Esri News
for Water & Wastewater

Summer 2015

Saving Hundreds of Thousands of Dollars by Controlling Non-revenue Water Loss

White House Utility District Speeds Repair with Real-Time Underground Leak Detection

By Sarah Alban, Esri Writer

White House Utility District (WHUD) is geographically Tennessee's largest water and wastewater utility. WHUD's service area extends to 600 square miles and serves a population of just over 94,000 people. In 2013, WHUD began implementing a vision of becoming a true geographic information system (GIS)-centric organization.

"We had reached a point where continuing to develop custom software interfaces between software applications became too restrictive," said WHUD general manager Bill Thompson.

Historically, WHUD has used GIS for asset information, workflows, rate modeling, customer service, gross revenue projection, subdivision records, lots sold and available, growth-area tracking, water-use tracking, trend detection, and more.

In 2005, WHUD implemented extensive leak detection that focused on the reduction of non-revenue lost water. Because of the size of WHUD's coverage

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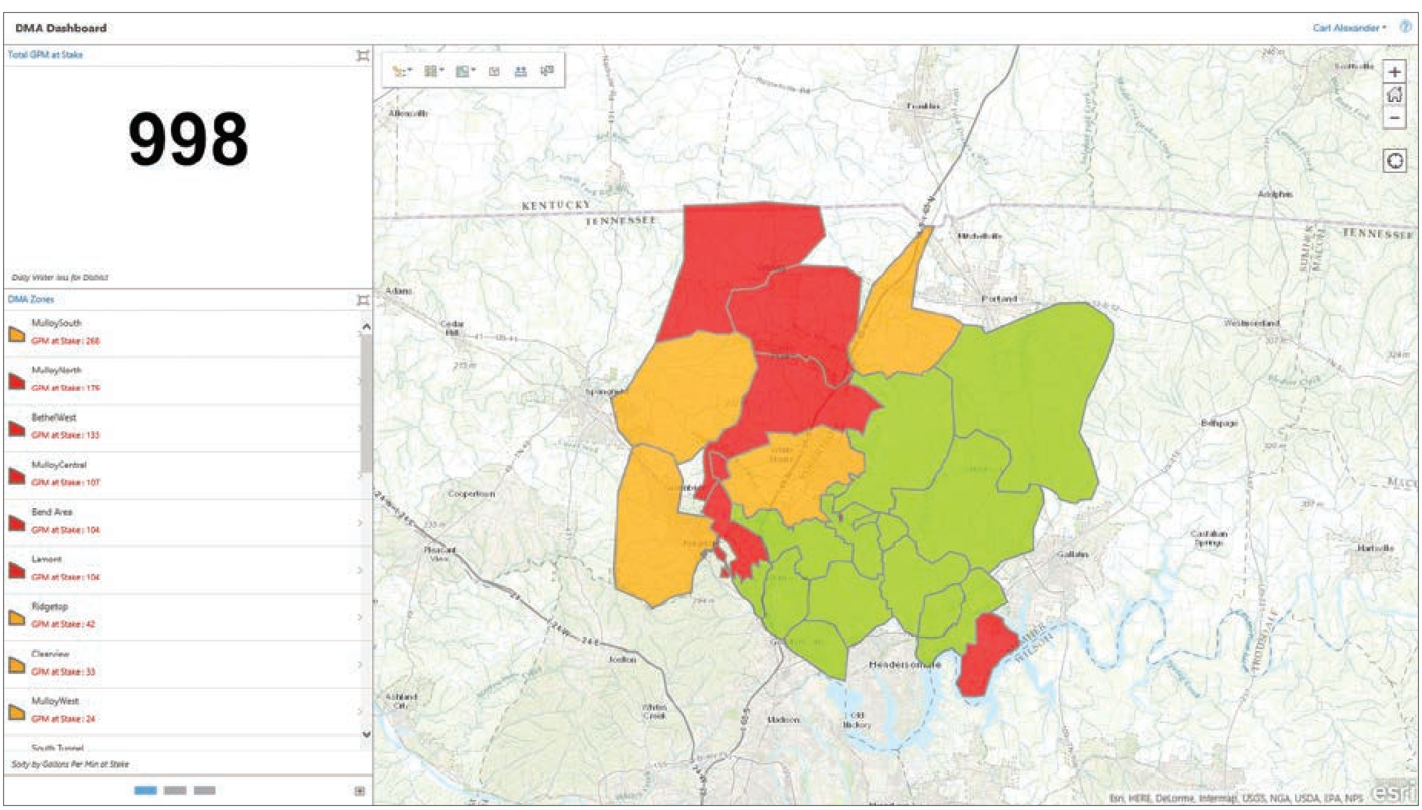

↑ On this dashboard, red indicates excessive leakage requiring field response.

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2015 Esri Water Conference Wrap-Up

More than 200 water, wastewater, and stormwater professionals joined us in Portland, Oregon, to make the first-ever Esri Water Conference a happy memory. Thank you to all who attended.

The conference kicked off with inspiring plenary presentations from Valor Water, American Water, and Northeast Ohio Regional Sewer District. And Portland's Matt Fried presented a story map highlighting Portland points of interest.

After a break, White House Utility District (WHUD) made the second half of the Plenary Session remarkable with use cases of huge time- and money-saving applications of the latest ArcGIS solutions, including near real-time underground leak detection. WHUD general manager Bill Thompson told us that WHUD has put GIS in charge of IT so that everyone can have access to the data to ensure utility-wide information sharing.

Attendees brought value to each conference event: technical sessions, paper presentations, the Hands-On Learning Lab, and walk-up GIS solutions kiosks, in addition to networking in the foyer.

We hope that you had a great experience at our first Water Conference. But if you weren't able to make it this year, don't miss it in 2016! We're getting bigger and better.

Esri Water Practice Sector

> "This event really afforded me the opportunity to see what others in my field are doing with GIS and helped to start the brainstorming process on the other ways that I can utilize GIS within a water utility setting."
>
> 2015 Esri Water Conference Attendee

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VALOR WATER ANALYTICS

We would love to hear from you about your experience. Please post comments about the conference on GeoNet or contact Christa Campbell at **ccampbell@esri.com**.

→ Jeffrey Duke, GIS Services Manager, Northeast Ohio Regional Sewer District, presenting during the water conference plenary.

Sponsorship Editorials

Reduce Liability with 811 App from BlueReview

Water and wastewater utilities are using a mobile app that leverages the ArcGIS platform to manage 811 (Call Before You Dig) utility locate tickets.

The app, BlueReview, replaces the traditionally cumbersome process of managing utility locate requests: from piles of paper work, inaccurate maps, incomplete documentation, and unidentifiable photographs to wasted time, mileage, and fuel spent in trips to and from the office.

With the Internet app, utilities receive the request, locate the assets with ArcGIS, take notes and photos, and instantly bundle and digitally file the work. A task that once took days now takes only minutes.

"Our customers love how simple and easy the app is to use and learn," BlueReview president Matt Hirst said. "And with ArcGIS Online, their GIS is literally at their fingertips."

Hirst says the time and cost savings users see are significant. But customers largely point to the liability protection from contractor or other claims related to a utility marking.

"We recently had a contractor call in with a dispute. BlueReview saved us all kinds of time and money because we had records with a photo, time stamp, and GPS location," said Kenton Moffett, Water Utility Manager of Ogden, Utah.

Utilities using BlueReview include Springfield, Illinois; Goochland County, Virginia; Salt Lake City, Utah; and Pagosa Area Water District, Colorado, to name a few. For more information, visit www.bluereview.net.

BlueReview®

Modeling with Cityworks

GIS has changed the way we understand the world around us. Intuitive modeling tools provide public agencies with the ability to view, manage, and manipulate the assets they care about—infrastructure, property, and facilities. Recognizing the powerful capabilities of the GIS and the inherent value of the geodatabase as the authoritative asset inventory, Cityworks introduced a new and innovative approach to asset management.

Built on the Esri ArcGIS platform, Cityworks is easily applied to anything modeled in a geodatabase. Public agencies, utilities, and special districts that care for infrastructure facilities, airports, marinas, botanical gardens, emergency response, urban forests, and more, are in touch with reliable and accurate data and geographic analysis tools that help managers make informed and timely decisions.

From the largest city to the smallest water district, the challenge is the same—having functional and dependable systems that are safe and reliable. Proactively scheduling maintenance; responding quickly and efficiently to customer issues; and managing the regulatory requirements of permitting, licensing, and related business processes are a tall order in today's economy. Discover why so many agencies around the world choose Cityworks—Empowering GIS for Public Asset Management.

