flexibility allows us to perform emergency troubleshooting and maintenance activities during data collection periods," Araya says. "We perform field verifications regularly and on an as-needed basis, and also do on-site data review."

As a result, data quality, reliability and availability have increased significantly.

"We needed to verify our monitoring sites more frequently and collect the data weekly. This demanded that we commit well-trained staff dedicated to the flow monitoring program. You can't do a quality job if you don't have staff assigned specifically to that effort."

Abraham Araya

That's critical in King County, where growth and an increasing population have the utility carefully reviewing all future needs. Accurate flow data helps the utility verify its assumptions on capital projects, none more important than the new Brightwater plant.

Sophisticated membrane technology will be used there to deal with industrial discharges, and data from the flow monitoring program has been the basis for the design of the plant.

Another example is flow monitoring at 10 pilot projects in 2002-2003 and 2003-2004 to quantify I&I before and after various sewer rehabilitation techniques had been employed. In addition, the utility tracks salt water intrusion and the buildup and impact of hydrogen sulfide on conveyance lines. Conveyance system repair and future piping needs also depend on reliable data from the monitoring program.

As a service provider to its 34 component agencies, the division strives to respond to its customers' needs, and here again, accurate flow monitoring plays a major role. "In terms of our clients, we have been able to deliver quality data, on time," says Araya. "If someone wants to monitor a certain portion of our system for their project, we are able to sit down with the project manager and discuss the need for monitoring and propose alternatives that may help them refine their scope on a project.

"We are also able to perform site investigations, assess site conditions, install the appropriate type of meter and start collecting flow data within a matter of days."

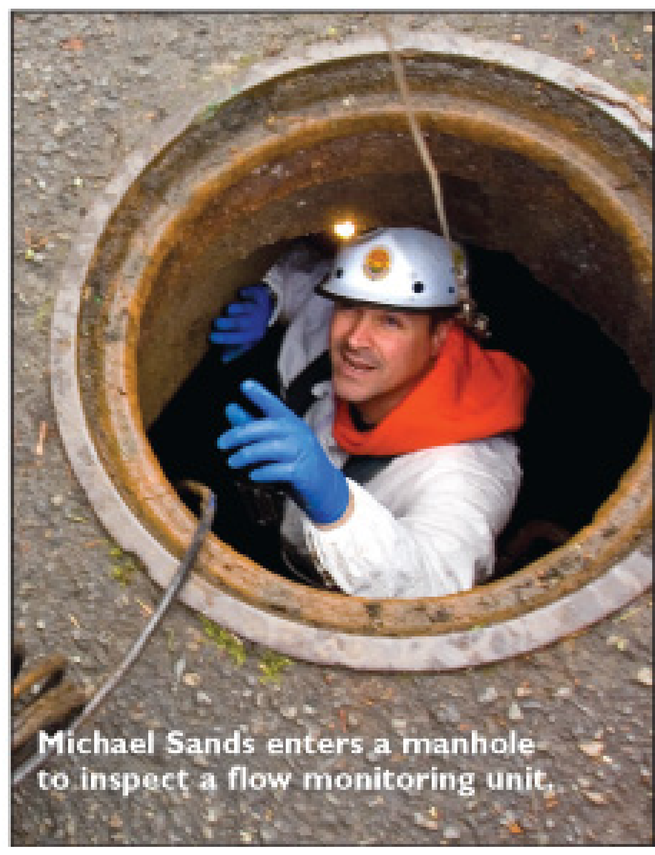
Lessons learned

In the nearly 10 years since the division initiated flow monitoring as part of its I&I study in 2000-2001, the utility has learned a number of critical lessons in how to make flow monitoring effective and economical. Among them:

- Devote adequate resources and staff to the flow monitoring project.
- Manage contractors and vendors for results.
- Use different flow meters for different applications.
- Develop standard operating procedures.

"Before the I&I study, we had one person maintaining as many as 90 to 100 sites, with help from another person for field work," Araya says. "As a result, we were depending on a single routine for obtaining all the data, regardless of site conditions. There were no systematic field verifications, data reviews or analysis."

The utility has since realized that effective flow monitoring requires adequate resources and has more than doubled its field staff to two, two-person crews, for a total of four people, who monitor 75-120 sites, plus an analyst to review the flow data. "This has allowed us to provide higher-quality data, better tailored to the needs of our end-users," says Araya.



Michael Sands enters a manhole to inspect a flow monitoring unit.

The utility's experience and interaction with contractors and vendors have also provided useful guidance. Araya says utilities must insist on high performance deliverables from contractors, including high uptime and verifiable high quality data. Utilities also need to have trained staff working with

contractors to perform QA/QC for data accuracy. QA/QC should be performed before the end of the monitoring period and the start of the modeling phase so that any questionable or problematic data can be checked out, Araya observes.

"Try to minimize the number of subtraction meters if possible," he adds. "The level of confidence in flow measurements decreases with the number of subtraction meters required to calculate or quantify the net flow from a particular basin."

When choosing vendors, customer service and technical support are paramount, and references are a must. "Some vendors may claim to have the best hardware or software for your monitoring needs," explains Araya, "but it is useless if you are not able to use it because of the lack of proper and necessary support."

Choosing meters carefully

The KCWTD recommends that vendors provide demonstration units so that the staff can collect as much information as possible before deciding which technology or combination of technologies to purchase.

"Look at things like ease of access to support, and how soon you get a response to your needs or concerns," says Araya. "Are the technical support staff well-trained to address your concerns and help you troubleshoot equipment problems?" Finally, vendors should offer training to ensure that the staff knows how to operate the technology properly and efficiently.

In meter selection, it's not a case of "one size fits all." Araya believes utilities should perform careful site investigations and choose the metering technology best suited for specific conditions. "For example, a metering technology that works well at a site with relatively deep flows and reasonable velocities may not work at a site exhibiting shallow flows (less than 2 inches) and fast velocities (4 to 8 feet per second or more)," he says.

The division uses a variety of metering technologies, depending on site conditions. Araya notes that previously most of the flow meters used pressure sensors to measure depth of flow. But the pressure sensors were prone to drifting, resulting in data loss or poor depth data quality.

Since then, the utility has added meters that use ultrasonic sensors to measure depth, and uses metering technology with velocity sensors mounted above the crown of the pipe at sites that are prone to sensor fouling.

Araya says the division had no set standard or guidelines for flow monitoring before the recent projects. "Now, we maintain a set of standard procedures based on manufacturers' suggested practices as well as our own experience," he explains.

Standard operating procedures (SOPs) include step-by-step instructions on meter installation, initial and successive field verifications, data downloading, on-site data QA/QC, and troubleshooting. In the field, crews carry a CD or printout of the SOPs in their trucks.

"We have started working on summarizing some of the most commonly used tasks into field pocket guides," says Araya. "We continually update these SOPs based on feedback from the field crew and any new information from meter manufacturers."

The bottom line? Quality data demands adequate resources. "We needed to verify our monitoring sites more frequently and collect the data weekly," Araya says. "This demanded that we commit well-trained staff dedicated to the flow monitoring program. You can't do a quality job if you don't have staff assigned specifically to that effort." ✦

MORE INFO:

- 114 **ADS Environmental Services**
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  www.adsenv.com
- 156 **Marsh-McBirney Inc.**
  800/368-2723
  www.marsh-mcbirney.com
- 32 **Sto-Away Power Cranes Inc.**
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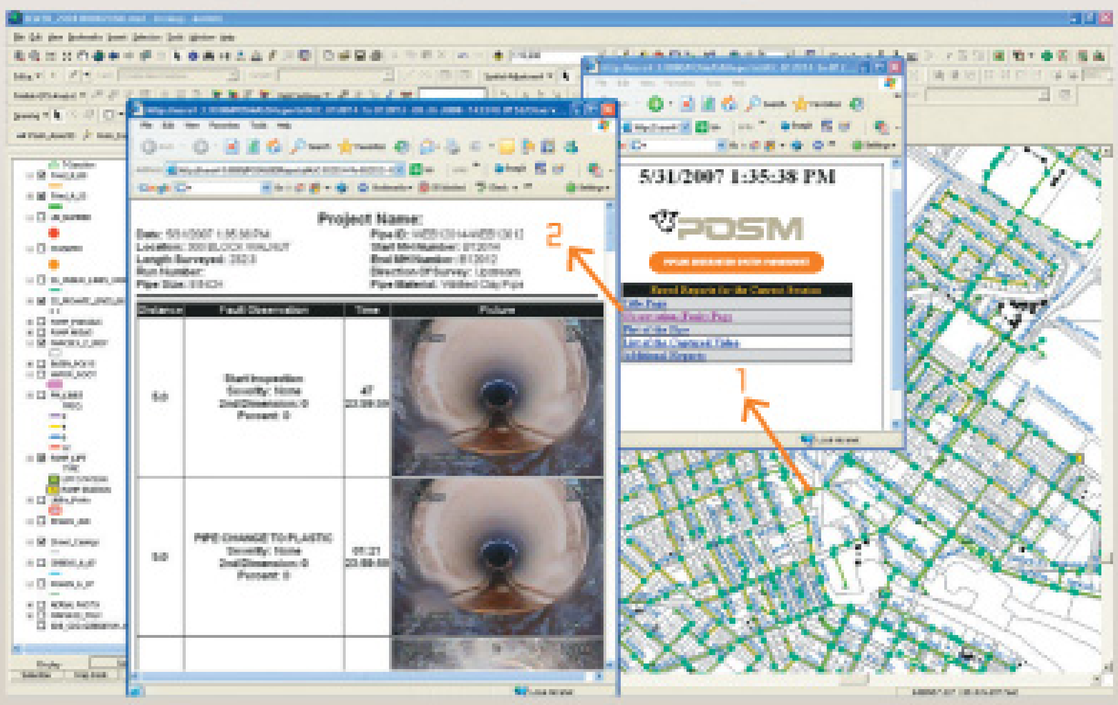

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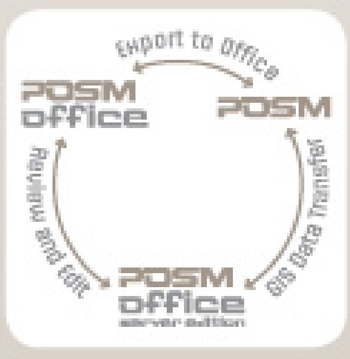

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FOCUS: SEWER

PUSHING OUT PAPER

The City of St. Paul applies technology to create a single source of electronic information on its aging system of sanitary and storm sewers

By Lauren Gudath

Facing the problems of sewer lines more than 100 years old, and network maps used to service them just as ancient, the City of St. Paul (Minn.) Department of Public Works took decisive action.

The department aggressively converted from paper-based mapping to an all-electronic system for recording data on its underground infrastructure. The initiative included conversion of existing maps to electronic form and the deployment of an electronic editing tool for sewer network data.

Turning more than a century's worth of sewer network information into spatial data was no small chore, but now that it is done, Public Works has a single repository for all its location and attribute information. That means users can access one up-to-date and accurate source of data for designing and planning and can easily distribute project information.

