

# Esri News

## for Water & Wastewater

National Issue  
Winter 2012/2013

## ArcGIS for Valve Exercise Program: One Utility's How-to Guide

By Tim Hayes and Kent Brown, City of San Jose, California, Environmental Services Department

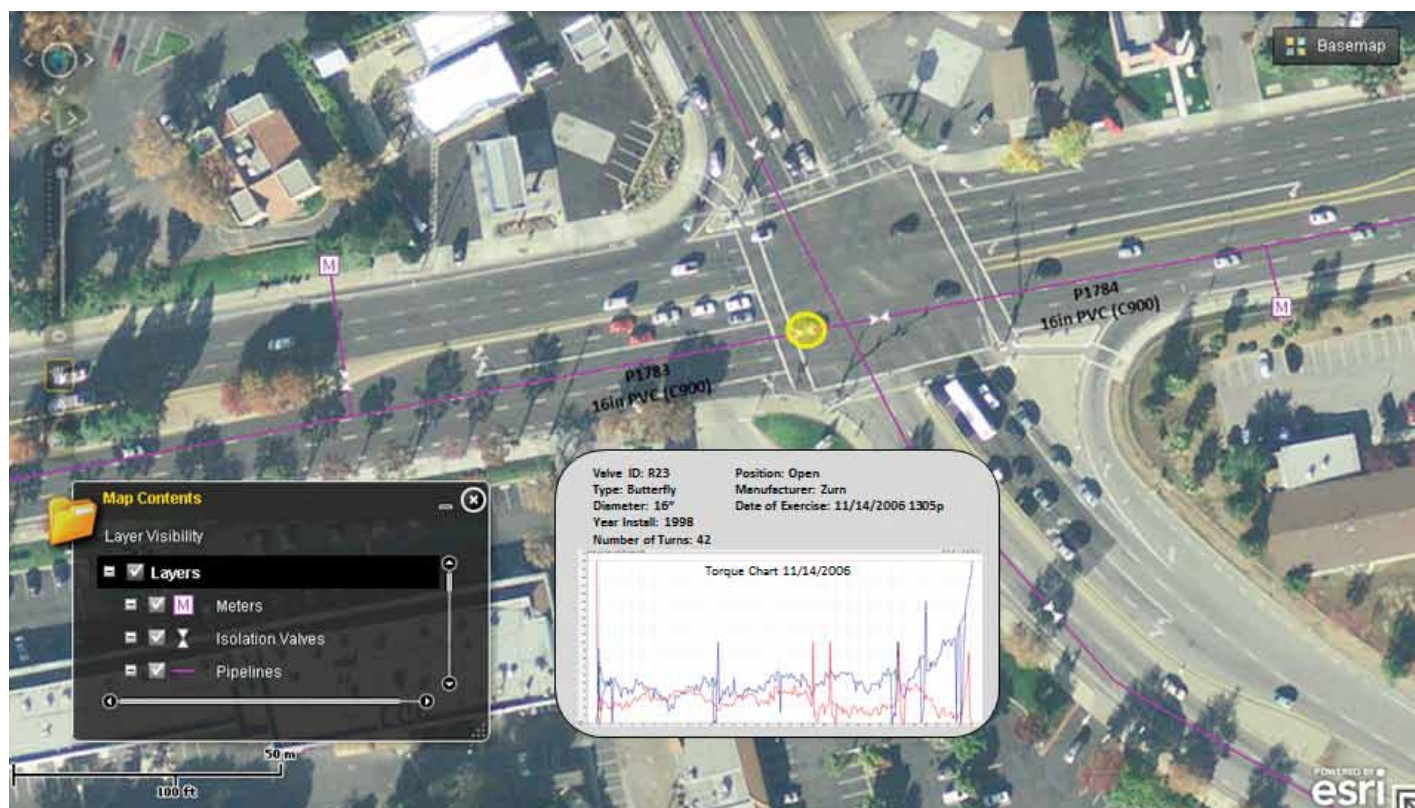
Isolation valves are among the most important assets of any water or wastewater utility. They are critical to operations. Typically, utilities exercise valves every two to three years, although some utilities exercise them more or less frequently. For the City of San Jose Environmental Services Department's recycled water utility valve exercise program, the objectives included building a valve feature class in the geodatabase and integrating high-accuracy GPS with valve exercise data. To meet the objective of developing a valve maintenance prioritization scheme, staff members used ArcGIS.