Cityworks®

Pipeline Management with Infrastructure Technologies

ITpipes by Infrastructure Technologies provides advanced inspection solutions for web, mobile and desktop. These fully integrate with the Esri platform and include solutions for data collection, management, and storage along with reporting for CIP and design. They also automatically integrate with the Esri and AMS billing and computerized maintenance management system (CMMS).

Data Collection

ITpipes streamlines daily processes and actions that used to be performed manually. Now, processes can be completed automatically by ITpipes, with the inspector seeing the results during the inspection. All equipment, such as closed circuit television (CCTV), high definition television (HDTV), sonar, laser, 3D, and side-scanning, works with ITpipes. And as inspections are completed, they sync up into a central repository and become accessible immediately to designated users and through GIS.

Esri Platform Integration

Every agency works differently. So ITpipes is designed with configurability and flexibility, and it works with various business models. With options for transferring data from GIS to ITpipes or vice versa, launching ITpipes web or desktop apps from ArcMap and ArcGIS Online, triggering actions, and more, clients get exactly what they want from these resources.

AMS/CMMS Integration

ITpipes leads the market with innovative, automated syncing and configurable bidirectional integration with most major AMS/CMMS systems. This turnkey implementation and integration now exists with Cityworks, Lucity, Accela, Maximo, and other solutions.

Infrastructure Technologies is known for providing a simple, powerful solution with unparalleled technical support and services to back it up.

Asset Management with Lucity

Lucity, Inc., offers software products and related services to US local government agencies and special districts. Lucity has been an Esri partner since 1996 (Gold Tier since 2010) and obtained the ArcGIS Online Specialty designation in 2014. Lucity and Oregon City presented at the 2015 Esri Water Conference.

The Public Works Operations Group in Oregon City, Oregon, operates and maintains the city's infrastructure system and fleet assets. The group recently found success deploying Enterprise Asset Management (EAM) from Lucity software.

Lucity's EAM leverages ArcGIS for Desktop and ArcGIS Server. It supports sewer cleaning, CCTV inspection, backflow prevention, flushing, and valve exercising programs. Oregon City deployed the solution by divisions: Wastewater (2008), Water (2010), Street (2011), Stormwater (2013). With the solution in place, the city was able to achieve its operational asset management objectives.

The EAM's user interface (UI) initially used a Lucity Desktop user interface (UI), but then became customized and expanded on with capabilities of the Lucity Web UI. Lucity plans a future deployment of the Lucity Mobile UI.

Oregon City now remains an active member of Lucity's client community and participates in regional user group meetings, including hosting the 2014 Northwest Group Meeting, and in Lucity's annual conference and training events. The city presented its success story at the 2013 and 2014 Lucity annual conferences.

Experienced Solutions Service from Neptune Technology Group

Today's water utilities are faced with increasing pressures, including water supply, efficiency, workforce, infrastructure, and bottom line. But every problem has a solution. Neptune Technology Group knows, because our people have answers.

Where does it get those answers? For one, from experience. The company has a long history of water industry firsts under its belt with constant innovation. The answers also come from listening. Neptune utility customers know that they can approach it with a challenge and that it will take the time to look at that challenge from all angles and recommend the best solution from its portfolio of products and systems. Whatever solution your utility seeks from Neptune, the answer will be specifically designed to meet your utility's needs.

Saving Hundreds of Thousands of Dollars by Controlling Non-revenue Water Loss

continued from cover

area, there were a number of unique challenges the district needed to address. The number-one challenge was getting accurate information that could be analyzed quickly. In the initial stages of the program, the district was very successful, as it was able to reduce water loss by 50 percent. However, WHUD finally reached a point where the results plateaued.

The primary reason this occurred was that technology at that time did not have the capability to receive real-time information that interfaced with other field asset information. WHUD staff recognized that the only way they could move forward was to find a solution to this problem. This is when WHUD reached out to Esri.

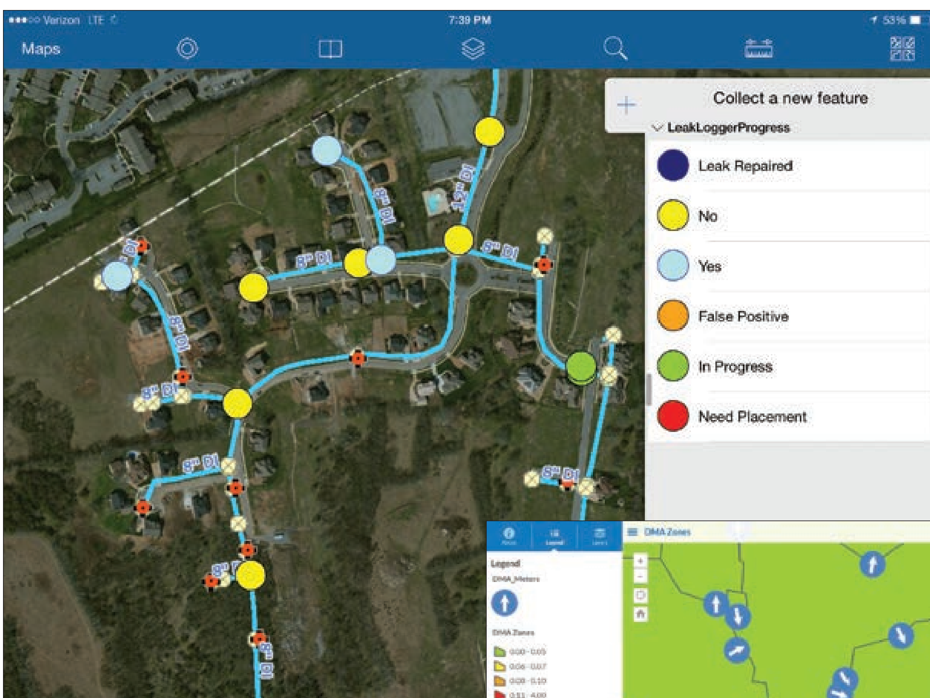
By working closely with Esri, WHUD was able to configure a connection that feeds real-time information from the district's smart meters into ArcGIS software. In conjunction with the real-time smart meter data, Esri also helped to configure the district's SCADA system so that flow meters, tanks, and pump stations are all displayed in real time. This information is accessible via ArcGIS for Server and ArcGIS Online as a web application and dashboard.

Underground leaks that once could take months to be found are now detected and repaired in two to three weeks.

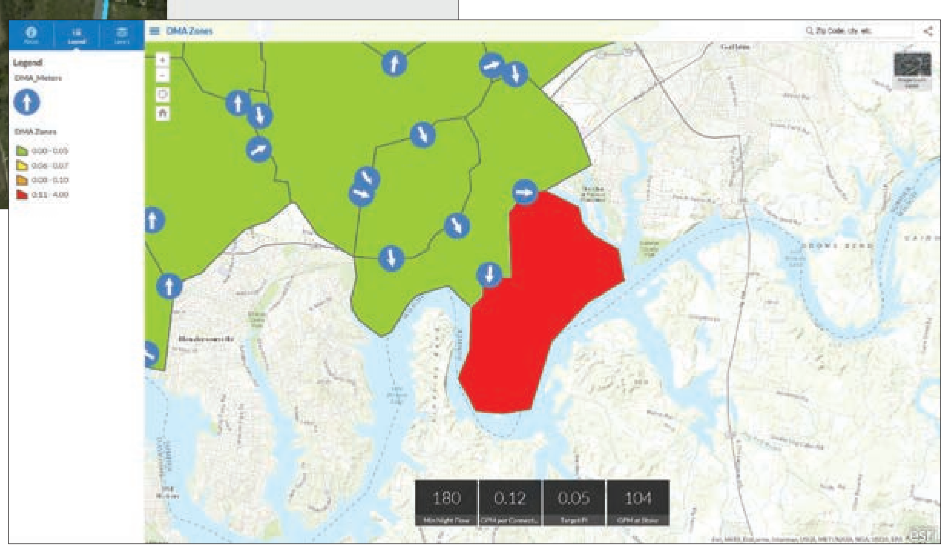
The web application uses color coding to show how a district metered area (DMA) zone's actual flow compares to what has been determined by the staff as an acceptable flow rate for a particular zone. Using a set of geoprocessing tools and models, WHUD office staff can find where water loss appears to be excessive and then isolate potential leaks down to subzones, individual valves, and specific pipe segments.

A configuration of the Collector for ArcGIS app called Water Leak Investigator lets field crews pull up detailed information on a specific leak, which includes projecting the number of gallons that is excessive for an area. Once an area is identified, office staff create point features to let field staff know where to place the leak loggers and share that information using ArcGIS Online.