In addition, the system gives the city's engineering and financial decision makers a complete overview of the sewer network that helps them make more informed decisions in managing the system and planning maintenance and rehabilitation projects.

A CAD map displays St. Paul infrastructure, including pipe connections.

Paul Ackerly, engineering aide technician for the St. Paul Department of Public Works, compares hand-drawn maps versus new digital imaging created using Topobase software from Autodesk. The program is designed to modernize and simplify mapping projects. (Photography by Lawrence Jones)

100 years of paper

Located on the Mississippi River and considered one of America's most livable cities, St. Paul was established in 1841. The city grew steadily and was completely built out by the late 1950s. Now home to 287,000 people, St. Paul has an aging sanitary and storm sewer

PROFILE:
City of St. Paul, Minn., Department of Public Works

FOUNDED:
1841

POPULATION SERVED:
287,000

STAFF:
471

INFRASTRUCTURE:
1,254 miles of sanitary and storm sewer

WEB SITE:
www.stpaul.gov

Engineering aide technician Paul Ackerly (right) and civil engineer Dan Bartholic display a section of vitrified clay pipe, the most common type used in St. Paul. All types of pipe are shown on the city's new digital maps that replaced 2,500 paper maps.

"Accurate records of the sewer network are critical for the efficient day-to-day operation of our system. However, in a time when our staff is shrinking and demand for information is growing, it is a big challenge to keep those records up to date. Improved technology and processes have made the task much easier."

Dan Bartholic

network with more than 1,250 miles of pipes.

"Accurate records of the sewer network are critical for the efficient day-to-day operation of our system," says Dan Bartholic, a civil engineer in Public Works. "However, in a time when our staff is shrinking and demand for information is growing, it is a big challenge to keep those records up to date. Improved technology and processes have made the task much easier."

The department had more than 2,500 paper network maps containing asset information, and each was meticulously hand-maintained by sewer utility engineering technicians. When Public Works designed a construction project, a technician pulled the relevant map and redrafted needed information from the paper plan into AutoCAD or, more recently, AutoCAD Map 3D.

The technician then added the design elements necessary for the project. After construction, engineering technicians drew the as-built information from the project onto the paper maps. The process was cumbersome and time-consuming.

While the amount of redrafting required by the paper-based process would seem to invite errors, that was not the case: Public Works staff found the records highly accurate. But inefficiency was a problem, and so was the inability to distribute network information easily. In addition, when moving the as-built information to the paper network maps, Public Works lost the precise engineering detail inherent in CAD drawings.

"It became clear that we needed to complete designs and maintain as-built information without significant redrawing," says Bartholic. "At the same time, we saw an opportunity to do more than just transition to all-electronic records. With a single spatial database for information, we would be able to integrate the network data with our GIS and other business systems. We also wanted to be able to easily support multiple projects and users simultaneously."

One source

Public Works and its records staff started the conversion process by scanning all 2,500 paper network maps. Technicians then imported the scanned maps into AutoCAD Map 3D, scaling and rotating the images to match real-world coordinates.

Using the scanned images as a guide, they drew the CAD line work for the mainline sanitary and storm sewers. The resulting asset maps were loaded to an Oracle spatial database. To enhance the conversion, a contractor read and key-entered attribute data for each pipe segment into the system.

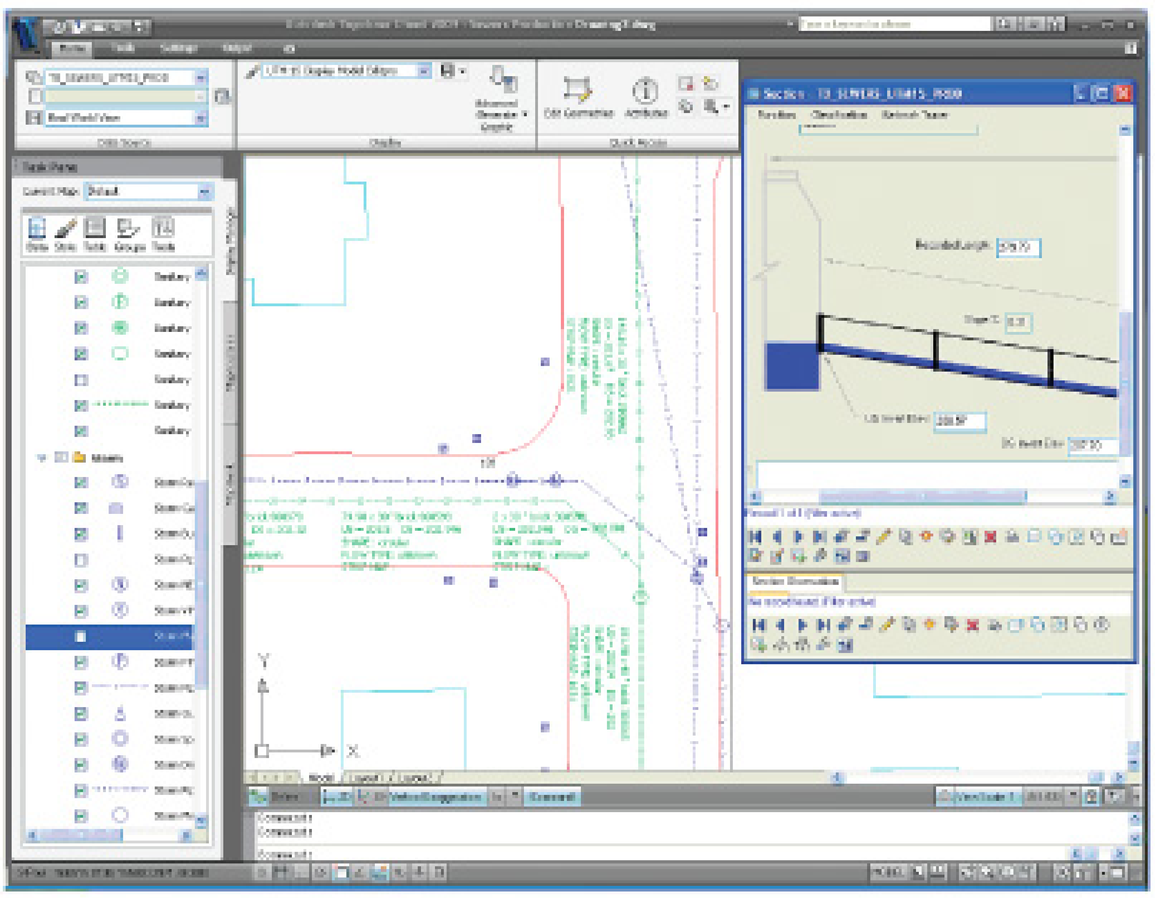
At that point, Public Works staff became aware of Topobase software from Autodesk Inc. The software is an infrastructure design management solution created to

BELOW THE SURFACE

Launched in 1996, the City of St. Paul's Residential Street Vitality Program (RSVP) is revitalizing neighborhood streets across the city.

Each year, the Department of Public Works repaves about 10 to 15 miles of the streets, giving citizens a smoother ride. At the same time, the repaved streets are lined with curb and gutter, trees and improved lighting. But the benefits of RSVP go beyond what citizens can see.

Some of the highest-value revitalization is taking place below the surface. As old streets are replaced, Public Works is proactively repairing and replacing aging sewer pipes. The local gas utility is upgrading its lines, and the St. Paul Regional Water Service is replacing lead connections and aging water mains. As a result, St. Paul residents will have an above- and below-ground infrastructure they can rely on for decades to come.



An editing window in Topobase software shows the plan view of the sewer network and a form window for a selected pipe segment. (Photo courtesy of Autodesk)

> **"From our perspective, one of the best things about the Topobase is that it can implement sewer network business rules, helping to ensure a high rate of compliance with data standards. For example, the software will not let us connect a storm sewer catch basin to a sanitary sewer main."**
>
> **Dan Bartholic**

provide easy access to design, spatial and asset information for engineering, GIS and field operations teams. Built on AutoCAD Map 3D, Autodesk MapGuide, and Oracle software, Topobase is an open solution with industry-specific workflows.

Public Works selected Topobase as the editing tool for its sewer network data. Because it uses the same software as the Public Works design process (AutoCAD Map 3D), engineering technicians had no difficulty learning to edit network data within the application. The software enables any number of Public Works staff members to use the system at the same time.

"From our perspective, one of the best things about the Topobase is that it can implement sewer network business rules, helping to ensure a high rate of compliance with data standards," said Bartholic. "For example, the software will not let us connect a storm sewer catch basin to a sanitary sewer main."

No more redrawing

The new system only recently went live, and the department is still transitioning its processes, but all-digital information already has enhanced the design process. Before, engineering technicians began a project by using a paper network map to redraw the relevant design information into an AutoCAD Map 3D project file.

Now, they can access the information they need electronically, and no redrawing is necessary. When they complete their work in AutoCAD Map 3D, they know that none of the intelligence they put into a design will be lost at the as-built stage. Instead, the as-built information moves easily back into the sewer network records database after construction.

Because the underlying data is stored in Oracle, the department could easily integrate the sewer data into its Web-based GIS viewer. The information comes directly from the master Oracle sewer database. If a citizen has a sewer-related question, a staff member can quickly get the information needed to answer. The staffer simply enters the relevant address or cross street, and the information appears on a browser-based map.

The existing asset database for work orders lacks highly detailed structural type and location information. But soon, the department's network data integration will extend to its Oracle-based work order management system.

As projects move through Topobase, integration between the two systems will keep the work order asset database up to date more automatically. Work orders will capture relevant equipment, materials and labor costs for each segment of the sewer network.

The system will also track locations within work orders with greater precision. Staff members will be able to use that information to enhance reporting and planning. For example, the department will be able to report easily on maintenance activities by cost, neighborhood, type of pipe, and pipe age, or any combination of those factors.

Single view

Now that the department has an integrated system, it can use a single digital view of its infrastructure to manage assets, rather than 100-year-old paper maps.

"Having a single digital view has made our sewer management processes faster and more efficient," says Bartholic. "For example, many of the pipes we installed in the 1920s are made of unreinforced concrete. That type of pipe can deteriorate significantly faster than other pipe materials, so we planned a rehabilitation program targeting them.

Vitrified clay pipe in St. Paul containing a plastic inner coating is the least of the worries of the St. Paul Public Works Department. Unreinforced concrete pipe installed in the 1920s takes priority for repair.

"Finding the locations where these pipes existed required combing through 10 years of paper construction records dating from the 1920s," he says. "The research consumed several weeks of valuable engineering time. If we had been able to use the new solution, it could have produced a map and listing of all the locations of unreinforced concrete pipes in minutes."

As Public Works begins to take full advantage of the new system, the staff enjoys the benefits of improved processes. The efficiencies and time savings that go with a single view pay dividends repeatedly. The technology helps the department maintain a sound and efficient wastewater collection system — a small but critical attribute of a most livable city. ✦

MORE INFO:

Autodesk
800/964-6432
www.autodesk.com

Photo courtesy City of Boulder

As part of Boulder's Keep It Clean Program (KICP), free two-day workshops for teachers provide background information on subjects like watershed mapping, storm drain marking, and water-quality testing.