### GPS and Valve Data Collection

The field equipment included a GPS receiver, valve exercise data logger, and valve exercise machine. It was important that the same valve ID was entered into both the receiver and the data logger, since these two sets of data would later be joined in the geodatabase.

To achieve the highest level of GPS accuracy, an external GPS antenna was used along with the receiver. In this situation, it was important

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↑ Maintenance staff can select any isolation valve from the map and obtain key information.

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# Thank You to Our 2012 Water/Wastewater Sponsors!

Esri is grateful to the sponsors of the 2012 Water/Wastewater Pool Party held July 25 during the Esri International User Conference at the Hilton Bayfront Pool Terrace. The event was a great opportunity

for the water, wastewater, and stormwater ArcGIS user community to get together, have a few laughs, and talk shop. We all enjoyed food, refreshments, and live music made possible by our sponsors. Thank you!

## Steel Level

A green rectangular box with the word "CRITIGEN" in white, uppercase, sans-serif font.

## Cast Iron Level



## Concrete Level



## PVC Level

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# Managing Inflow and Infiltration to Comply with a Consent Decree

By Jerry Biedenbender, SD1

Sanitation District Number 1 (SD1) is a regional sewer utility that serves three of the northernmost counties in Kentucky. SD1 is responsible for the collection and treatment of northern Kentucky's wastewater as well as regional stormwater management. As the second largest public sewer utility in Kentucky, SD1 serves approximately 220 square miles, including more than 30 municipalities and unincorporated portions of Boone, Campbell, and Kenton counties.


SD1 maintains more than 1,600 miles of sanitary sewer line, 142 wastewater pumping stations, 15 flood pump stations, 8 package treatment plants, 3 major wastewater treatment plants, more than 400 miles of storm sewer, and over 29,000 storm sewer structures.

In 2005, SD1, with state and federal environmental regulators, entered into the Clean Water Act consent decree, a legally binding document outlining an accelerated program of activities designed to further improve water quality, address overflows that generally occur during wet weather, and ensure compliance with the act. The settlement, negotiated by the US Environmental Protection Agency (EPA), Kentucky's Environmental and Public Protection Cabinet, and SD1, calls for a 20-year plan to improve the area's waterways by addressing raw sewage overflows from the combined and separated sewer systems within the district's service area.

↓ A manhole overflows due to I&I when it rains.








**Summary of Dye Test Results**


15 RIDGE Newport



**Report of results sent to the home owner**

**Summary of Drain Results**

Drain #	Dye Result	Dye Source	Tributary Area
1	negative	Downspout	
2	negative	Downspout	



**Smoke and Dye Address Form**

15 RIDGE Newport

Date/Time: 05/31/2012 999-99-03-945.00 Weather: Calm

Crew: Truck 2 Ground Condition: Dry

Pipe Segment: Upstream MH: 0490012 Precipitation: Dry

Downstream MH: 0490011 Last Rain Event: 5/29/2012

Owner: DPU Measure Code: Total station

Comments: Scanned image:

**Notes**

- The property lines, if shown, are approximate and do not represent the actual property line for your house. They are in proximity.
- The red dots indicate a positive test result. A positive test result is defined as that particular drain type being connected to the sanitary.
- The green dots indicate a negative test result. A negative test result is defined as that particular drain type being not connected to the sanitary.

SCREAM™ Smoke

**Observations**

Property Type	Address	Dye Result	Dye Source	Distance from DS (ft)	Offset (L/R)	Offset Distance	X	Y	Dye Intensity	Dye Outlet	Tributary Area	Building Detail #	Detail Correlate #
Private lot	15 RIDGE Newport	negative	Downspout	201.5			1576041.04804	575939.2	85025	Street			
		RIDGE_15_Downspout_159.jpg						RIDGE_15_Downspout_Corrected_159.jpg					
<p><b>Comment:</b> Daylights to curb cut in front of house.</p>													
Private lot	15 RIDGE Newport	negative	Downspout	201.5			1576064.298	575939.1	27082	Street			
		RIDGE_15_Downspout_159.jpg						RIDGE_15_Downspout_Corrected_159.jpg					
<p><b>Comment:</b> Daylights to curb cut in front of house.</p>													

↑ Report results are sent to the homeowner.