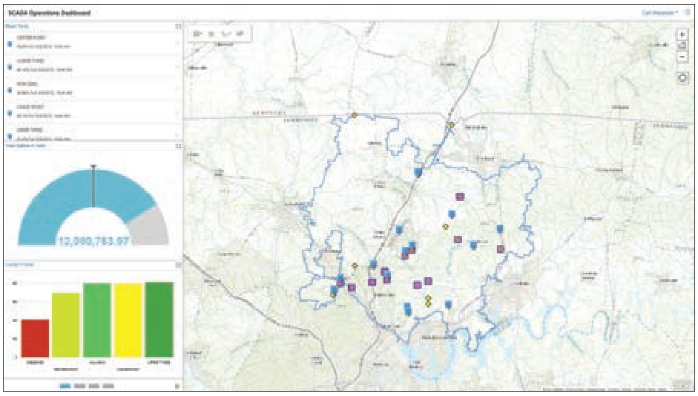
Staff place loggers and leave them in place overnight. The next day, staff go out and read the data from the loggers. The data is then input on the logger



↑ Leak loggers provide the final key to pinpointing underground leak locations.



→ A zone-based analysis narrows down leak locations.



← Real-time SCADA data integrates with the leak dashboards.

point feature so office staff can see whether a leak has been identified.

"If we have found the leak, a work order is created to fix it," Thompson said. "If not, we continue the process in that area until the leak is found. Once the leak is found and fixed, the new flow data for this DMA zone is updated and the zone will change colors to reflect the repair."

All the district's flow meters are set up with high- and low-flow alarms. Anytime a meter goes above or below the gallons per minute (GPM) threshold, an alarm is sent. ArcGIS GeoEvent Extension for Server receives that alarm and creates a GIS feature that notifies WHUD personnel on their devices, regardless of the type of device they use.

Staff can then access the alarm location on any device through a point feature GeoEvent Extension creates. They can assess the situation in real time and even compare historical data, such as pressure over time, to determine whether they need to dispatch a crew.

GeoEvent Extension might alert them to a low-pressure tank, for instance, which they can then compare to historical pressure recordings for that tank. Staff can even further compare this to service data, such as customer call-ins related to low pressure, and make a decision based on their findings.

Three Days or Fewer to Repair All Leaks

Underground leaks that once could take months to be found are now detected and repaired in two to three weeks. The district will have the ability to cut its repair time down to 72 hours by July 1, 2015. All field staff have access to mobile GIS.

"The key benefit to ArcGIS in the field is the fact that it can be viewed in real time," Thompson said. "This information allows us to be proactive rather than reactive."

The monetary savings that can be realistically achieved will, in all likelihood, exceed $1 million per year, according to the district engineer Pat Harrell.

Beyond the direct monetary savings that are easily identified lie the indirect savings. These indirect savings translate into recovered treatment plant capacity as well as distribution capacity recovered in transmission lines. Other cost reductions, such as electricity, wear and tear on equipment, and savings in overtime, make the system more efficient and proactive. Those benefits have a direct effect on customers for impacting both short- and long-term water rates. WHUD expects initial savings to offset the cost of installing smart meters and the information technology infrastructure.

Other utilities in the region have made site visits to learn how WHUD is using technology to effectively detect leakage that is not coming to the surface.

"With ArcGIS Online, it's not as daunting as half the people think it is," WHUD GIS director Carl Alexander said. "Using out-of-the-box COTS solutions like Collector has made it simple to get the tools deployed into the hands of our team quickly."

In fact, Harrell said, "So much data is coming in the system at this point that the district has been caught a little off guard by the speed and quality of the information collected."

GIS in Charge of IT

So far, WHUD has improved planning, decision making, and customer service with the leak detection system.

"The best part is that you don't have to be an engineer to make use of the GIS," Harrell said.

When customers call in, customer service representatives are accessing the web map. They can see right away whether there are pressure issues. They are even using ArcGIS Pro to see in 3D data visualizations the effect of elevation in tank and pump-station pressure and provide more accurate interpretations. In just a few minutes of analysis, staff can determine low- to no-pressure features and use their findings to troubleshoot problems, including determining whether a customer should use a pump when constructing a residence. Developers also work with WHUD to see pressure issues.

After WHUD completes the smart-meter installation, its GIS department will perform real-time data integration. The information from critical big data feeds will display on simple, accessible viewers.

"When we decided to move to a true GIS-centric environment, we felt like it was critical to examine every aspect of our organization from top to bottom," Thompson said. "In so doing, one of the things that I personally felt strongly about was the role GIS should play in the organization. I felt GIS should not report to the engineering department but should work collaboratively with [it]. I also felt equally as strong that IT should report to GIS instead of GIS reporting to IT. If we are to achieve our goal of having a true GIS-centric environment, GIS must be moved from [being] an afterthought in the organization to a leadership role where our actions support our commitment."

Austin Water's $400,000 Idea for Water Conservation

Utility Develops Award-Winning Application to Enforce Drought Restrictions

> "ArcGIS Online is just a more powerful way of accessing your data."
>
> John Schulz, GIS Analyst, Austin Water Utility

Serving over 850,000 customers with water, wastewater, and reclaimed water services comes with responsibility—even before a multiyear drought.

For several years Austin, Texas, has been in stage 2 severe drought restrictions with the likelihood of entering stage 3 by mid-2015. The Texas Highland Lakes—Austin Water Utility (AWU)'s primary water source, formed by the Colorado River—are falling, resulting in rising water-use restrictions.

Conserving water helps to comply with federal, state, and city regulations; promotes green living; and reduces costs of water and wastewater treatment. But it also means less revenue due to less water use.

Meanwhile, AWU's water conservation group has had to enforce what were, at times, confusing restrictions. Customers are allowed irrigation watering once a week based on address and property type, but washing cars at home and decorative landscape fountains are prohibited. Exemptions include vegetable gardens and drip irrigation.

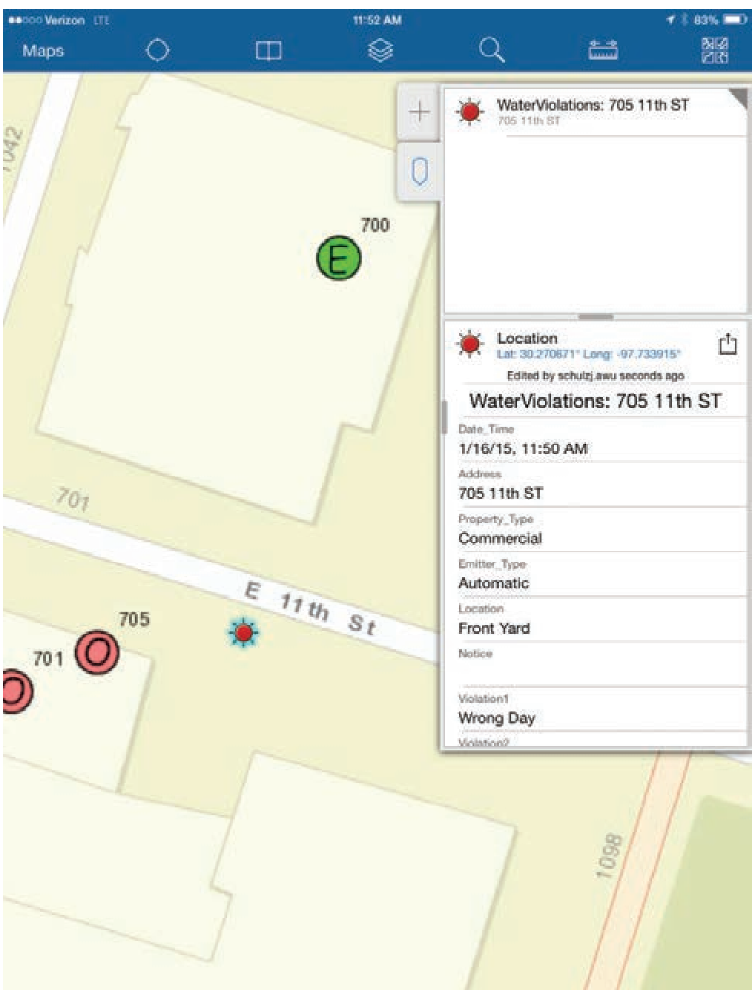
"It's very complex, this level of exemptions and restrictions," GIS analyst John Schulz said. "Someone has got to monitor that."

In 2012, four AWU inspectors patrolled for water violations between 10:00 p.m. and 6:00 a.m., several nights a week. The inspectors shifted from residential to commercial patrols randomly while collecting violations on paper and with digital cameras. In-office personnel would manually enter the field notes into their tracking system. Data was nonstandard and nonspatial.

"It was a labor-intensive process," Schulz said.

Then in early 2013, the utility started exploring what it could do with its ArcGIS Online organizational account. IT supervisor Dolph Scott suggested using ArcGIS Online for water conservation.