FOCUS: STORM

PARTNERSHIP PAYS

A Keep It Clean Program helps the City of Boulder (Colo.) and its neighbors reach out to students and citizens and protects against stormwater pollution

By Angus W. Stocking, L.S.

Shaped by gravity and topography, watersheds rarely conform to political boundaries. And yet, counties, cities and villages need to be aware of issues that affect local watersheds, and must do what is necessary to protect and preserve them.

The City of Boulder, Colo., is especially motivated to take care of the region's water supply. Western municipalities are keenly aware of year-to-year differences in water supply, and the always-present specter of drought.

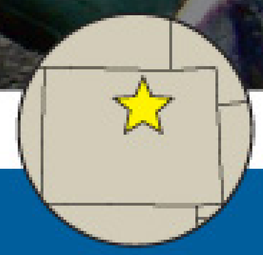
Pollution is also a concern. Donna Scott, Boulder stormwater quality specialist, says, "Watershed education arose out of the need to address water quality issues associated with behaviors like driving, not picking up pet waste, improper disposal of household waste, and the dumping of motor oil."

Major components of Boulder's response to these challenges include a comprehensive outreach program that educates students and the public about water issues, and a large-scale collaboration with other entities within the watershed. The collaboration enables pooling of resources, along with consistent regulation and enforcement throughout the watershed.

Of course this all takes place within the context of a stormwater program resembling that of other large cities. But by placing emphasis on public outreach and collaboration, Boulder is acknowledging that the 300,000 or so inhabitants of Boulder County can have a lot more effect on the watershed than even the best efforts of any stormwater department.

Uniting to conquer

"A core component of Boulder's response to NPDES guidelines is the Keep It Clean Program (KICP)," explains Curry Rosato, the city's watershed outreach coordinator.



PROFILE:
City of Boulder, Colo.

INCORPORATED:
1871

POPULATION:
92,000

AREA:
25.4 square miles

ANNUAL RAINFALL:
20 inches

OPERATING BUDGET:
$3.1 million (2008 stormwater and flood control)

WEB SITE:
http://ci.boulder.co.us

Left: 4-year-old Kailas Abbott brushes a new Keep It Clean medallion that was replaced on a storm drain in her neighborhood. Kailas, her parents and neighbors are part of the Keep It Clean Program. Right: The Keep It Clean medallion. (Photography by Joe Amon)

WHAT, EXACTLY, IS A WATERSHED?

In North America, a watershed is technically known as a drainage basin, defined as "an extent of land where water from rain or snow melt drains downhill into a body of water, such as a river, lake, reservoir, estuary, wetland, sea or ocean. The drainage basin includes both the streams and rivers that convey the water as well as the land surfaces from which water drains into those channels, and is separated from adjacent basins by a drainage divide."

Somewhat confusingly, in some parts of the world, it's the drainage divide that is known as a watershed.

Drainage basins, in one sense, can be precisely defined by tracing the high contour surrounding the funnel-like drainage to a particular body of water. In another sense, all smaller drainage basins, such as the Boulder Creek Watershed, are subsumed in one of several very large drainage basins.

All of western North America and some other parts of the world, for a total of 13 percent of the world's land mass, drain to the Pacific Ocean. The world's largest drainage basins empty into the Atlantic Ocean, which drains 47 percent of the world's land mass.

KICP is a partnership of Boulder County; the cities of Boulder, Longmont and Louisville; and the towns of Erie and Superior. Together, these jurisdictions largely cover the watershed. The partners have entered a five-year intergovernmental agreement (IGA) with a written description of the practices they will employ to comply with their joint stormwater permit.

Cost allocation is based on each partner's urbanized population, as defined in the IGA. The group's steering committee includes voting representatives from each partner. "The partners developed a plan that describes how each state-required minimum control measure will be addressed," says Rosato. "It calls for the use of common themes and elements throughout the watershed, including the development of common stormwater ordinance language for commercial and residential activities."

The partnership definitely facilitates the sharing of resources. "The City of Boulder already had an established program that included school-based education and community outreach," says Scott. "The KICP contracts with the city to provide these education programs to other partner communities."

"We know that education is a critical component of our watershed awareness program, and there really is an interest among existing conservation groups and a big potential for increasing citizen involvement."

Curry Rosato

The partners also collaborate on new outreach efforts and are happy to see their work help others outside the partnership. "One thing we did in 2004 was to use an EPA grant that KICP received to create mascots and a campaign to brand our water protection efforts in our region," says Scott. "Those mascots — H_2O Joe and Flo — are now statewide mascots."

Getting to the schools

To reach students, KICP developed a thorough curriculum that caters to the needs of teachers. The Water Ranger Program, for grades 4-5, and the Thirsty Lizard Project, for grades 6-8, come with course materials for teachers to copy and reuse, and supporting educational aids that can be checked out from a central library maintained by KICP.

To help encourage adoption by teachers, the material comes with specific information on how the courses help students meet testing requirements of individual schools and Colorado Student Assessment Program testing.

Teachers are also supported by free two-day workshops that provide background information on subjects like watershed mapping and storm drain marking, and hands-on experience in water quality testing. Because KICP programs are easy for teachers, adoption is very high. "A lot of success measurement comes down to bean counting," says Rosato. "I know, for example, that we're reaching 5,000 students annually. I also know that teachers consistently report that their knowledge of water and water quality issues increased as a result of training, and that 79 percent of students said that the lessons will change the way they use water."

Other student outreach programs include a flood safety unit, a watershed resource guide, an interpretive Boulder Creek trail guide with information keyed to 14 accessible stations along the creek, a water resources library with items like aquatic insect study equipment, and science fair project support. One fun, high-impact project is the Children's Water Festival, which reaches more than 900 students each year. Teachers sign up to attend, and there are associated activities that involve children's parents.

Reaching the public

KICP also reaches out to the general public comprehensively, with programs that require varying

amounts of participation. At the low end of the commitment spectrum are public lectures like the monthly Watershed Forum Series and a speaker series that provides qualified speakers for groups that request one. Topics include water conservation, stormwater quality, and drinking water, and talks can be customized for particular groups.

If neighborhood groups are a little more interested in doing something, KICP works with them on storm drain marking projects, or trains and equips Stream Teams that look after agreed-on sections of streams in much the same manner as Adopt-a-Highway programs.

Really motivated groups can receive guidance; tools, gloves and trash bags; and free trash collection for creek cleanups. "With just a few actions each year, groups can be well on their way to maintaining local waterways," Rosato says. The program also provides fun giveaways, like T-shirts, that reward participants and spread the KICP word.

ings. When a lot of people take action at their homes, we know we're getting results."

One eye-catching and popular part of the outreach program is the freshwater aquarium maintained at the Boulder Public Library's main branch. Colorado native fish are on display, along with a model of the Boulder Creek Watershed.

As with any outreach program, success measurement is difficult. "We get a lot of our feedback from evaluations and surveys, and we're doing well by that measure," says Rosato. "We also had an independent evaluation of KICP, which concluded that we're making progress and are a leader in our region. But there's always room to improve. We haven't yet made a quantifiable connection between our programs and water quality."

Other pieces

The City of Boulder, with a population of about 100,000, certainly benefits from the regional partnership. But the city has substantial stormwater infrastructure in place as well: 178 miles of active pipe, ranging from 4 to 36 inches. The majority is reinforced concrete pipe, but there is a fair amount of cast iron, corrugated metal, ductile iron and newer materials like HDPE. Boulder has 15 tributaries and 13 ditches, and the storm system discharges from some 900 outfalls. That's a lot of structure to maintain, and there are other challenges as well.

"We encounter some special problems," says gravity systems maintenance supervisor Mike Emarine. "There are a lot of roots in our system. There are areas with excessive groundwater, which causes problems with the bottom of CMP, and there are a lot of trees in the older parts of the city whose leaves clog the tops of catch basins and manholes."

To stay on top of maintenance, Boulder has an ESRI-based GIS in place that is still a work in progress. "It was initially set up with points at all the catch basins and manholes, and the pipe runs were mapped and identified with very little detail, just a record number," says Emarine. "But now, when mains, catch basins or manholes are visited or accessed, all information for that specific location is entered into the database. This information is then used to prioritize repairs, replacements and capital improvements."

The stormwater department has one dedicated TV crew working full time, using an inspection system from CUES Inc. and a bubble top TV van. Inspection data is currently stored on VHS tapes, but Emarine expects to upgrade to digital information in 2009. GIS users can call up tape indexing from the GIS interface. Another crew works full time jetting with a jet truck from Sewer Equipment Co. of America, and cleaning with a Vactor combination truck.

Seven-year-old Logan Abbott delivers a Keep It Clean fish to a neighbor in Boulder County to bring awareness to the Keep It Clean Program.

Photo courtesy City of Boulder

A group of teachers pose for a picture during one of the training programs offered for educators under Boulder's Keep It Clean Program.

Tail wags dog

Motivating a large urban population with a small staff and limited budget is hard work, but, as Rosato says, it's necessary. Large-scale changes that have major impacts on water use and conservation must involve education.

That public outreach efforts can effect massive change is not in doubt. The substantial decrease in smoking and increase in seat belt use are examples often cited by those looking for ways to change public behaviors. By making good use of resources, and partnering with other stakeholders, the City of Boulder is getting the best possible return on its educational efforts. ✦

MORE INFO:

18 **CUES Inc.**
407/894-0190
www.cuesinc.com

220 **ESRI**
909/793-2853
www.esri.com

2 **Sewer Equipment Co. of America**
800/323-1604
www.sewerequipment.com

5 **Vactor Manufacturing**
815/672-3171
www.vactor.com

WHAT GRADE WOULD YOU GET?

Civil engineers give the nation's underground infrastructure a grade of D-minus. Companies in the trenchless industry must approach repairs with high standards.

By Irvin Gemora

Every four years, our country's infrastructure gets graded by the American Society of Civil Engineers (ASCE). With its Report Card on America's Infrastructure, ASCE rates 15 areas of critical infrastructure, including roads, bridges, drinking water and schools.

Once again, I wasn't surprised by the near-failing grade of D — the same as in 2005 — for the overall condition. Knowing what I know about underground infrastructure, I took a wild guess at what grade that area would receive. I assumed it was no better than a D, and I was right. As in 2005, the report gave drinking water and wastewater systems a D-minus. It noted that by 2025, about 50 percent of water mains will reach or surpass their useful lives.

The grim reality is that we're never going to catch up. Have we failed as an industry to make our issues a priority in the minds of politicians? The public? Key decision-makers? Dozens of articles by experts in every aspect of infrastructure have been published. Forums have been conducted around the world. Recently, a documentary, *Liquid Assets,* aired nationwide, highlighting the problems with sewer systems around the country. Clearly, we're raising awareness of our issues, but what more can we do? Here are some ideas.