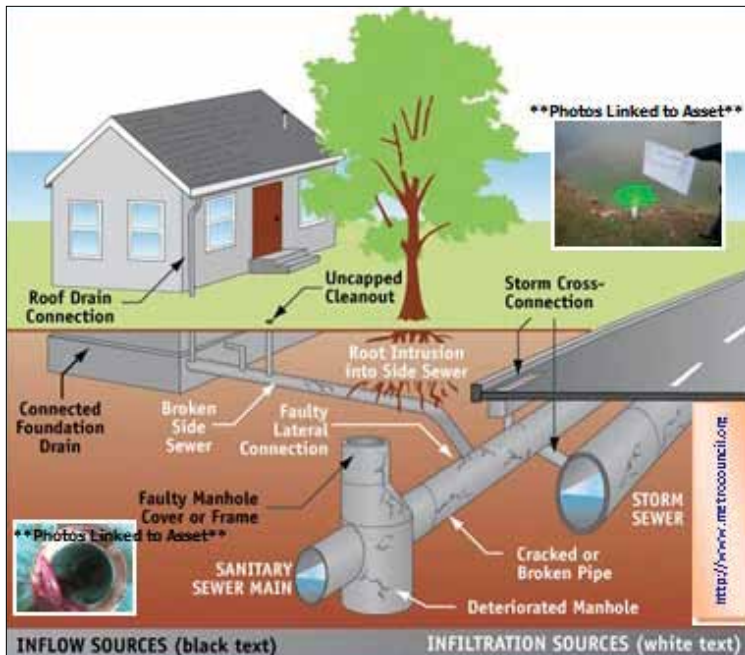
## SD1's Approach

SD1 uses ArcGIS to maintain a proactive approach to sanitary sewer maintenance and has an infiltration and inflow (I&I) program devised to detect and minimize or even eliminate stormwater from entering the sanitary sewer system. The I&I program involves the use of GPS technology to verify accurate x,y coordinate locations for manholes. Other measures include regular data analysis, inspections, manhole repairs, internal sewer line cleaning and televising, dye testing (to determine deficiencies and the degree of severity), pipe repairs, and internal slip lining where needed. Staff members also perform house-to-house inspections to verify and correct the sanitary sewer connections.

## What's So Bad about Inflow and Infiltration?

Inflow and infiltration occur when clean storm- or groundwater enters the sanitary sewer system through holes, breaks, joint failures, connection failures, illegal connections, or downspouts or from cross-connections with storm sewers. Most inflow comes from stormwater, and most infiltration comes from groundwater. Both inflow and infiltration increase the amount of flow conveyed through the system and pump stations, adding to the expense of treating the flows. Ultimately, this affects the costs to operate and maintain the sewers. Inflow and infiltration are direct causes of sewer overflows, resulting in creeks and rivers becoming contaminated.

continued on page 6



↑ A visual representation explains the different causes of I&I. The testing photos are linked to assets being tested.

## I&I Elimination Workflow

Six of the 11 steps for detecting and eliminating inflow and infiltration require the use of GIS. The trace tool helps determine the scope of the project and is utilized in the planning process phase.

Once the project area has been established, a GIS analyst heads to the field with a Trimble GeoExplorer 6000 series GPS unit running ArcGIS to collect precise locations for all sanitary structures within the area. The GPS unit is capable of achieving accuracy of less than a decimeter. Without accurate locations, the dye testing crews would risk wasting time looking for manholes or recording test results on the wrong assets.

The dye testing crews also use ArcGIS in their TV truck to digitize the testing locations at the point where the dye exits either onto the ground or into the storm system or, illegally, the sanitary system. All this data is then synchronized via ArcGIS, analyzed, and used for running reports and creating maps. In cases where there are illegal connections, the homeowners are given the opportunity to correct them. After that, crews perform a retest to verify the fix is sufficient, and then the data in ArcGIS is updated.

## You are GIS.

You gain knowledge, share expertise, and help us understand our world.

There's a place where GIS goes beyond coordinates, breaks free of categories, and reaches past analysis. A place where products are launched, ideas are shared, and inspiration is set loose.