"This project seemed like a great test case," Schulz said.



↑ Water violations can be collected and input into the GIS, with relevant attributes, from the field.

A Flexible, Fast Field Solution

AWU had used Esri technology for years for planning and managing infrastructure, water-use analysis, and more. Its 13-person GIS services team has been considered a critical part of the utility's daily operations. Approximately 100 employees at AWU use ArcGIS for Desktop.

Schulz and Scott spent two weeks developing and deploying the Collector for ArcGIS app. They built forms that enabled easy water-conservation enforcement. They loaded GIS datasets from feature classes into ArcGIS Online that were optimized for a web interface.

"The really cool thing about ArcGIS Online is that once you have a service set up to it, you can update the data, delete data, query the data," Schulz said. "It's just really, really flexible."

After a week of testing by the end users, AWU deployed the solution. "It happened pretty rapidly," Scott said.

Conservation inspectors have been using Collector for two years. They capture data with features that mimic familiar editing features of ArcGIS for Desktop. Address points are color-coded to easily distinguish between odd and even numbers for orientation at night. The inspectors can toggle layers to access the needed features and use a search tool that lets them locate an address.

"ArcGIS Online is just a more powerful way of accessing your data," Schulz said.

One useful feature is the linear measuring tool, which helps determine how far water runs down a street and, therefore, to inform a correct violation fee. Entering a violation is as simple as tapping the screen or using the device's GPS location to capture information, including photos and videos. An aerial basemap and Esri's StreetMap Premium for ArcGIS give one more verification point before the inspector issues the citation. Additional GIS data, like service territory and municipal utility districts, helps inspectors know whether a location is an Austin Water customer or someone else's.

"It's very easy to use," Schulz said. "It takes maybe 15 to 30 minutes of training with field personnel to be productive with Collector. This technology provides an easy way of getting data out to the field and allowing field personnel to update that data and get it back to us. Now, using ArcGIS Online and these apps, we have that capability."

Personnel in the office place data from ArcGIS Online into AWU's custom in-house tracking system, Water Conservation Tracking System (WCTS).

Liquid Savings

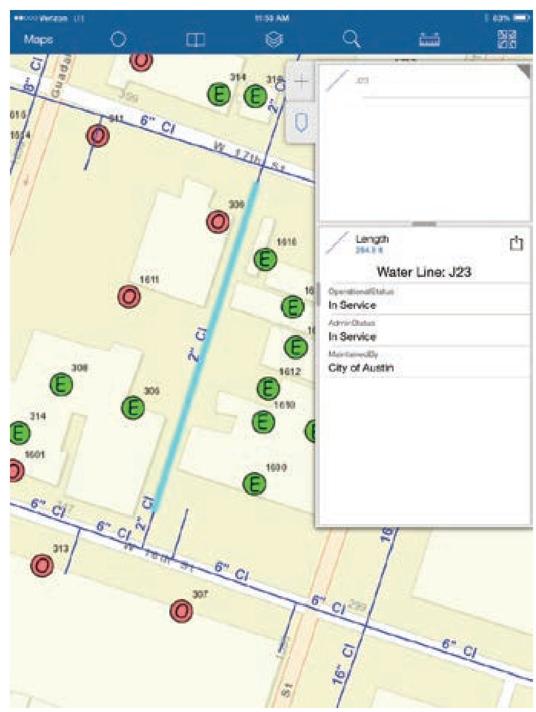
Among the biggest benefits is a savings of $350,000 in overtime and temporary-personnel hours that had been needed to manually enter field data from the legacy collection workflow. In addition, revenue from violation citations has increased approximately $50,000 by using the app. For soft benefits, AWU says personnel no longer feel overwhelmed by the amount of work they had before.

"You can see how much more work we are doing with less personnel," Schulz said.

AWU won the Esri Special Achievement in GIS (SAG) Award for its innovative application of GIS toward water conservation. In addition, Public Technology Institute presented the utility its Technology Solutions Award for energy/environment technology.

Other utilities have inquired what AWU is doing for water conservation enforcement.

↑ Addresses are coded as odd or even, to facilitate violation logging.



↑ In-app measuring tools let fieldworkers track information needed for issuing violation citations.

For more information, e-mail **John.Schulz@austintexas.gov**.

Tackling Business Risk with GIS

By Jerry Biedenbender and Jordan Hamm, SD1

Sanitation District No. 1 (SD1) is a regional sewer utility serving three of the northernmost counties in Kentucky. In 2005, SD1 entered a consent decree with state and federal environmental regulators for two reasons. First, SD1 wanted to address overflows in northern Kentucky's wastewater collection system, which generally occur during wet-weather events. Second, SD1 wanted to ensure Clean Water Act compliance.

The decree—negotiated between SD1, the US Environmental Protection Agency (EPA), and Kentucky's Environmental and Public Protection Cabinet—calls for a 20-year plan to improve the area's waterways by addressing the raw sewage overflows. SD1 entered the EPA's Capacity, Management, Operation, and Maintenance (CMOM) programs as part of the decree.

CMOM mandates that a sanitation district inspect all sewer pipes once every 10 years. Previously, SD1 operated on a relatively reactive approach, inspecting only problem pipes or pipes in areas with known issues. Naturally, as the number of pipe inspections increased, the number of known pipe-related issues increased. This newfound knowledge made for a busy maintenance program.

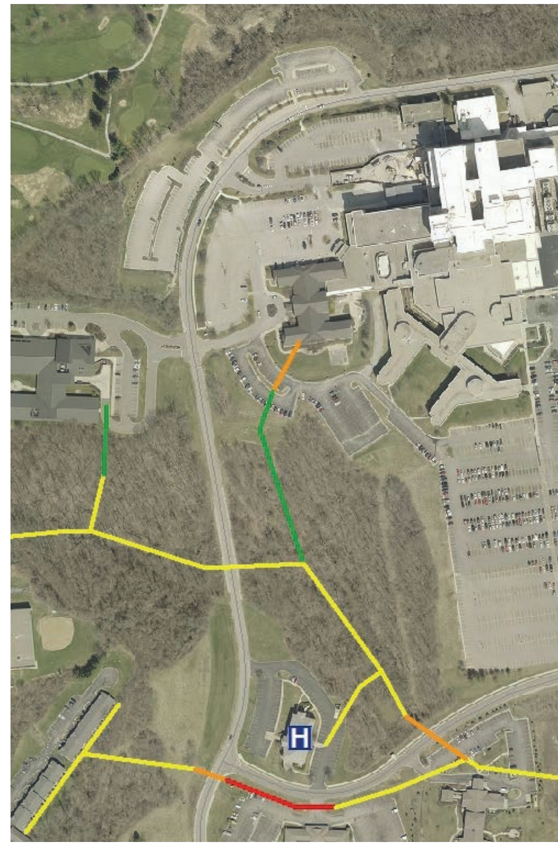
SD1 needed a way to prioritize maintenance.

Why Generate a COF Score?

Historically, SD1 drove its maintenance program by probability of failure (POF) scores. SD1 calls this its "SCREAM" score.

A POF is similar to the more common PACP score (a score of the pipe's structural condition based on a visual coding assessment). Both POF and PACP scores tell us the likelihood of a pipe's failing. Collectively, we all know what happens when a pipe fails: flow stops.

SD1 had scored more than 27,000 pipes for POF when it determined the need to refine its overall risk assessment. Prioritizing rehabilitation schedules had become time-consuming and overwhelming, especially when taking into account the impact on communities if a pipe were to fail.



Phase One
Laying a Strong Foundation

It's a given that a building is only as strong as its foundation. The same proves true for COF scores. The foundation of a reliable COF score is twofold: strong data collection and solid, repeatable calculation processes. With this in mind, SD1 began its COF calculations.

It broke the project into several phases. The first phase was choosing the categories by which to base each pipe's critical impact. With the help of a local consultant, SD1 chose three categories for this: cost, social or health, and environmental. Each category had its own criteria. Cost criticality, for example, consisted of four criteria: diameter, depth, surface, and overflow backup. There was a total of nine criteria for the three categories.

Phase Two
Data Collection

SD1 had the criteria to run its COF scores. Now it needed to collect the data.

The data needed to include the locations of police department, school, fire department, hospital, and other important buildings. With these data points collected, SD1 could calculate the distance between pipes and buildings.

This completed the strong foundation—criticality criteria and collected data—for generating a COF score.

Next came the geoprocessing phase.