Educate lawmakers and the public. Look for opportunities to educate others on the vital role of our nation's sewer systems. Write articles and explore speaking opportunities to spread the word. Knowledge is power, and the more we can educate key decision-makers on our underfunded industry, the more we'll benefit.

Adhere to strict standards. While our infrastructure might not get a passing grade, the quality of our work should. I invite you to test yourself and your business. How well are you adhering to standards? What is the quality of your work? How do you evaluate jobs? Your employees? If you were to give yourself a report card — what grade would you receive?

We have an obligation to ensure that rehabilitations to our underground infrastructure are conducted using the highest standards for long-lasting success. For more than three decades now, NASSCO has been setting standards for the rehabilitation of underground utilities. We can help you adhere to these standards with extensive training, education and networking opportunities.

ASCE takes the position that a failing infrastructure can't support a healthy economy. I agree. Unfortunately, to most politicians the word infrastructure rarely if ever includes those parts that are out of sight. The gap between funding and needs is significant.

It is estimated that $255 billion will be needed over the next five years to raise drinking and wastewater infrastructure to acceptable levels. That means we need $51 billion annually to update or replace existing systems and build new ones. Only $28 billion in yearly spending actually occurs, resulting in a deficit of $23 billion.

We must continue to educate lawmakers and the public on our industry. Our aging systems are reaching the 100-year-old mark or more. We have an obligation to our industry, our public and ourselves to protect our nation's most vital public asset — the sewer system.

We must continue to educate lawmakers and the public on our industry. Our aging systems are reaching the 100-year-old mark or more. We have an obligation to our industry, our public and ourselves to protect our nation's most vital public asset — the sewer system.

I'm certain that in our lifetime our nation's underground infrastructure will not receive a passing grade. I feel the same about other areas of infrastructure. But just because we can't completely cure the patient, we can at least stop the bleeding. Help me and your industry. ✦

Irvin Gemora is executive director of NASSCO. He can be reached at director@nassco.org. The NASSCO headquarters is at 11521 Cronridge Dr., Suite J, Owings Mills, MD 21117.

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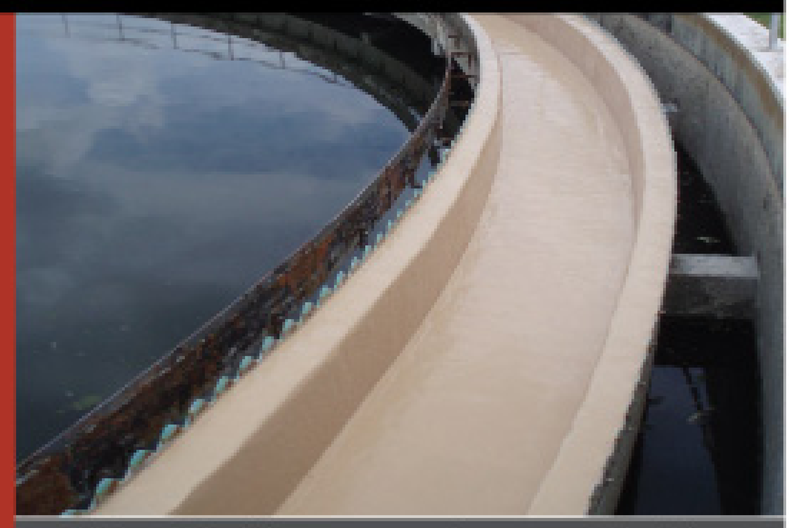

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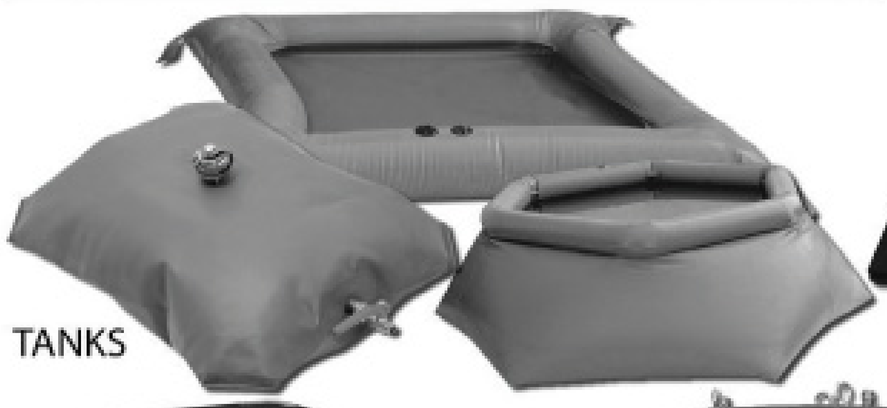

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A LITTLE TLC

CIPP lining helps a small Wisconsin village rehabilitate backyard sanitary sewer lines with little disruption to local landscapes

By Jim Force

The Village of North Bay is a picture-perfect enclave of homes, manicured yards, and tree-lined streets tucked into the north side of Racine, Wis., overlooking Lake Michigan.

But beneath the peaceful surface lurked an 85-year-old sewer system with concrete pipe and "break-in" laterals badly deteriorating under the relentless attack of hydrogen sulfide. And not only that, the sewer mains ran beneath the backyard property lines of each homeowner, not under the street.

"There was no way we could excavate to repair the lines," explains Rick Cermak, village trustee in charge of water and sewer. "Digging up everybody's yard would have been impossible." On the other hand, if the village allowed the system to fail, it faced a major sewer replacement project that would be even more disruptive.

It was a perfect case for sewer rehabilitation using cured-in-place pipe (CIPP) lining. The village completed rehabilitation of the worst of its 9,000-foot gravity sanitary sewer system in January 2008 and plans to rehabilitate other sections as village funds permit. "We want to be proactive," explains Cermak.

Public works volunteers

North Bay is an incorporated village of about 265 residents. A volunteer board handles village affairs, and Cermak, a manager with the local firm Case New Holland, is responsible for "all utilities beneath the ground."

The sewer system, consisting of 6-, 8-, 10- and 12-inch pipe, collects wastewater from 97 homes and empties it into a concrete wet-well beneath the village community building. There, two 700 gpm Chicago centrifugal pumps grind and pump the wastewater through a force main to the Racine municipal wastewater system.

Most of the village lies below the grade of the Racine line. Racine bills the village quarterly for treatment based on flow measured by a flow meter/totalizer in the force main. North Bay homeowners pay sewer fees to the village totaling about $23,000 per year. Racine provides drinking water and maintains the village water distribution and metering systems.

The village embarked on the lining project after previous televising revealed deterioration in certain locations. But rather than spot-fix those sections, the village decided in August 2006 to clean and inspect the entire system. "We decided to televise everything, so we would know best where to put our dollars," Cermak recalls.

General Pipe Services of Waukesha, Wis., used waterjetting equipment to clean the lines and then conducted a complete video inspection, generating a report using Visual Pipes software (UEMSI). The pictures showed extensive deterioration, and the village hired the engineering firm of Baxter & Woodman of Burlington, Wis., to review the DVDs and map the damaged sections. "Pipe walls were cracked, and pipes were sagging and broken," reports Cermak. About 50 lateral connections were literally falling apart, most of the grout having disintegrated.

"Working in the backyards presented special challenges. Visu-Sewer did a nice job, disturbing as little of the landscape, gardens and tree lines as possible, and working quickly to avoid inconveniencing the homeowners any more than necessary. Some of the work went into the wee hours of the night to get private laterals reopened."

Rick Cermak

Says Mark Kolczaski, project manager with Baxter & Woodman, "We surveyed the system, and made recommendations for repair or replacement of the lines. CIPP was the obvious choice because of the location of the lines and manholes.

"Then we did a detailed design and prepared the bid package for manhole-to-manhole CIPP lining of 3,300 feet of sewers," Kolczaski says. He notes the survey also identified leaky manholes, which called for inflow dishes (Cretex Specialty Products) to be installed beneath the covers to prevent even more infiltration and inflow.

Vendor services

Once the project was underway, Baxter & Woodman provided field assistance and helped the village with project and budget administration. "It's important for us as a small village with no public works staff to retain vendors who can provide additional services of this kind," says Cermak. "We rely on our vendors probably more than a conventional utility might."

Baxter & Woodman put together a competitive bid package, and Visu-Sewer Inc. of Pewaukee, Wis., won the job. "We've done a lot of

BETTER MOUSETRAPS

PRODUCT:
National Liner system

APPLICATION:
Manhole-to-manhole cured-in-place pipe repair

BENEFITS:
Avoided backyard excavations

USER:
Village of North Bay, Wis.

MANUFACTURER:
National EnviroTech Group, Houston, Texas

CONTACT:
281/874-0111;
www.nationalliner.com

work for Wisconsin communities, large and small," says John Nelson, sales manager. "CIPP is a specialty of ours."

Visu-Sewer uses the National Liner system from National Enviro-Tech Group, Houston, Texas. Working from manhole to manhole, technicians inserted a non-woven, needled, polyester felt into the pipelines. Saturated with a thermosetting resin, the liner was heated to activate the resins and cure inside the host pipe, creating a new pipe with a design life of at least 50 years.

After the new pipe was fully cured, the Visu-Sewer team reopened the lateral connections using a remote-controlled robotic cutter. Finally, they chemically regrouted the lateral connections.

"Working in the backyards presented special challenges," Cermak says. "Visu-Sewer did a nice job, disturbing as little of the landscape, gardens and tree lines as possible, and working quickly to avoid inconveniencing the homeowners any more than necessary. Some of the work went into the wee hours of the night to get private laterals reopened."

While CIPP was the ideal technology in the tight conditions, the project did encounter one difficulty. One old sewer line had 45-degree bends crossing a property owner's backyard. "In order to line it properly, and for future cleaning and maintenance, we needed to put in straight pipe sections and join them at a new manhole," says Cermak.

"Unfortunately, the spot where the manhole needed to be was occupied by a mature pine tree that shaded two yards. We looked at several alternatives, but in the end we had no choice but to take it down." The village reached an agreement with the neighbors on the financial value of the tree and made sure all excavated areas were cleaned up and restored as much as possible.

Keeping residents informed

Throughout the project the village board held meetings and sent newsletters to residents, letting them know the poor state of their sewer system, the ramifications of doing nothing, and the impact of the CIPP rehabilitation on their property. "We can't always keep everybody happy," Cermak says, "but I think we did a good job in fully explaining the project."

The project cost $175,000, not including engineering fees and the original televising. Because of its small size, North Bay does not qualify for state or federal grants, and must pay for sewer repairs out of its own budget.