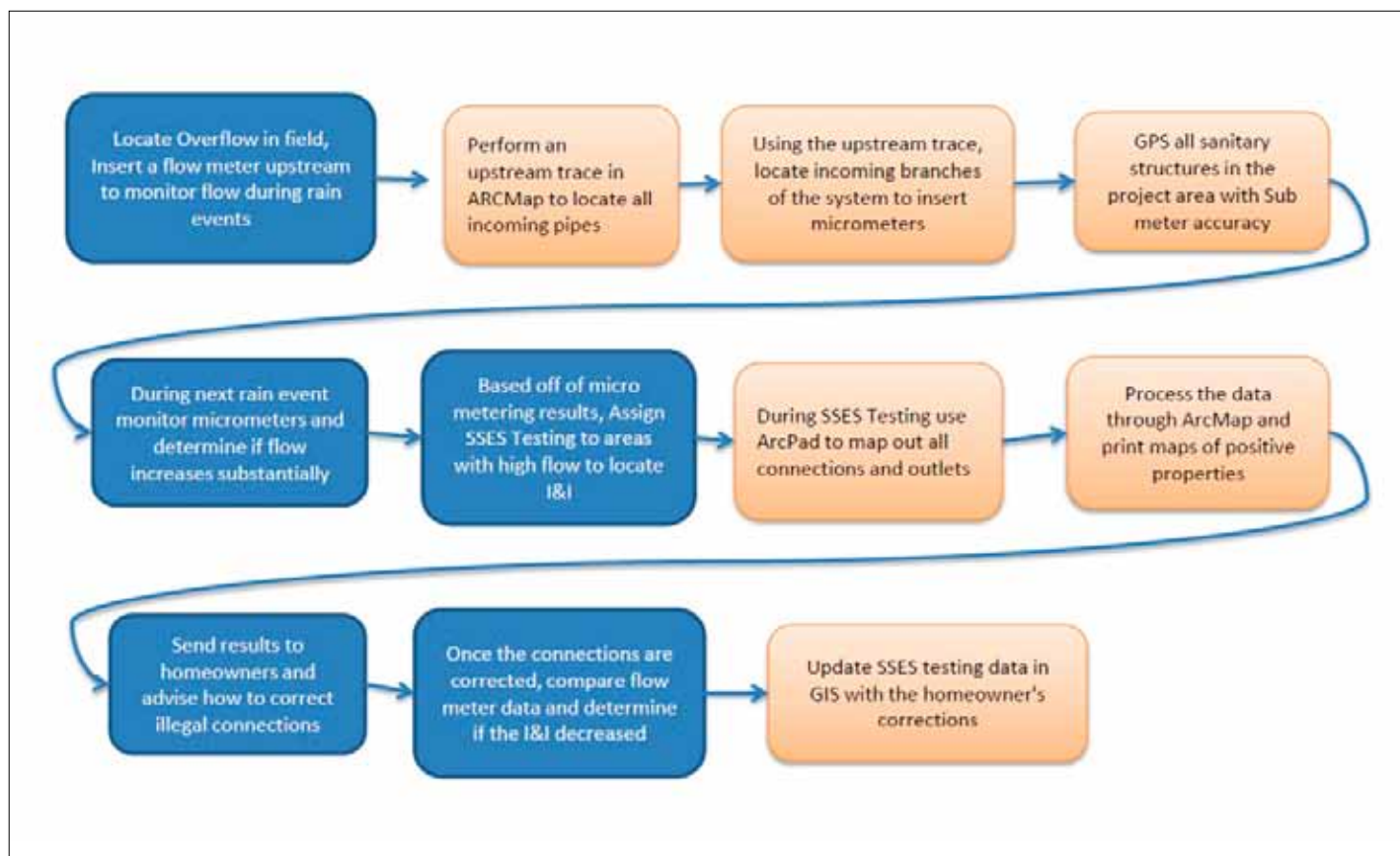
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United we map!

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July 8–12, 2013 | San Diego Convention Center





↑ I&I elimination workflow: GIS inputs are represented by the faded orange boxes.

### Custom GIS Tool

A custom GIS tool was created to automate the process of exporting maps and results. When this tool is activated, the user is prompted to choose a project area. All parcels within the project area will have a JPEG file exported at a specific extent and labeled with the property identification number (PIDN). The PIDN is a unique number that allows the JPEG file to be linked to a SQL Server service report that is exported as a PDF and sent to the homeowner.

For more information, contact Jerry Biedenbender at [Jbiedenbender@sd1.org](mailto:Jbiedenbender@sd1.org).