Phase Three
Geoprocessing with ArcGIS ModelBuilder

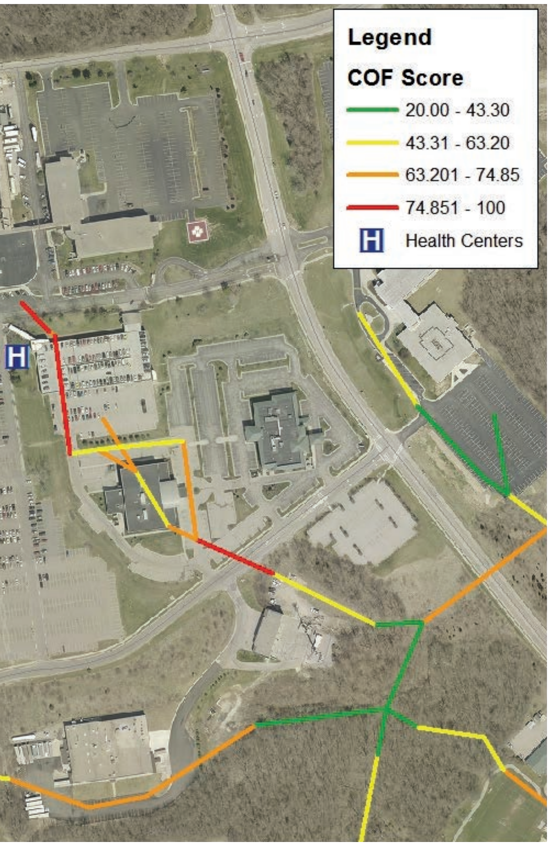
SD1 had two objectives for processing a COF:

1. Find the most efficient way to process data.
2. Do so in a manner that could be easily repeated at regular intervals.

ArcGIS ModelBuilder, within ArcMap, satisfied both of these goals.

SD1 used a wide variety of geoprocessing tools within ModelBuilder to create complex processes that built on the results of each other. Using the Near tool, for instance, SD1 collected attributes such as distance between pipes and buildings. The process yielded a score based on the pipes' proximity, or nearness, to these critical features. The closer a pipe was to a school, for instance, the higher the near score.

↓ A single asset snapshot shows consequence of failure (COF), with green indicating the pipes that would create the lowest fiscal impact if they were to fail.



SD1 decided to generate a business risk exposure (BRE) score for all pipes. A BRE score is a combination of POF and of consequence of failure (COF) scores. It calculates the nature and level of exposure an organization is likely to face in the event that an asset or group of assets fail.

So to generate its BRE score, the district needed to generate its COF score.

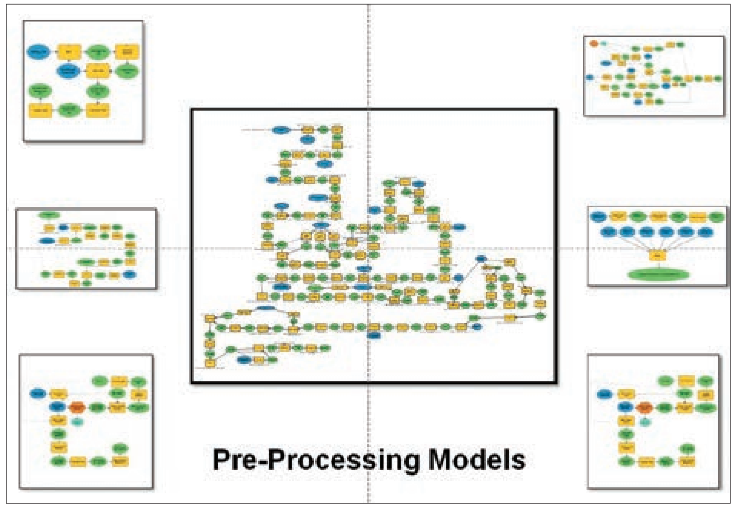
A COF, as defined by the EPA, is the real or hypothetical results associated with asset failure. In other words, the COF establishes the impact an asset failure would have on the surrounding community.

At this stage, the COF score was SD1's only missing puzzle piece.

Scoring with ModelBuilder

Each of the nine criteria associated with the three COF categories—cost, social and health, and environmental—was geoprocessed through ModelBuilder. Output values were scored from 1 to 5, with 1 indicating the lowest consequence of failure and 5 indicating the highest. One cost criterion was diameter, for instance. A pipe with an eight-inch or smaller diameter was given a score of 1, whereas a pipe with a 36-inch or greater diameter was scored at 5.

SD1 then used the Calculate Features tool to weigh each criterion. The weighted criteria in turn helped weight the categories. From these, SD1 staff could generate its overall COF score. They added the COF score to the POF score, or SCREAM score, for the final result, a BRE score.



← These ArcGIS ModelBuilder models geoprocessed the data, preparing it for calculating a COF score.

Overcoming Obstacles

During the COF process, SD1 encountered and overcame a few obstacles to achieve the following:

Data Consistency

As a regional sewer utility, SD1 relies on geospatial data from three counties. At times, these counties arrange data differently from one another. Using Esri's ArcGIS Data Interoperability extension, though, SD1 could make the data consistent for internal users and data processes, including the COF process.

Data Integrity

Two of the criteria the COF required were diameter and depth. While SD1 assets generally contained this information, a number of assets had a value of 0 for either or both fields. To combat this, SD1 built models using the Select Layer By Location and Summary Statistics tools in ModelBuilder. The model selected a pipe with a value of 0. Then it selected all pipes within a 100-foot buffer and summarized the average depth or diameter of those pipes. This average value replaced the 0 value, giving SD1 the data it needed to complete the COF process.

Data Accuracy

One of SD1's models assigned an elevation to each building. The model used the Spatial Join tool to join a contour layer with the elevation value to the building layer. A number of buildings lacked the elevation value after the model ran, though, which SD1 realized was due to the building polygon not intersecting with the contour line. SD1 modified the existing model by adding a "for" iterator that ran the model a total of six times. The enhanced model iterated by intervals of 10 from 0 to 50 to yield a building elevation for the majority of buildings, thus satisfying another part of the COF process.

For more information on ModelBuilder, visit **esri.com/desktop**.

Fort Worth Saves up to 1,700 Hours and $150,000 on Inspections

Water Department Sees Quick ROI after Deploying Inspections Solution

By Darrell Gadberry, Regulatory and Environmental Coordinator, and Mark Shell, IT Business Systems Coordinator

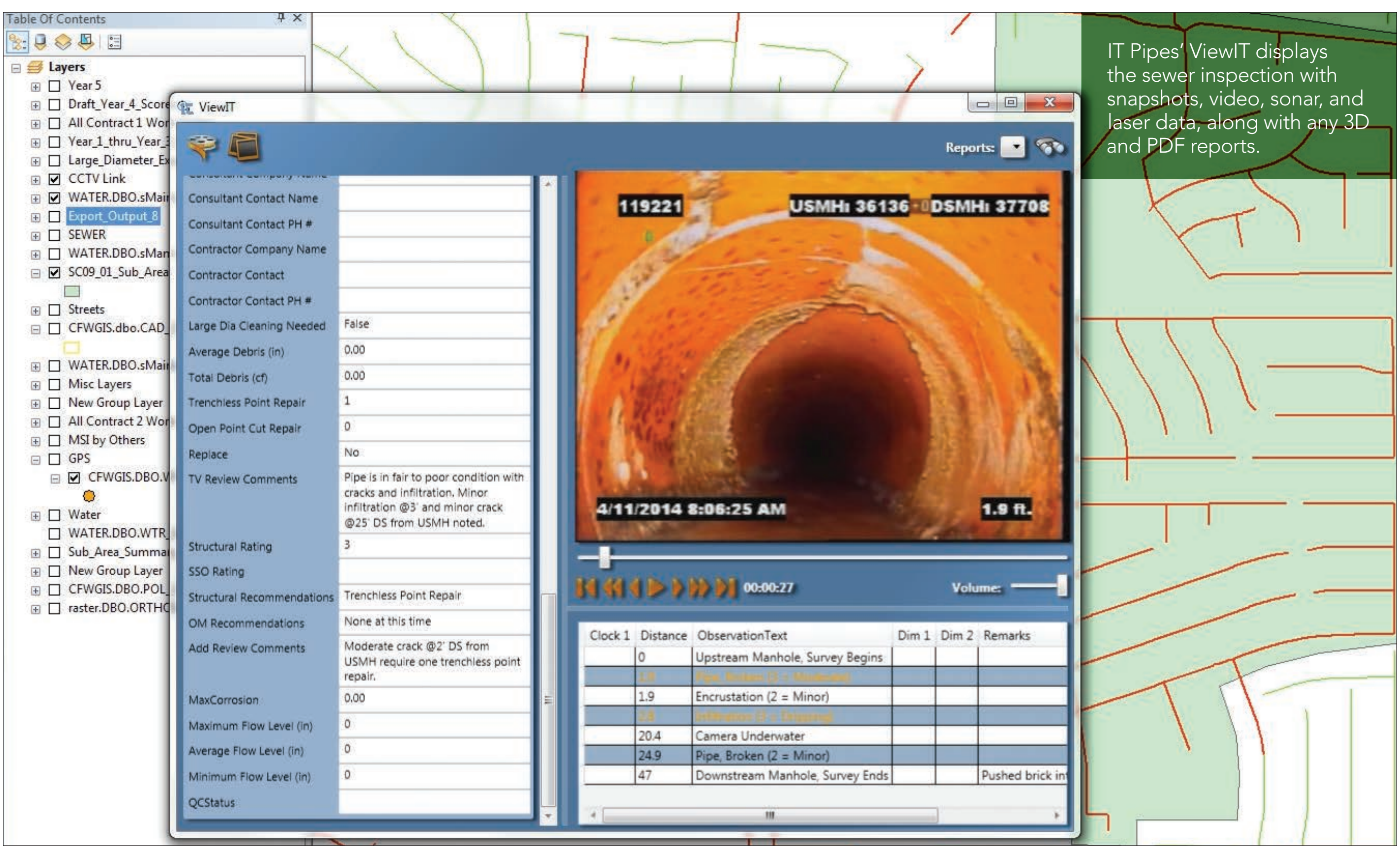
With more than 3,050 miles of sewer and eight closed-circuit television (CCTV) crews, Fort Worth Water Department (FTWWD) maintains two comprehensive sewer inspection programs. These programs—the Sanitary Sewer Condition Assessment (SSCA) Program and Interceptor Condition Assessment Program (ICAP)—include internal and external resources. With SSCA and ICAP, the utility inspects 284 miles of small-diameter pipe and 36 miles of larger pipe, respectively, per year.