Cermak reports that the lining has already reduced flows. "Our eCMAR (compliance maintenance annual report) for 2007 reflected a 12 percent reduction in flow compared to 2006," he says. North Bay plans to line other sections of its system as funds become available to potentially reduce flows even further. ✦

MORE INFO:

314 **Cretex Specialty Products**
800/345-3764
www.cretexseals.com

210 **National Liner**
281/874-0111
www.nationalliner.com

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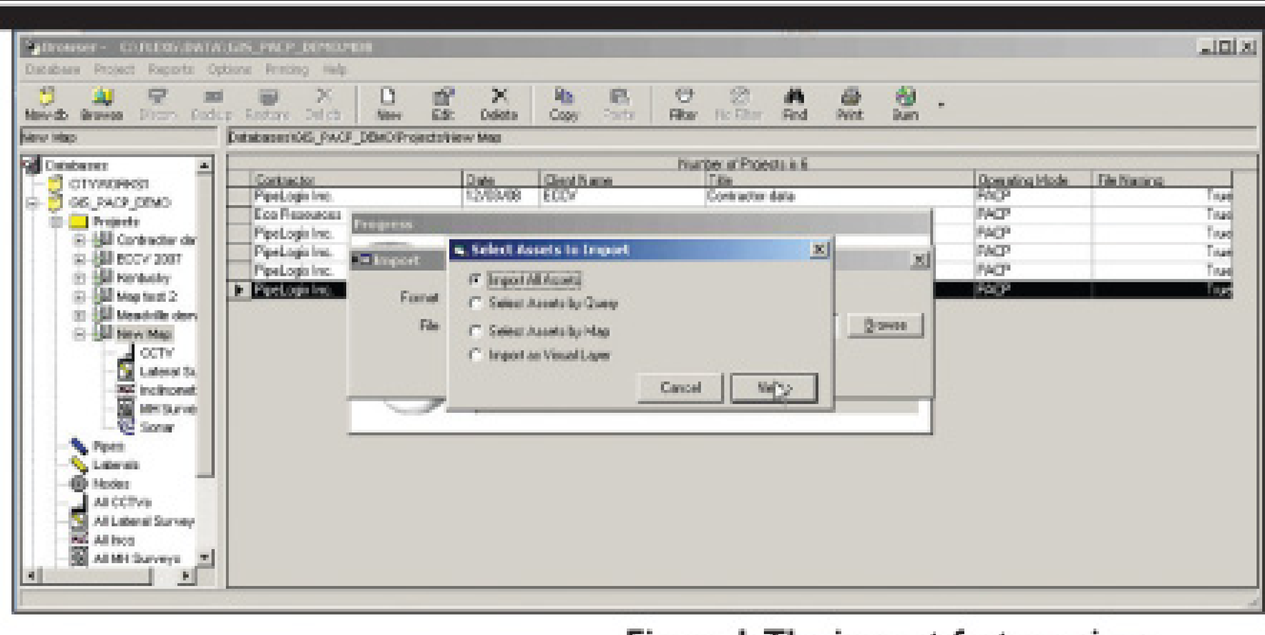


Figure 1. The import feature gives users options for selecting assets to import for review.

MAKING THE LINK

The latest version of flexidata-GIS software from PipeLogix Inc. links pipe inspections with mapping information to enhance efficiency in managing assets

By Erik Gunn

Pipe inspection software continues to get more sophisticated. Features that allow the recording of data while a video inspection proceeds have become routine. Today's more advanced programs also provide capability to interface with widely used asset management software and geographic information systems (GIS).

One such offering is the flexidata-GIS module from PipeLogix Inc. of Palm Desert, Calif. It was the first module with capability to link a user's existing GIS map data into the inspection database. Joan Stone, PipeLogix president, demonstrated the latest version of that system in a Web-based conference on Feb. 17.

Walk-around

Flexidata-GIS looks and acts like a standard Windows-based application. Typically launched from a desktop shortcut, it opens to a browser window consisting of a left-hand pane that is a directory of folders and a larger right-hand pane that is the usual work space. A menu bar and a toolbar offer standard options for accessing and working with files, creating reports, searching, printing and deleting.

Folders in the left pane take the user to various individual inspection projects and databases for pipes, laterals, nodes, CCTV inspections, lateral surveys, and others. To provide adequate computer power to work with GIS mapping files and stored inspection video, the company recommends computers be equipped, at minimum, with dual-core processors and at least 2 MB of RAM. It is assumed that most data, particularly video, will be stored on terabyte servers on a network.

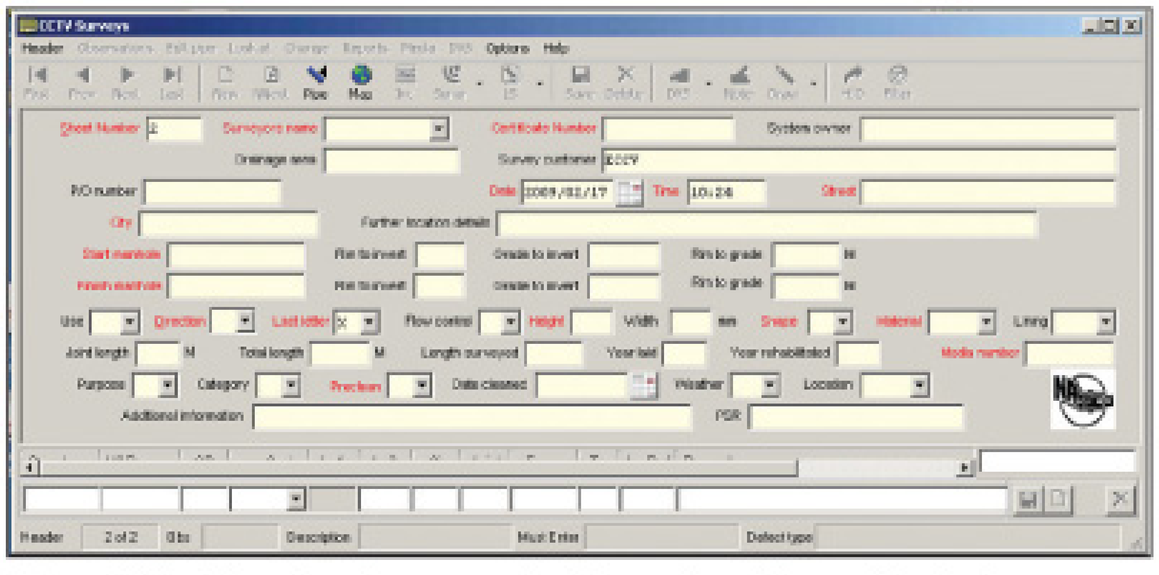


Figure 2. A data-entry form requires inspection information to be entered using the industry-standard PACP coding system.

Operation

Stone demonstrated a series of operations. She began by showing how flexidata-GIS can import data from existing shapefiles. Stone clicked on a shortcut icon and entered a user name and password. The program's browser opened, defaulting to the projects list and opening the folder for the database used most recently, in this case: GIS PACP DEMO.

Stone moved the mouse cursor down to an icon for a new simulated project, New Map, then imported map data for the project by choosing "import" from the project menu at the top of the browser window. The import feature lets users choose whether to import all assets, select assets by query, select assets by map, or import the infor-

TECHNOLOGY TEST DRIVE

EQUIPMENT:
Flexidata-GIS inspection database software linked to GIS mapping data

MANUFACTURER:
PipeLogix Inc.,
Palm Desert, Calif.
866/299-3150
www.pipelogix.com

LOCATION OF DEMO:
Internet

DEMONSTRATED BY:
Joan Stone, PipeLogix Inc. president

LIST PRICE AS DEMONSTRATED:
GIS license $2,350
(requires flexidata Full Reporting License, $8,400)

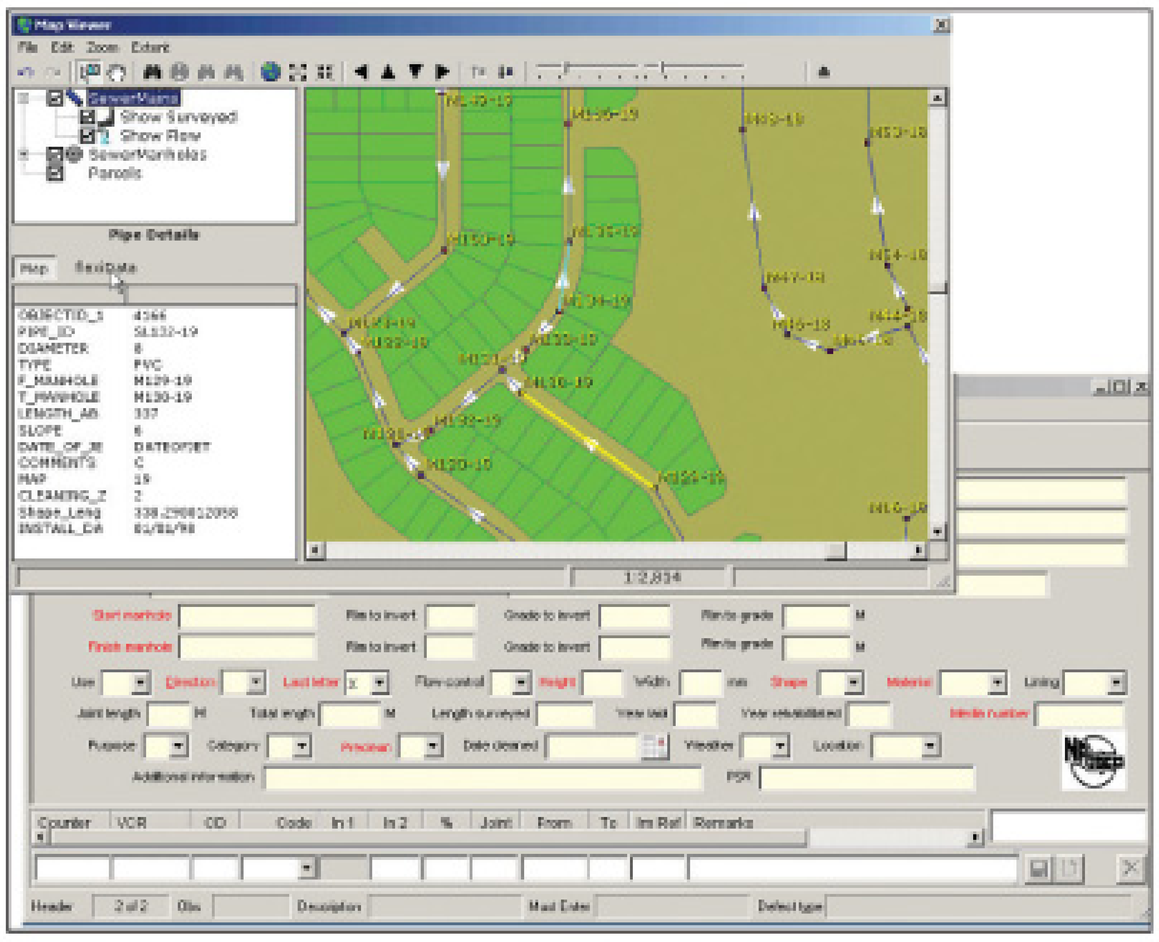


Figure 3. The pipe selected for inspection is highlighted in yellow on the Map Viewer screen.

mation as a visual layer.