## Esri Online

### Follow the Esri Water Community on Twitter

Keep up with the latest GIS news—especially as it relates to the water/wastewater industry—by following Esri on Twitter:

- Esri Water Team—@esriteamwater
- Lori Armstrong, Esri water industry solutions manager—[Twitter.com/Lori\\_Armstrong](https://twitter.com/Lori_Armstrong)

### Access the Water Utilities Resource Center

This website is for the ArcGIS water, wastewater, and stormwater utility community. It provides useful templates and best practice information, enabling users to implement ArcGIS to manage water utility information, perform daily operations, and support long-term planning.

Visit [resources.esri.com/waterutilities](http://resources.esri.com/waterutilities).

### Join a Discussion about How GIS Meets Today's Challenges

Pull up a virtual chair at the Spatial Roundtable and join the conversation of GIS thought leaders as they address topics requested by the geospatial community: [www.spatialroundtable.com](http://www.spatialroundtable.com).



# City of Woodland Refines Water Crew Dispatch

## GIS-Based Route Sequencing Gives City Leverage in Contractor Bidding

By Matthew DeMeritt, Esri Writer

Today, decreasing budgets and volatile gas prices have forced governments to closely evaluate their fleet deployment practices. Even small local government fleets can log enough miles to justify routing software to save fuel and vehicle wear and tear. Last year, the City of Woodland, California, concluded that dispatching crews to shut off water for non-payment of services (one of the city's most fuel-consuming operations) could be easily improved with an electronic routing system.

With a population of 55,000 and relatively small footprint, Woodland has crews that know the pavement well. Since a portion of the work orders entail only single visits to homes (e.g., to turn off water service in a vacated residence), dispatchers don't need to generate routes for

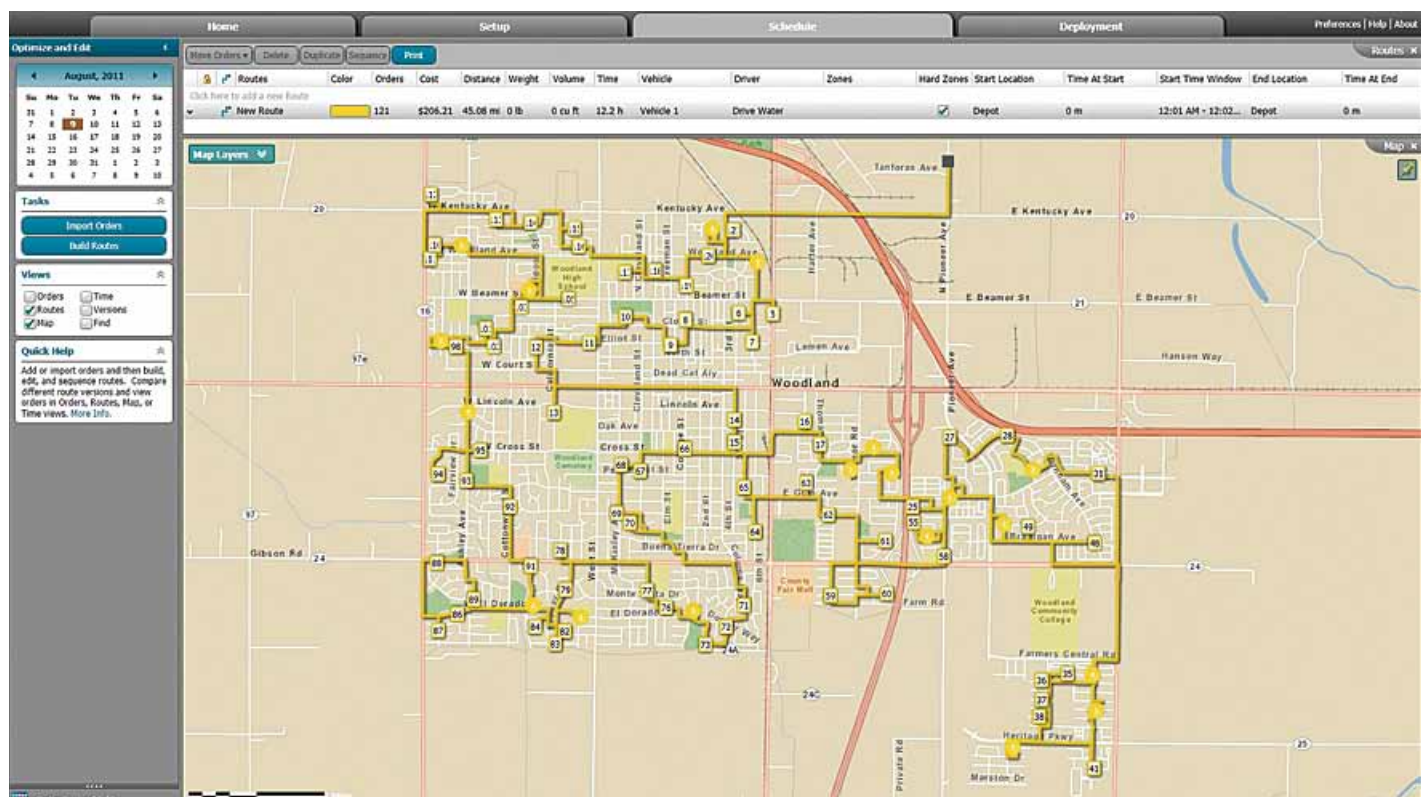
those trips. But when Woodland began to notice a steady increase in the number of residents failing to pay for water service, which often requires multiple visits per address, improving staff response to water payment delinquency seemed in order.