Finding a Break in Asset Inspections

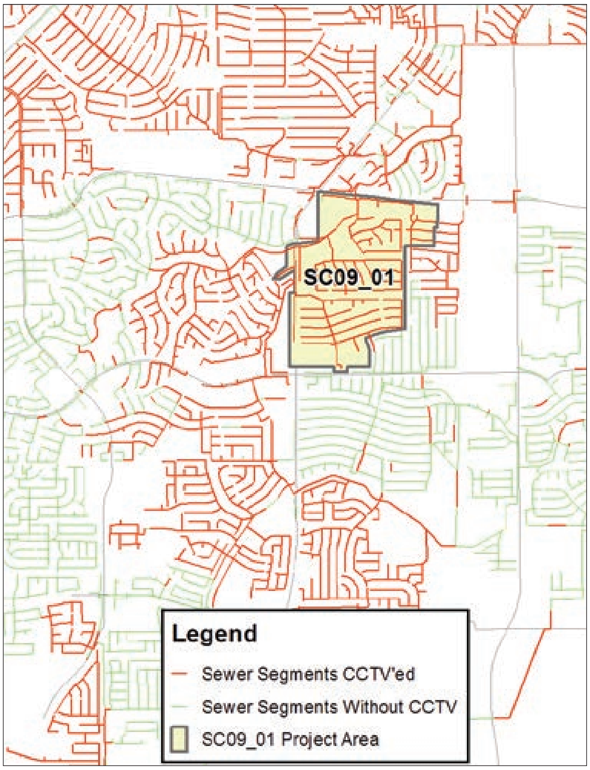
Each year, we produce 30 to 40 SSCA and ICAP reports. With all this data, we needed a robust system for inspection management and inventory. In 2008, our spatial model had break nodes at changes in diameter, material, alignment, and other items. This posed a major challenge with CCTV, which is generally tracked asset to asset or manhole to manhole. Due to our break-node spatial model, we could have several assets within one break or several breaks within one asset. This made it difficult to integrate inspection data with industry-standard applications. We also found it hard to have a clear understanding of how inspections, operations, and maintenance being performed related back to the GIS.

In order to take full advantage of our spatial data, we would spend hours clipping out projects and editing each one. Producing those SSCA and ICAP reports translated to 700–900 of labor hours annually.

In addition, our supervisor and assistant supervisor would have to invest significant time each week in transferring data to the office from inspection vehicles. Since projects were coming in at various stages of completion, this process also allowed errors and omissions. We estimate that



IT Pipes' ViewIT displays the sewer inspection with snapshots, video, sonar, and laser data, along with any 3D and PDF reports.



↑ Visualizing assets in ArcGIS allows a quick check on the status on the overall project to inspect the sewer system.

we dedicated 600–800 labor hours to this process annually.

With help from Esri's team, we made a major move in our GIS from "trunk" sewer lines, which were only distinguishable by referencing stationing numbers along points ranging from grade breaks to manholes, to manhole-to-manhole segments with independent names. We no longer require the cumbersome tasks associated with the stationing of upstream and downstream footage measurements.

Adaptable Programs, Configurable Design

In 2009, FTWWD moved to Esri's model for water and wastewater geodatabase design and a variation of the Local Government Information Model (LGIM). This design allowed us to begin interfacing with Esri partners' off-the-shelf integration models. We generally avoid customization in programs, but we do need highly configurable, adaptable programs that fit into and streamline our business processes.

In 2009, we migrated our vehicles and office to ITpipes inspection software from Esri partner Infrastructure Technologies. This software was much simpler and more contemporary from an equipment standpoint and also allowed us to integrate data beyond just CCTV. Our inspection data is all SQL, and we also dedicate a four-terabyte server to media.

On our new, industry-standard GIS model with ITpipes, we have more integration options. Today, our supervisors use GIS to assign asset inspections to a field unit and send all related information from the office. The field crews can update the GIS without any data entry issues, which expedited inspections.

Our model is also now asset to asset, so the field information easily ties back into the GIS. When inspections are complete and synced back to the central repository, any user can access them—immediately!

In addition, we use ITpipes' ViewIT, so our users can select a line and launch a desktop- or browser-based version of ViewIT software that displays the inspection with snapshots, video, sonar, and laser data, along with any 3D data and PDF reports. We can even review multiple inspections side by side with ViewIT, and this didn't require any extra training with our staff. It takes literally minutes to learn how to use this viewer.

Now 53 percent of our system has an actual condition score, and we can visualize on the Esri map what still needs to be done. By 2019, approximately 100 percent of the system will have an actual condition score! With the new ability to tie assets in inspection management to assets in GIS, we can now check the status on this overall project, or we can drill down to specific areas—in seconds. The old school method of pulling up maps, having long meetings, and so forth, pales by comparison.

What's Next?

We also set up ArcGIS Online on iPhone, so any FTWWD employee can pull up sewer and water lines data—with imagery—in minutes. Employees can display attribute data and even pull up our old PDFs while in the field. In addition, we built an app that lets us review any open or active work orders from the field.

Ongoing projects include setting up hardware to have our inspection units automatically sync data to a centralized inspection database. Relatedly, we're evaluating cloud storage options. We estimate this syncing will save 700 labor hours annually by eliminating hard drive transfers, manual merging of data, and more.

Direct Return on Investment

Implementing the Esri model for water and wastewater geodatabase design was quick. But perhaps even better, we were able to document our return on investment (ROI).

FTWWD estimates that moving to the industry standard and integrating with partner solutions ITpipes GIS SendIT, ViewIT, and Sync applications will save approximately 1,300 to 1,700 labor hours annually.

In addition, by displaying infrastructure and associated documents on any smart device through ArcGIS Online, we are saving a minimum of $150,000 in printing and distribution annually.