Stone selected all assets (Figure 1). After she clicked Next, the program presented a verification dialogue in the form of a pull-down menu listing several types of assets — pipe, manhole and lateral — as well as options for Visual and Rastor layers.

She selected an appropriate template (most users, she said would have just one or two templates for importing data) to map the fields from an existing shapefile into flexidata. Stone explained that the function could be used to import both data and a map or just one or the other. Proceeding with the operation would import all the assets into the flexidata pipe tables, lateral tables or manhole tables. (Because a typical import takes about 20 minutes, Stone did not actually complete that part of the procedure.)

She then showed how the system is used to enter information for an inspection project. Back in the flexidata browser, she chose the New Map folder and went to an item nested within it called CCTV to simulate creation of a new survey. Clicking on the New icon brought up a data entry form (Figure 2), requiring inspection information to be listed in the NASSCO-PACP format.

Once data in the project form were completed, Stone clicked on a map icon on the form's toolbar to open a map of a city's sewer assets. One segment of sewer line was highlighted as having already been surveyed; Stone used the cursor to draw a square around that area on the map and zoom into it. In a pane in the upper left corner, she then opted for a view showing the direction of flow of the sewer.

Stone used the map to select the pipe for inspection (Figure 3), and the pipe was then highlighted. Returning to the survey project form, she filled in a field asking whether the survey would go upstream or downstream; she selected downstream. With the selection, the application automatically filled in the start and finish manhole on the form and pulled information on the diameter, material and total length of pipe from the database. Additional fields included information for the inspector's name and PACP certificate number, what form of precleaning was required, and others.

Stone then simulated entry of

The linkage of data on inspections directly with map information offers a powerful visual key that is likely to be helpful in managing infrastructure, and especially in coordinating project locations for maximum efficiency.

data during an inspection, entering information as if proceeding from the entry manhole. If an actual camera had been operating, it would have fed footage information automatically to the database. She simulated entering data from a fault, and then clicked to finish the survey. To show the storage of data from an actual survey, Stone returned to the browser and retrieved a different, completed survey already associated with a video recording.

To simulate how an engineer back at the office might use the data collected in the field to do a follow-up review of the findings, Stone used data from the actual inspection and exported the information to a shapefile, working from the flexidata-GIS browser window. Exporting was quick: From the menu bar at the top, Stone chose survey, then export, leading to a series of menus from which she chose specific exporting options (Figure 4).

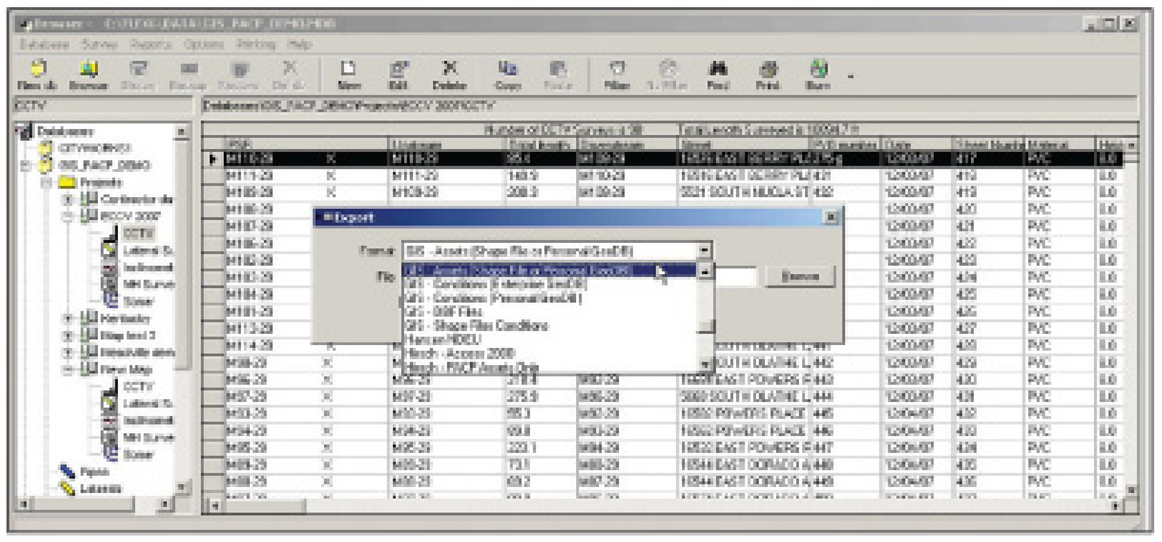


Figure 4. Users export data collected in the field to shapefiles by clicking on a series of menus that offer various exporting choices.

The procedure exported the information as a layer. Once the information was exported, Stone left the flexidata-GIS program and started a different program, Arcmap, to which PipeLogix has added a special flexidata-GIS toolbar. Stone used that to link back to the flexidata database.

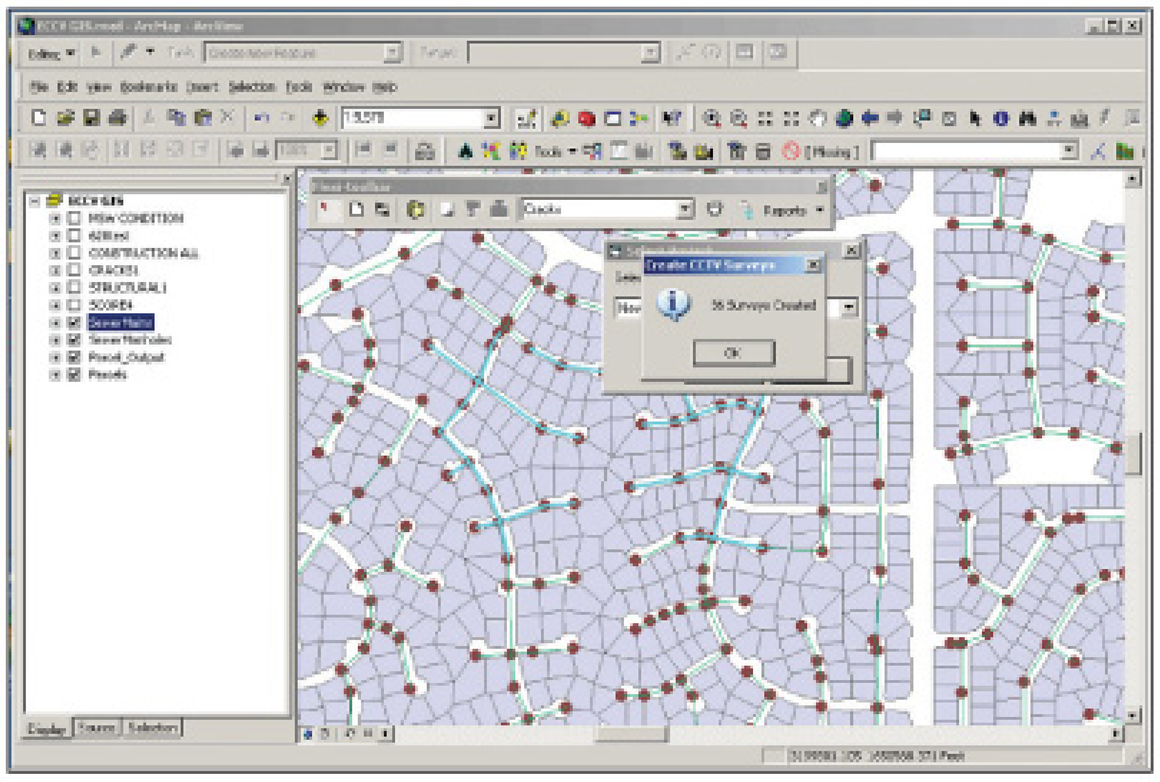
Navigating to the map of the neighborhood where the inspection was conducted, Stone showed how the map image of the inspected pipe highlighted areas that had been recorded during the inspection. Conditions recorded during the inspection appeared here as dots on the stretch of pipe, and the information was readily available by clicking on the segment.

Using the flexidata toolbar in Arcmap, Stone then retrieved images from the inspection itself. Selecting another layer in the database, she searched for pipes with cracks, which showed up in red. When Stone selected one to review more closely, it turned turquoise. By clicking on the Reports button on the Arcmap flexidata toolbar, Stone opened a PDF of the selected pipe's inspection report.

Stone explained that when using Arcmap with the flexidata toolbar, a supervisor can select specific areas for surveys. Using the mouse to draw a box around a neighborhood and zoom in on it, she clicked on a button on the toolbar to create surveys.

The system automatically set up surveys for 36 segments of sewer

Figure 5. The system is automatically set up to survey specific sewer line segments in a neighborhood.



line in the neighborhood (Figure 5). Returning to the flexidata program, she then showed how the application had automatically begun filling in location information for survey forms corresponding to each survey (Figure 6).

New projects can also be created in flexidata without going to Arcmap. In flexidata, Stone clicked on Options, then chose Map Manager. That feature lets the user link the map to the layers needed for the inspection project.

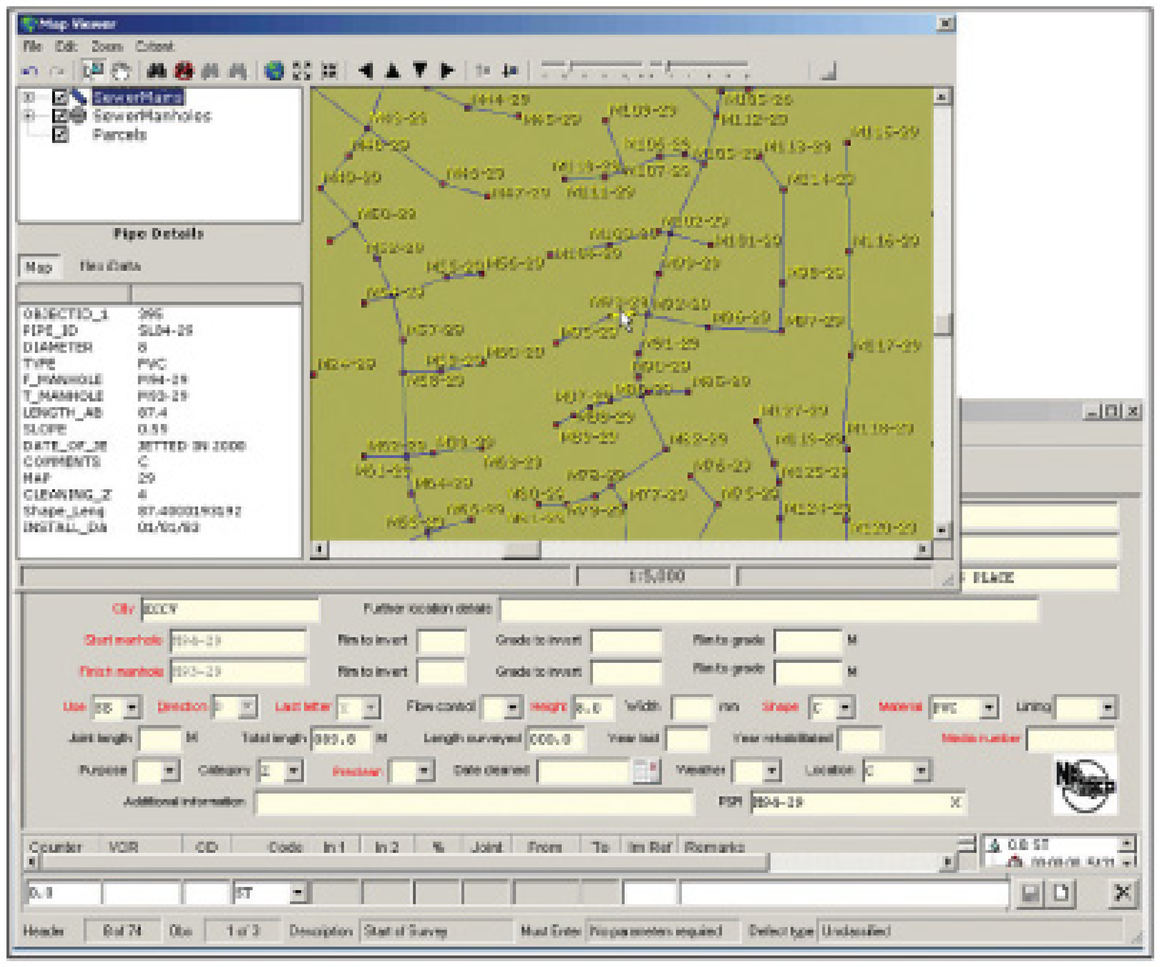


Figure 6. The application automatically fills in location information for the survey forms corresponding to each survey.