Convinced that geospatial technology could create a better system, Daniel Hewitt, GIS specialist for the City of Woodland, applied an ArcGIS solution from Esri. "It wasn't just a matter of turning off the water, mission accomplished," says Hewitt. "Three out of four times, the bill gets paid and crews must revisit the residence to turn the water back on—sometimes within the same day. Being a GIS guy, I knew a geography-focused application would help solve this."

To respond to water bill nonpayment, the City of Woodland Finance Department creates driver manifests for the water crews. With so much doubling back, drivers had no time to think about their lists spatially and logistically. "Our system consisted of nothing more than the finance guys handing crews an Excel file with a randomly organized list of addresses that required shutoff," says Hewitt. "Even with an understanding of the local geography, they could not always respond nearest to farthest, which would obviously make the most sense in terms of vehicle wear and tear and fuel consumption."

**"Contractors give us a bid on what they think all their driving will add up to in replacing these meters."**

Daniel Hewitt, GIS specialist for the City of Woodland



↑ The City of Woodland generates optimized water shutoff routes from simple Excel spreadsheet data.



# On the Road

## Easy Transition

ArcGIS allowed Hewitt to import the Excel lists of nonpaying residences that the Finance Department generated and create an ordered list of stops. To communicate with the geodatabase, the software requires that Excel spreadsheets have columns denoting city and state. "I added those columns to the spreadsheets so I could feed them into the system," says Hewitt. "From there, the program generated sequenced, turn-by-turn routes for water crews."

Hewitt took his findings to Manuel Soto, technology services manager in Woodland's Public Works Department, to see if he could get support to acquire Esri's route optimization technology. Initially, the department questioned whether precise routing in a small city with a staff of mostly Woodland natives was even needed. To address that concern, Hewitt used maps to show that sequencing the stops from nearest to farthest was more critical than the routing. "The main problem we had was lots of unnecessary backtracking," says Soto.

The ArcGIS route optimization solution created a sequenced order of stops from a simple address list. After clarifying the specific benefit, Soto got approval from the Public Works Department to purchase the technology the department needed. Soon afterward, Woodland began officially implementing the solution.

The new efficiency in creating ordered driver manifests has reduced the number of crews needing to travel. Before acquiring its new routing software, Woodland sent out an average of eight water crew vehicles per day. Today, five vehicles can do the same amount of work. GIS helped the City of Woodland refine its fleet scheduling practices and reap dividends in fuel and labor savings.

## Bonus Benefit

Woodland also found a novel use for its GIS as a bargaining tool for outsourcing. Recently, the city hired a contractor to replace thousands of faulty water meters with more accurate, tamper-proof meters.

"Contractors give us a bid on what they think all their driving will add up to in replacing these meters," says Hewitt. "We showed them how sequencing their stops shortens travel, which helps them calculate a more appropriate cost."

For more information, contact Daniel Hewitt, GIS specialist, City of Woodland, at [daniel.hewitt@cityofwoodland.org](mailto:daniel.hewitt@cityofwoodland.org).