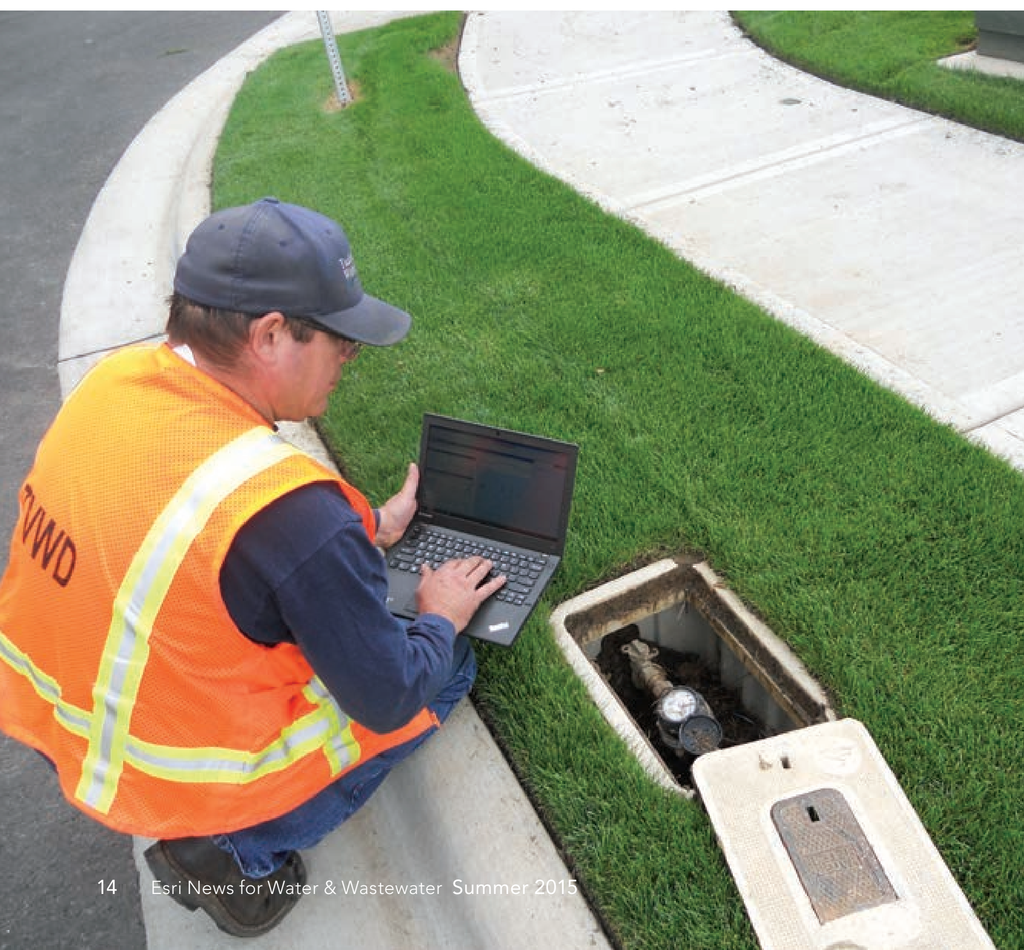
For more information, please contact Darrell Gadberry at 817-999-7907 or **Darrell.Gadberry@fortworthtexas.gov**.

Tualatin Valley Water District Integrates Asset and Billing Information

By Liz Ohlmann, Information Technology Officer, Tualatin Valley Water District; Steve Kerr, Cityworks Department Manager, POWER Engineers; and Ryen Tarbet, Asset Management Specialist, Cityworks

As the second largest water supplier in Oregon, Tualatin Valley Water District (TVWD) serves more than 200,000 customers across a 44-square-mile service area. With almost 60,000 service connections, TVWD owns and operates its own water distribution infrastructure. The district also provides maintenance, meter reading, and billing services for neighboring utilities. The elected TVWD Board is responsible for establishing policies that 120 district staff members carry out to ensure smooth everyday operations of the district.

↓ TVWD field crews bring meter information straight to their job location to capture asset and billing information.



TVWD is committed to industry best practices. Over the past two years, the district has used Cityworks as its GIS-based asset management platform. With Cityworks, TVWD integrated business processes across its automated meter reading (AMR) program, utility billing, and asset management. The interrelationship of these processes has become the core of efficient and sustainable water utility management at TVWD.

How Billing and Assets Work Together

Prior to Cityworks, TVWD's GIS did not include meter data; the meter-to-cash billing process required lots of paper forms. This, in turn, required spending many hours organizing and reentering information, which resulted in redundancies and errors. Now, with Cityworks, the district's business processes integrate with the physical meters and billing. Cityworks lets field crews bring TVWD's meter information directly to their work site. At each meter, crews capture and maintain both asset and billing information. Updating information in the field keeps the asset-management and customer service representatives apprised of the same information, accessed across the GIS-based platform.

Tracked in the GIS

The enterprise GIS captures meter location, service lateral size and location, and physical attributes of each meter. These can be used for life cycle maintenance and replacement projects. Revenue generation relies heavily on billing. The billing system collects register numbers, account types, consumption, and other information that directly affects a customer's bill. Customer service and billing employees manage any system updates.

"Cityworks allows us to better monitor situations that in the past would have required more time and research," customer support services manager Brenda Lennox said.

TVWD employees use a custom inspection form in Cityworks. POWER Engineers, a global engineering consulting firm, developed the form so that it automatically populates information the billing system needs. During changeouts, field crews enter meter readings and model numbers on the form. These same inspection results appear in a Cityworks in-box that customer service and billing staff can access through a custom billing form TVWD developed. Staff accept or reject each inspection after reviewing it for errors. Accepted information gets

→ Field updates sync to the office to keep staff apprised in near real time.

updated in the billing system. Rejected information enters a customer service supervisor's Cityworks in-box for resolution.

Each night, the meter billing information is also updated in the GIS.

"Having meter exchanges automatically uploaded to the billing system helps us avoid manual entry mistakes and has definitely made our process faster," customer service and billing supervisor Kathy Gannet said.

Since field crews can enter information directly, new meter installations have become much easier to track.

"This makes tracking installations significantly easier and prevents duplication of entries," Lennox said.

Field crews can simply select a service point to pull up customer information on-site.

"So far, the process has been promising," said Chris Johnson, a supervisor for in-field customer service. "Having meter install and exchange information at our fingertips has been helpful."

Johnson sees opportunities for using Cityworks for more integration and automation in coming years. "I look forward to TVWD's future use of Cityworks so we can automate even more of our processes to increase productivity," he said.

The new data ownership the field crews took on has added significantly to the quality of billing data. The district mapped meters in its GIS by matching a regional address layer to the existing billing addresses. What began as a 90 percent match rate for addresses transformed into a 99 percent match rate after the Cityworks implementation, which cleaned up approximately 5,000 addresses.

Having meter information readily available benefited the field crews too. They could be rerouted, resulting in more efficient meter readings. Meanwhile, the district used this capability to reroute field crews when it became necessary to read meters for a neighboring utility.

Overall, the Cityworks platform lets TVWD sustain its meter-to-cash cycle and plan infrastructure with a long-term goal of continuing water-to-meter services. As new requirements for quality, emergency flow, and urban footprint reduction grow, Cityworks provides one way the district will drive up its infrastructure operations and control maintenance costs.

There are other ways utilities like TVWD can tap into the growing demand for AMR and advanced metering infrastructure (AMI) technology. Looking ahead, the district expects to gain by adopting additional best practices for conservation, demand management, loss and leak control, and more—all of which contribute to a happier customer and higher gross revenue.

Improving Work Processes, Increasing Revenue

Pre-Cityworks	Post-Cityworks
Paper forms required two to three hours per day to organize work.	Cityworks automates meter installation information, entering this once into both asset-management and billing systems. Errors and unknowns are dramatically reduced from field data entry.
Redundant meter information resulted from manual information entry.	Duplicate data entry is eliminated, resulting in a more efficient workflow.
Some meters did not appear in the GIS because they lacked geographic information.	TVWD has a greater ability to analyze consumption data, thanks to updated service points and meter information in the GIS. In addition, a streamlined AMR replacement project uses GIS reports.
Fieldworkers had to check information from the field; some data got entered multiple times.	Customer service workloads are optimized, thanks to integrated field data entry.

It's 10 p.m. Do You Know Where Your Assets Are?

Your GIS might.

By Derek B. Scott, Marketing and Technical Manager, AMERICAN Flow Control

For those of us old enough to remember, a 1960–70s public service announcement popularized the question, Do you know where your children are? A time stamp always accompanied the announcement, just prior to the local news broadcast.

As asset management becomes more critical for public utilities, many municipalities find themselves asking a similar question: Do you know where your assets are?

Hydrant and Valve Inspector

Capture these asset features:

1	Manufacturer
2	Model
3	Date of manufacture
4	Depth of burial
5	Elevation of nozzles from grade
6	Main valve opening size
7	Draining or nondraining configuration
8	Direction to open
9	Traffic model or nontraffic model type
10	Inlet size and type
11	Number of outlet nozzles and configuration
12	Nominal diameter of smaller hose nozzles, including thread code
13	Hose cap type and size
14	Nominal diameter of larger pumper nozzle, including thread code
15	Pumper cap type and size
16	Operating nut and nozzle cap wrench code
17	Paint color code
18	Manufacturer order number
19	Customer name
20	Customer address
21	Product item number
22–25	Address fields
26	Special notes

A GIS helps you understand relationships, patterns, and trends in data through visualization and interpretation. GIS is more than a key to managing asset location; it's a vehicle for doing more with less.

At AMERICAN Flow Control, we offer solutions on the Trimble Connect and Esri platforms to help stretch operations and maintenance budgets—every dollar of which is more critical today than ever. Our Hydrant and Valve Inspector solution uses the Esri platform to mobilize data collection and eliminate human error.