Observer comments

As with many software applications, flexidata-GIS appears likely to take a little time to understand its structure so that users can become comfortable with it. The linkage of data on inspections directly with map information offers a powerful visual key that is likely to be helpful in managing infrastructure, and especially in coordinating project locations for maximum efficiency.

Manufacturer comments

"The key component a city needs to get this all to work properly is GIS files with data behind them and upstream and downstream manhole numbers for every pipe," says Stone. Users can import asset databases into new flexidata databases or use the software with existing databases. This gives users with older file systems access to the program.

A few of the features could not be shown because the demonstration was conducted online and because the demonstrated software was a beta version of the newest edition of the application, according to Stone.

> **"The key component a city needs to get this all to work properly is GIS files with data behind them and upstream and downstream manhole numbers for every pipe."**
>
> **Joan Stone**

The software's standard license covers a desktop user, with full reporting, and a truck supervisor with light reporting. The license is enforced with a key inserted in the USB port, so one license can be used on more than one inspection truck so long as they are not simultaneous. Stone recommends that data be stored on a network to allow maximum access to the information it contains. ✦

MORE INFO:

37 **PipeLogix**
866/299-3150
www.pipelogix.com

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.

EMPLOYEES SEE THE LIGHT

A Texas water utility drives efficiency improvements by getting employees more involved and giving them a better view of the big picture

By Ken Wysocky

In a manner of speaking, employees of Austin Water Utility treatment plants used to work in silos. They operated as independent entities, largely isolated from each other's best management and operation practices.

But propelled by an intense quality improvement program, management and employees grabbed their figurative sledgehammers and slowly broke down the walls. By sharing ideas and best practices for various processes, they improved water quality, met increased demand for water services with fewer water plant employees, significantly raised the utility's bond rating, and increased employee and customer satisfaction.

"We gained efficiencies through standardization," says Bart Jennings, business strategy manager for the utility, which serves about 850,000 customers in metropolitan Austin, Texas. "For example, if an employee moves to a different plant to fill in for a retiring employee, they don't have to learn a whole new way of doing things. This gave management greater flexibility. The intellectual power of employees is greatly enhanced when people work outside those silos."

Tangible results

The results were dramatic. By challenging employees to develop better treatment processes, the utility improved water quality from 0.22 NTU in the early 1990s to 0.01 NTU in 2008.

Efficiency also increased. For example, the miles of water and wastewater pipe for each full-time water plant employee increased from 5.0 in 1996 to 6.1 in 2008, and water and wastewater accounts have increased by 127,000 since 1992.

The utility handled the growth even though it slowly eliminated 24 full-time plant positions during roughly the same period. The utility achieved the reductions, which now save $1.2 million annually, by not filling positions as they became vacant. In addition, the utility's bond rating rose from A2 to Aaa, the highest possible ranking.

Last but not least, customer satisfaction with water quality increased from 61 percent in the early 1990s to 83 percent in 2008. Those gains would not have been possible without cooperation from the employees' union, Jennings says.

"We created a partnership with the union by explaining that we needed to become more efficient and improve productivity," he says. "The total quality management wave of the 1990s was hitting, and community businesses were asking us what we were doing to treat ourselves more like a business. We needed a totally different way of looking at how we operated. It took some time, but the union bought into it and worked well with management."

Focus on excellence

The silo demolition process started with formation of a quality council of managers and workers from all departments. "We wanted input from all levels of the organization," Jennings says.

The team was charged with benchmarking utility operations against industry standards set by the American Water Works Association. Through that process, the team established strategic planning processes, created new employee reward and recognition programs, developed new job evaluations that tied performance to measurable goals, and initiated cross-training programs to improve efficiency.

Process improvement drives everything the team considers. It even affected more mundane programs, such as employee recognition, which used to focus on service longevity. "If you lived and breathed long enough, you'd be recognized," Jennings says. "But that doesn't drive improvement." Now the program rewards and recognizes teams and employees that make the plants operate better than they did before.

Employee training is another example. Training used to focus mainly on teaching workers to use tools and equipment for license certification, not on leadership skills or career progression. "The former looks strictly at legal requirements," Jennings observes. "The latter is a holistic perspective — how employees can better their contributions to the team and improve themselves, too."

Cross-training added even more benefits. As vacancies arose, mainly through retirements, the utility didn't always have to fill the position. Moreover, when employees have downtime, they now can help in other areas. "They're more vested in the overall plant operations," Jennings says.

"We gained efficiencies through standardization. For example, if an employee moves to a different plant to fill in for a retiring employee, they don't have to learn a whole new way of doing things. This gave management greater flexibility."

Bart Jennings

Big-picture perspective

Before the quality management programs, there was a disconnect between employees' jobs and the utility's goals. For example, reducing per capita water usage is one of the utility's goals, because it delays the addition of treatment facilities and reduces water purchases from the Colorado River Authority. Yet employees didn't always know they could influence that goal by the way they did their jobs.

"If we can improve irrigation audits, then we can reduce the amount of water used," Jennings says. "That saves customers money and helps the utility achieve its goal of reducing water usage. Now there's more linkage between employees' activities and tasks and the utility's strategic objectives and goals."

Now about 15 years old, the quality improvement program is still evolving. Once a month, all maintenance and operations supervisors from the three water treatment plants and two wastewater treatment plants meet to discuss topics from employee training and retention to operating problems.

"People learn from each other," Jennings notes. "They talk about issues, and someone will say, 'Oh, we already dealt with that and solved it this way.'"

Surveys show that employees are much more satisfied now than years ago. That's a result of management taking their input seriously and using it to make visible improvements. Moreover, better communication between management, supervisors and employees means people more clearly understand job expectations.

"When we first got started with total quality improvement, someone in our human resources department pulled out an employee survey from the 1970s, and it was really depressing," Jennings recalls. "We were dealing with the same problems in the 1990s that we were in the 1970s.

"It underscores the need to be constantly vigilant about making even incremental changes and improvements in our corporate culture. It's an ongoing issue." And it's a lot easier when silos don't block the view of the big picture. ✦

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ASSOCIATION NEWS

Help for Small Systems

To help small utility operators and managers, the U.S. EPA has developed a free, easy-to-use computer program, Check Up Program for Small Systems (CUPSS). It was designed with the help of a workgroup that included representatives from state agencies, technical assistance organizations such as the National Rural Water Association, EPA regional offices, and small wastewater and drinking water utilities.

The four main goals of the software are to assist with the communication between the operator and the decision makers, help move utilities from crisis management to informed decision making, facilitate more efficient and focused utility operations, and improve financial management.

Grant Makes Training Possible

Thanks to a grant from the U.S. EPA, the National Rural Water Association was able to provide water system operator training to the 130 water systems on the islands of Hawaii. The NRWA had been providing the training to the 48 contiguous states and Alaska since 1977, but it previously did not have funding for Hawaii.

Marchegiani, Silke Receive Recognition

Kim Marchegiani of the Bangor (Maine) Water District won the 2009 Sid Anthony Award of Merit. Also, Christopher M. Silke, P.E., a senior project manager and corrosion control specialist in the Water Practice Group, has been selected to serve as a committee member for the American Water Works Association (AWWA) Water Research Foundation.

LEARNING OPPORTUNITIES

University of Wisconsin-Madison Courses

The University of Wisconsin-Madison Department of Engineering Professional Development is offering the following CEU, LU, PDH classes at the Madison campus:

- May 7-8 – Preparing an Effective Municipal Capital Improvements Plan
- May 12-14 – Fundamentals of Drinking Water Treatment
- May 20-22 – Modeling Unsteady Flow Using HEC-RAS 4.0
- June 8-9 – Understanding Water Chemistry for Practical Application
- June 10-12 – Designing Wastewater Pumping Systems and Lift Stations
- June 23-24 – Upgrading Your Sanitary Sewer Maintenance Program

Call 608/262-2061 or visit http://epdweb.engr.wisc.edu.

American Public Works Association

APWA has these courses as classroom workshops or Web-based broadcasts:

- May 1 – Self Assessment Using Management Practices Manual, Pittsburgh
- May 5-7 – Public Fleet Management, Boston
- May 6 – Public Infrastructure Inspector, Part 1, Web
- May 13 – Public Infrastructure Inspector, Part 2, Web
- May 20 – Public Infrastructure Inspector, Part 3, Web
- May 21– Traffic Mediation: Neighborhood and Pedestrian Safety Programs, Web
- June 3 – Public Fleet Manager, Part 1, Web
- June 10 – Public Fleet Manager, Part 2, Web
- June 17 – Public Fleet Manager, Part 3, Web

Call Carrie Merker at 800/848-2792, ext. 5213, or visit www.apwa.net.

American Water Works Association

The organization is offering the following CEU/PDH seminars:

- May 6-7 – Water Demand and Conservation Management: Planning, Policy and Rates, Orlando, Fla.
- May 20-21 – Distribution System Assessment & Rehab, Charlotte, N.C.

Call 800/926-7337 or visit www.awwa.org.

Municipal Sewer & Water invites your national, state or local association to post notices and news items in this column. Send contributions to editor@mswmag.com.

CALENDAR

May 3-6
National Clean Water Policy Forum, Renaissance, Washington, D.C. Visit www.wef.org.

May 3-7
Residuals and Biosolids 2009 Conference, Oregon Convention Center, Portland, Ore. Call 703/684-2441 or visit www.wef.org.

May 4-6
American Water Resources Association Spring Conference, Marriott, Anchorage, Alaska. Call Michael Lilly at 907/479-8891 or visit www.awra.org.