### Team Water/Wastewater Meeting

February 22–23, 2013

Louisville Water Company

Louisville, Kentucky, USA

[esri.com/Industries/water/community/team-water](http://esri.com/Industries/water/community/team-water)

### Rural Water Association of Arizona Annual Technical Conference

March 5–7, 2013

Chandler, Arizona, USA

[rwaa.info/](http://rwaa.info/)

### American Water Works Association Utility Management Conference

March 10–13, 2013

Glendale, Arizona, USA

[www.wef.org/UtilityManagement2013/](http://www.wef.org/UtilityManagement2013/)

### California-Nevada Section, American Water Works Association Spring Conference

March 25–28, 2013

Las Vegas, Nevada, USA

[ca-nv-awwa.org/CANV/web/events/SC/web/events/sc13.aspx](http://ca-nv-awwa.org/CANV/web/events/SC/web/events/sc13.aspx)

### New Mexico Rural Water Association Annual Conference

April 15–18, 2013

Albuquerque, New Mexico, USA

[www.nmrwa.org/conference.php](http://www.nmrwa.org/conference.php)

### Wasser Berlin

April 23–26, 2013

Berlin, Germany

[www.wasser-berlin.de/en/](http://www.wasser-berlin.de/en/)

### Association of California Water Agencies Spring Conference and Exhibition

May 7–10, 2013

Sacramento, California, USA

[www.acwa.com/events/2013-spring-conference-exhibition](http://www.acwa.com/events/2013-spring-conference-exhibition)

### Aquatech China

June 5–7, 2013

Shanghai, China

[www.aquatechtrade.com/china](http://www.aquatechtrade.com/china)

### American Water Works Association Annual Conference and Exposition (AWWA ACE)

June 9–13, 2013

Denver, Colorado, USA

[www.awwa.org/ACE13](http://www.awwa.org/ACE13)

### Team Water/Wastewater Meeting

July 6, 2013

San Diego, California, USA

[esri.com/Industries/water/community/team-water](http://esri.com/Industries/water/community/team-water)

### Esri International User Conference

July 8–12, 2013

San Diego, California, USA

[esri.com/uc](http://esri.com/uc)

## Valve Feature Class

In the Valve feature class, the following fields were included:

- Valve ID: A unique identifier
- Type: Possible values of Gate Valve or Butterfly Valve
- Class: Piping on which the valve is located, populated with one of the following values: Main, Lateral, Blind Flange, Pump Station, Reservoir, Air Relief, or Blowoff
- Condition: The condition of the valve at the time of exercise
- Priority: A value of 1–3, 1 being the highest priority for valve replacement
- Manufacturer: The name of the company that manufactured the valve
- Model: The valve model name
- Torque Chart: A hyperlink to the torque chart
- Date of Exercise: The date the valve was exercised
- ID of Valve Operator: The name or ID of the person who exercised the valve
- Exerciser Model: The type or name of the valve exercise machine used
- Position: The position of the valve at the start of exercise
- Torque Units: The units of measure used during exercising, usually in pounds per square foot
- Torque Used: The amount of torque used during the exercise of each valve
- Begin Time: Time exercise began
- End Time: Time exercise ended
- Diameter: Diameter of valve
- Diameter Units: The diameter units, usually inches
- Number of Turns: The number of turns for each valve
- Operation Direction: The direction in which the valve is operated (clockwise or counterclockwise)
- Install Date: The date valve was installed (This can also be the replacement date.)
- GPS Northing: The GPS northing coordinates of the valve
- GPS Easting: The GPS easting coordinates of the valve
- GPS Correction Type: Values including whether the GPS data was collected in real time or postprocessed
- GPS Receiver Used: The type/make/model of the GPS receiver used
- GPS Horizontal Accuracy: The horizontal accuracy of the valve GPS coordinates

## ArcGIS for Valve Exercise Program: One Utility's How-to Guide

continued from cover

to ensure that the antenna was as close as possible to the actuator that turns the valve.

The GPS antenna was mounted to the external frame of the valve exercise machine, and the GPS receiver was mounted inside the truck and linked to the antenna via coaxial cable. The advantage was that operators did not need to carry their receiver each time they exited their truck, preventing it from being dropped or otherwise damaged. In addition, this removed one more step in an otherwise repetitive process. The operator simply positioned the valve exercise actuator over the valve and then activated the GPS receiver and the valve machine at the same time.