Case Study: Castle Rock

Recently Castle Rock, Colorado, saved time and money on data collection with the Hydrant and Valve Inspector and Esri technology. Castle Rock uses AMERICAN Flow Control hydrants and valves. Each asset bears a bar code that captures 14 or 26 manufacturer attributes for valves or hydrants, respectively. Fieldworkers scan the codes with Trimble Connect mobile devices. The information transfers seamlessly to an Esri-powered geodatabase. Field technicians can also photograph asset condition, the surrounding area, and the workflow platform to track and report maintenance and repair needs. This replaces printed checklists, which Castle Rock employees used to enter manually from the field into the database.

"The way we were previously doing things was getting the job done," Castle Rock utility maintenance supervisor John Chrestensen said. "But it was redundant. Now work orders are created and technicians can complete inspections more quickly. We're improving our billing processes, quickly responding to customer needs, and gathering data for our asset management program."

More Gains Grounded in Location

The value of spatial analytics doesn't stop there. GPS alone offers quantifiable gains. Take Fredericktown, Missouri, for instance. The town lowered its Insurance Service Office (ISO) rating three points just by documenting 300 hydrant locations, manufacturer year, and manufacturer name. The findings—publicized by a University of Missouri press release by Frank Wideman—showed an improvement in fire-services quality. The move also directly lowered property owners' annual premiums by 15 percent. In a town of fewer than 4,000 people, those savings directly impact the whole community.

The GPS solution had one more benefit: faster emergency response time. Wideman points out the obvious gains in Missouri's violent tornado season. For other geographies, the same solution could speed response in hurricanes, earthquakes, and so forth.

There are tangible benefits to GIS alone, but imagine what happens when you add GIS to GPS—when you enlist a true turnkey system. Imagine the benefits of knowing the location, age, and manufactured attributes of valves, hydrants, and pipes in areas experiencing catastrophic events, particularly when a natural disaster completely redefines the asset landscape.

GIS, GPS, and mobile asset awareness help overcome these hurdles. At the very least, they lessen the blow.

In fact, the application of these technologies now allows elevation recording in 3D via GPS. Replacing as-builts with this information can eliminate costly human errors to ensure more accurate data. Locating buried lines in an emergency, for instance, becomes more efficient. Also, routine field operations and regulatory compliance are optimized by recording that the utility has met industry standards and insurance requirements, not to mention the value of these technologies in litigation situations.

The list of added value goes on. These tools support forward-thinking initiatives (e.g., identifying system-performance deficiencies), long-term planning, green conservation efforts, collaboration with authorities, and more.

Sky's the Limit

Hydrant and Valve Inspector exploits cloud computing too. Today, remote servers can network with each other, so computers and mobile devices share intelligence. Hydrant and Valve Inspector is also an app that's available at the iTunes store, at Google Play, or direct from Trimble to work on the Trimble Connect platform.

New features in the latest app release let utilities plan, dispatch, and approve work orders on a secured Trimble Connect website. Field technicians can record on a multitude of preferred devices (e.g., iPhone, iPad, Samsung Galaxy, Juno T41, Trimble Geo7X) and even pull directions to job sites and access detailed asset maps from the GIS. The app can work offline too. The GIS world offers so much more than asset-location identification.

So do you know where your assets are?

For more information about Hydrant and Valve Inspector by AMERICAN Flow Control, visit **www.american-usa.com/sales.html**. Click Valves and Hydrants to connect with your local representative.

About the Author

Derek Scott is the marketing and technical manager for AMERICAN Flow Control. He holds a bachelor of science degree in mechanical engineering and has more than 30 years of experience in the water and wastewater industry. Scott joined AMERICAN in October 1988 and is currently responsible for the division's marketing and technical functions. He represents the company on several standards committees, including AWWA, ASCE, MSS, and NSF. He currently serves as the secretary for the ANSI/AWWA Standards Committee on Gate Valves and Swing Check Valves.

→ A Castle Rock, Colorado, utility inspector updates his records after inspecting one of 3,500 hydrants in the city's water distribution system.

Spatial Data a Catch for Pierce County

In 2009, Pierce County Road Operations staff inspected drainage features. The inspections showed that a lack of field access to map data had left some catch basins in need of cleaning. To remedy this, the county staff increased assessments and cleanings. However, by 2010, the cost of assessing and cleaning peaked at $120 per catch basin.

What did they do?

In 2013, seeking ways to increase efficiency, Road Operations staff replaced laptops and a manual database-reconcile process with iPads using Esri® ArcGIS℠ Online. Staff deployed the Collector for ArcGIS® app for field-workers and over a dozen operational dashboards for supervisors. Now, teams can access over 200,000 drainage features via ArcGIS Online.

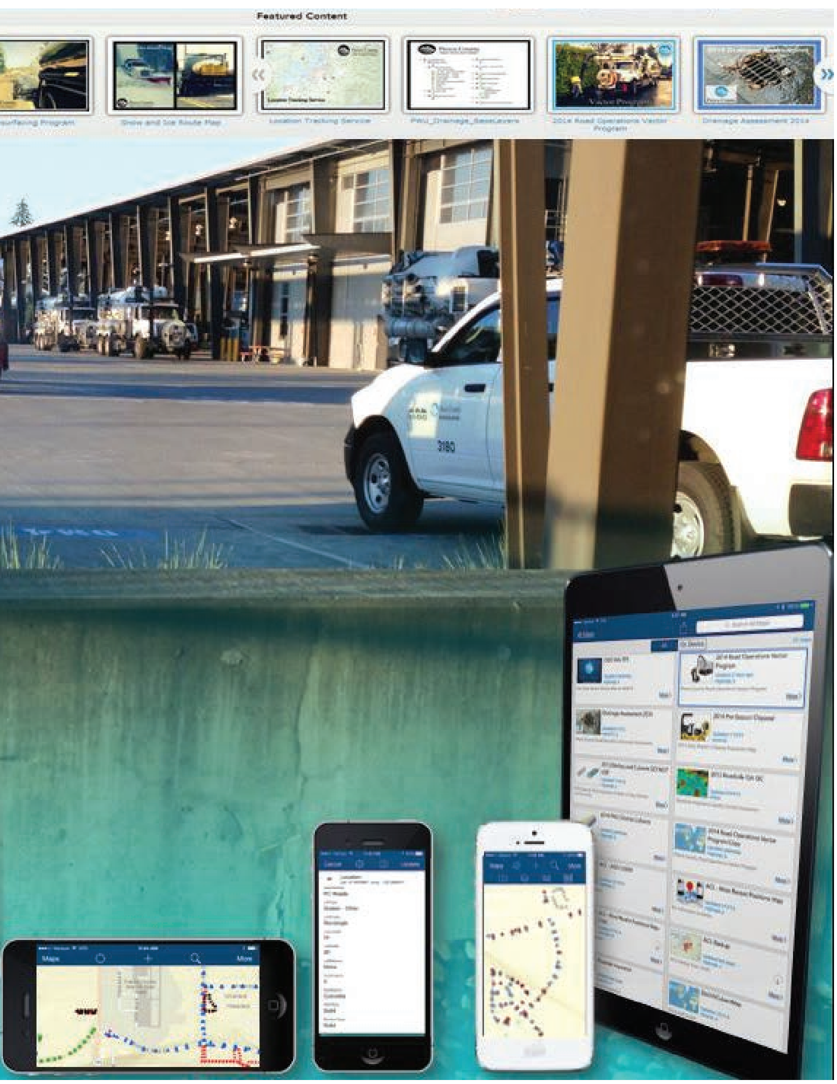
Do I need this?

Achieve greater field efficiency by making your GIS accessible through online and offline mobile applications. By 2013, Pierce County's cleaning and assessment costs associated with regulation compliance dropped to $60 per catch basin. Field teams complete more basins per day, at lower cost. Field GIS access saves costly travel time getting crews to the office, as staff no longer need to reconcile data manually each day. Over 35 Road Operations workers and supervisors access the mobile and dashboard GIS.

For more information, visit **solutions.arcgis.com/utilities/water**.

↓ Pierce County field technicians access and edit GIS on mobile devices.

← Pierce County field technicians access and edit GIS on mobile devices.



"Supervisors can see locations of all work orders spatially, using appropriate work-task filters. They have total access from the office or field. Thanks to maps, apps, and dashboards, they can see up-to-date work order status—with pictures—and adjust schedules as work is completed."

Bryan Chappell,

Water Quality Supervisor, Pierce County Public Works and Utilities, Road Operations Division

← A suite of mobile GIS applications and dashboards enabled Pierce County to streamline its catch-basin inspections for greater efficiency in compliance and significant cost lowering per inspection.

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