May 5-7
Water Environment Federation Technical Exhibition and Conference (WEFTEC), Anchorage, Alaska. Call 800/666-0206 or visit www.weftec.org.

June 7-10
PennTec Annual Conference, Lancaster Host Conference Center, Lancaster, Pa. Call Cindy Rock at 570/549-2204 or visit www.pwea.org.

June 14-18
American Water Works Association Conference and Exposition, San Diego (Calif.) Convention Center. Call 800/926-7337 or visit www.awwa.org.

June 17-19
Florida Stormwater Association Conference and Exhibits, Sanibel Harbour Resort and Spa, Fort Myers, Fla. Call 888/221-3124 or visit /www.florida-stormwater.org.

June 21-24
American Society of Agricultural and Biological Engineers International Meeting, Grand Sierra Resort and Casino, Reno, Nev. Call Sharon McKnight at 269/428-6333 or visit www.asabe.org.

June 28-July 1
Nutrient Removal Conference, Omni Shoreham, Washington, D.C. Call 703/684-2441 or visit www.wef.org.

June 29-July 1
American Water Resources Association Summer Specialty Conference, Snowbird Ski and Summer Resort, Snowbird, Utah. Call 540/687-8390 or visit www.awra.org.

Green Mountain Water Environment Association

The organization is offering the following courses:

- June 3 – Hands-On Leak Detections and Water Loss Control, site TBA
- June 9 – Operation and Maintenance of Wastewater Pump Stations, Waterbury, Vt.

For information, call 802/229-9111 or visit www.gmwea.org.

Green Stormwater Management

The U.S. EPA and the U.S. Botanic Garden produced an online video, "Reduce Runoff: Slow It Down, Spread It Out, Soak It In," that highlights rain gardens, green roofs, and rain barrels to help manage stormwater runoff. Watch the video online at www.epa.gov/owow/nps/lid/video.html.

Household Sewage Study

Contributions of Household Chemicals to Sewage and Their Relevance to Municipal Wastewater Systems and the Environment identifies organic compounds that may be present in municipal wastewater.

Published by the Water Environment Research Foundation, the study selects compounds by examining volume production, consumption pattern, and physicochemical properties. Researchers developed methods to model the behavior of individual compounds through treatment processes. The report has a database of HPV chemicals and organic compounds found in household commodities. Visit www.werf.org for the report in soft cover, CD ROM, and PDF format. ✦

Product Spotlight

Flow Logger Works in Pipes or Open Channels

By Ken Wysocky

Stingray from Greyline Instruments Inc.

The Stingray open channel flow logger from Greyline Instruments Inc. enables technicians to monitor wastewater velocity and flow without entering manholes.

"A sewer manhole is a difficult environment. You don't want to work an instrument keypad in one, if at all possible," says Ernie Higginson, Greyline advertising manager. Compact and portable, the Stingray unit is designed for use in open channels, partially filled sewer pipes, and surcharged pipes. It works with municipal stormwater, combined effluent, raw sewage or irrigation water.

To deploy the unit, a technician affixes a stainless steel bracket 12 to 16 inches into the influent pipe (or to the bottom of an open channel), then slides a sealed, corrosion-resistant ultrasonic sensor into it. A cable connects the sensor to a watertight electronic logging unit that collects the sensor data.

The installer then sets the 3-pound logger to take readings at intervals from 10 seconds to 30 minutes, and hangs it inside the pipe. The logger records the date and time of the readings and the water level, velocity and temperature. PC software allows users to view the data in real time by connecting a laptop on site. The logger can store up to 130,000 data points.

After installation, the technician can press a button to activate an LCD display, which confirms that the unit is operating, and confirms the reading levels, signal and battery strength, and logger capacity. "You can leave the unit inside the pipe for up to three years, although a month is more typical," Higginson says.

The calibration occurs after a technician downloads the log file into a computer, using an RS232 connection. After setting up parameters, such as the pipe diameter and the preferred unit of flow measurement (gpm, for instance), Windows-based software converts the collected data into a flow survey, including minimum, maximum and average flow. It can calculate flow for round, rectangular, trapezoidal and egg-shaped channels, and converts between common measurement units.

"You can bring a laptop computer on site and download the data, or bring the logger to a computer," Higginson says. "After the data is downloaded, the software automatically creates a flow chart based on the pipe or channel size. The software displays it as a graph or a table, or you can export it to a spreadsheet program."

The unit runs on four standard alkaline D flashlight batteries, and the software program is included. **For information: 888/473-9546 or www.greyline.com.**

LMK Introduces Toolbox Launcher 89

The portable Toolbox Launcher from LMK Enterprises Inc. is designed for lining 2-inch-diameter drain pipes. The CIPP lining system is able to renew up to 40 feet of pipe in one continuous installation, as well as negotiate 90-degree bends. Used with a variety of resin systems, ambient cure time is less than two hours. **815/433-1275; www.performanceliner.com.**

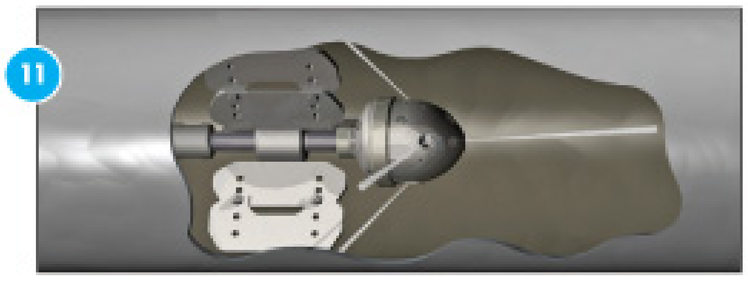
Autodesk Introduces Infrastructure Modeling Software

The AutoCAD Map 3D 2010, AutoCAD Raster Design 2010, Autodesk MapGuide Enterprise 2010 and Autodesk Topobase 2010 are the latest infrastructure modeling software products from Autodesk Inc. AutoCAD Map 3D 2010 uses open-source Feature Data Object data access technology to provide direct access to formats used in design and GIS for mapping a broad range of spatial information. AutoCAD Raster Design 2010 extends the power of AutoCAD software and AutoCAD-based products by enabling engineers and designers to use scanned paper drawings, maps, satellite images, aerial photos and similar imagery. Autodesk MapGuide Enterprise 2010 is a mapping platform designed to deliver CAD and GIS information via the Web. Autodesk Topobase 2010 provides a single source of network information for maintenance, planning, reporting and integration into asset management and operational systems. **800/964-6432; www.autodesk.com.**

Advance Products Offers Radolid Protection Caps

Radolid protection caps with volatile corrosion inhibitors from Advance Products & Systems are designed to protect nuts and bolts from destructive corrosion. The caps can be pressed onto nuts and bolts by hand, and snap into place. Loading the caps with APS's high melt corrosion inhibitor grease provides added protection. **800/315-6009; www.apsonline.com.**

StoneAge Offers Bigger Badger Nozzle

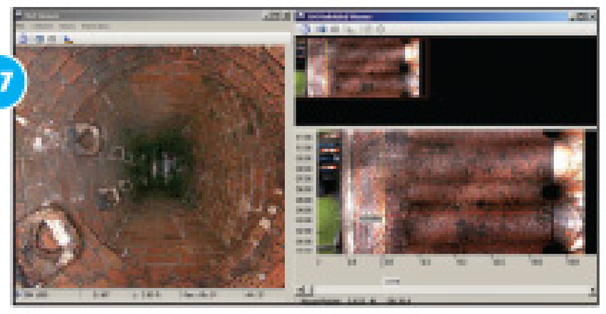


The Bigger Badger cleaning nozzle from StoneAge Inc. is designed to handle multiple 6-inch, 90-degree bends or larger with the use of a centralizer. Featuring 15,000 psi with a 1/2-inch rpt inlet or 20,000 psi with a 9/16-inch MP inlet, the nozzle has a flow capacity of 14 to 55 gpm. The tool comes equipped with an adjustable speed control (50 to 300 rpm) that enables the operator to maximize productivity by changing the adjustment sleeve with the wrench provided. No disassembly or fluid change is required. **866/795-1586; www.stoneagetools.com.**

SewerLock Offers Manhole Cover Locking System 430

SewerLock manhole sub-ring locking systems are designed to deter manhole cover theft, prevent dumping of fats, oils and grease, and catch street construction debris. The locking systems are installed into both new and existing manhole risers just below the manhole cover. **408/761-5882; www.sewerlock.com.**

PipeLogix Releases flexidata 360 Module



The flexidata 360 Module from PipeLogix Inc. is designed to work with the latest scanning camera technology, such as Panoramo and Panoramo SI, in both pipe and manhole surveys. When used with flexidata Lite, the module launches the Panoramo scanner and creates an IPF file that can be played back for review. In the full or manhole versions, analysis tools create survey data from three different pipe views. **866/299-3150; www.flexi-data.com.** ✦

Cloverleaf Tool Names Rawlings General Manager

Kevin Rawlings has been promoted to general manager for Cloverleaf Tool Co. Rawlings has 12 years experience in sales, marketing and distribution. He will be responsible for day-to-day operations.

RIDGID Introduces "Luck of the Draw" Video Contest

The "Luck of the Draw" video contest from RIDGID invites RIDGID tool users to record and post an original one- to four-minute video that features the RIDGID logo and two of three mystery elements that will be given to contestants upon registering through the Web site, www.ridgidvideo.com. Five finalists will be chosen and posted on the Web site for voting. Videos will be judged on persuasiveness, creativity and entertainment value. Five finalists will receive an all-expense paid trip to the RIDGID Roundup Customer Event. The grand prize winner will receive $2,500 in RIDGID tools. The contest runs through July 31. Winners will be announced on Sept. 11. ✦

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CLASSIFIED AD FORM

Please print ad legibly below with ***correct punctuation*** and ***phone number.*** Circle each word to be bolded, if any. ($1.00 extra per word)

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- ❑ Business Opportunities
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- ❑ Drainfield Restoration
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- ❑ Jetters-Truck
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- ❑ TV Inspection
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CHOOSE THE PUBLICATION(S):

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Deadline: 1st of the Month

❑ ***PUMPER***
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❑ ***PRO***
Deadline: 17th of the Month

❑ ***MUNICIPAL SEWER & WATER***
Deadline: 1st of the Month

❑ ***ONSITE INSTALLER***
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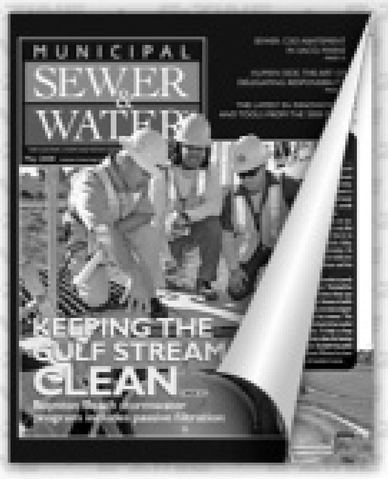

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