### Data Analysis and Prioritization

A two-step process was used to prioritize which valves were to be replaced. First, the Condition field was populated with one of four values obtained from the valve exercise data: I = inoperable, DR = low/high turn to diameter ratio, Z = zero turns, and ATC = abnormal torque charts.

The second step was to compare the Class field values with the values in the Condition field. Then, the Priority field was populated by setting the valves' priority on a 1–3 scale, with 1 being the highest priority: 1 = valves located on mains, laterals equal to or greater than 6 inches in diameter, pump stations, and reservoirs; 2 = valves located on laterals smaller than 6 inches in diameter; and 3 = valves located on blowoffs, air reliefs, and blind flanges.

### Finishing Up

The final step in the process was to ensure that the maintenance staff had access to this data in an easily understood format that required a minimum of training and time. The best solution was to use the existing Flex map viewer with ArcGIS for Server. This allows maintenance staff to select any isolation valve from the map and obtain key information related to the valve exercise, for example, valve ID, diameter, number of turns, manufacturer, and torque chart.

For more information, contact Tim Hayes at [Timothy.Hayes@sanjoseca.gov](mailto:Timothy.Hayes@sanjoseca.gov).

# IBM Intelligent Water

## Water Stress Is Everywhere

Water is one of the world's most abundant substances. However, it is also fast becoming one of the planet's most stressed resources. Access to clean water is a critical issue that affects economic activity, development, and business around the world. Increasing regulatory pressures, climate change, aging work forces, failing infrastructures, and a growing focus on social responsibility and environmental risk management are forcing organizations to reassess the impact water management has on their economic well-being.

## Gain Insights from Rain to Drain

As water and wastewater management challenges and costs continue to increase, information technology and collaborative innovation play a vital role in helping communities, businesses, and governments deal with complex water issues. The combination of new instrumentation and skyrocketing data volumes, new data types, and the demand for real-time responses requires a new kind of water management intelligence. Current systems are generally stand-alone and limited in scalability, which inhibits effective decision making across departments and throughout organizations. Smarter water management systems need to provide an integrated operating picture with robust real-time analytics, modeling, and decision support capabilities.

The IBM Intelligent Water solution is designed to optimize water operations and create new opportunities for innovation and business value by delivering integrated insights into a utility's infrastructure, assets, and operations. The solution uses advanced data management, visualization, correlation, and collaboration technologies to transform the vast amounts of disparate data (received from various devices, including metering systems) on assets, systems, and stakeholders into actionable information that can guide executive and operational decisions.

The IBM Intelligent Water solution employs an Esri map in its user interface. The Esri map can be either authoritative content from a local customer implementation of ArcGIS or a map service from ArcGIS Online. In addition, the water infrastructure network analysis capability of the IBM solution, which prioritizes maintenance, is driven by the ArcGIS Network Analyst for Server extension.

## An End-to-End View of Operations

The Intelligent Water solution helps operations and infrastructure become more reliable and efficient. It integrates and analyzes a wide variety of data sources and both provides an intuitive way of visualizing and understanding patterns and anomalies and makes it easy to act on them. The result is a view of water or wastewater operations that transcends individual systems, devices, and departments. This end-to-end view provides the key information needed to make better decisions that help lower costs and risk while increasing or recapturing revenue and enhancing customer satisfaction.

The Intelligent Water solution helps water and wastewater operators leverage operational data holistically to create insights and improve water management, anticipate potential delivery disruption, better forecast long-term water demand, coordinate resources to protect water supply, and drive conservation and sustainability.

## Building on Intelligent Operations

Intelligent Water includes the IBM Intelligent Operations for Water product, a water management platform that enhances infrastructure visibility to deliver an advanced level of situational awareness, event and incident management, informed decision making, and collaboration among stakeholders. IBM Intelligent Operations for Water helps on many fronts:

- Combined sewer overflow mitigation
- Water conservation and smart metering
- Smarter irrigation for parks and golf courses
- Water and wastewater situational awareness and quality management
- Pressure and leak management
- Urban flood management
- Work scheduling optimization

IBM Intelligent Water is available in a variety of deployment options. The software can reside in a data center, or for utilities and cities with limited IT infrastructure or resources that prefer a subscription service model, the solution is also available on the IBM SmartCloud.

For more information and to contact IBM, visit [www.ibm.com/software/industry/intelligent-water](http://www.ibm.com/software/industry/intelligent-water).

# IBM Intelligent Water







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