

water writes

Esri • Spring 2011

GIS for Water/Wastewater

Macon Water Authority Improves Asset Reliability

By Mark Raspotnik, Macon Water Authority PCA Project Manager

Macon, Georgia, has the distinction of being the Cherry Blossom Capital of the World, with more than 275,000 Yoshino cherry trees that put on a spectacular pink show each spring. With the work being done by the Macon Water Authority (MWA), the city may soon also be known for its world-class, efficiently operated water and wastewater services.

MWA serves approximately 54,000 metered customers in Macon and Bibb Counties

and operates a sewage collection system. Recognizing the importance of and the need to support good management of its assets, MWA began to implement asset care and work management best practices in 2007. The goal of the project, which uses an asset reliability model (ARM), is to enable the operations and maintenance departments to be more proactive.

Through the ARM Initiative, MWA is concentrating on how the organization manages

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asset care, and in doing so is focused on increasing service capacities through more reliable asset performance and workforce productivity improvements. The ARM Initiative is substantially restructuring the way in which asset care, maintenance, and reliability are managed at MWA's various facilities.

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The screenshot shows a GIS application interface with two main panes. The left pane is titled 'WD NEXT 7 DAYS' and contains a table of work orders. Below it is a section titled 'GEOCODED SR' with a table of geocoded requests. The right pane is a map view showing a network of pipes and roads in the Macon area, with a scale bar at the bottom indicating 4 miles.

WorkOrderId	Description	Priority	Status	Submit To	Proj Start Date
809389	Remove & Repla	3	SCHEDULE	BURGAMY, STEVE	11/25/2009
833084	PPM	3	SCHEDULE	COOK, DUDLEY	11/24/2009
894378	Investigate	3	SCHEDULE	COOK, DUDLEY	11/24/2009
836511	PPM	3	REQUEST		11/30/2009
836519	Repair the Main	3	HOLD-PARTS	BEARD, MIKE	11/24/2009
836535	PPM	3	REQUEST		11/30/2009

RequestId	Date Initiated	Description	Priority	Category	Submit To
829236	7/10/2009	CALL - Investigat	3	WATER	LOVE, YVETTE
829201	6/25/2009	CALL - Investigat	3	WATER	LOVE, YVETTE
829346	8/21/2009	CALL - Investigat	3	WATER	SUPPORTSERV
833465	9/28/2009	Change Meter	3	WATER	SUPPORTSERV
832665	9/23/2009	CALL - Investigat	3	WATER	LOVE, YVETTE
833304	9/26/2009	Various Meter Re	3	WATER	SUPPORTSERV

Announcements

Search Definition Changes:
The authority-wide saved searches for each FS zone have been updated to return ONLY OPEN Service Requests

This is a side-by-side view of the inbox and map. Users employ this map to write work orders against assets in the GIS database.

Esri on the Road

**American Water Works Association
Annual Conference & Exposition**
June 12–16, 2011
Washington, D.C., USA
www.awwa.org

Esri International User Conference
July 11–15, 2011
San Diego, California, USA
esri.com/uc

National Rural Water Association H2O Xpo
October 4–6, 2011
Louisville, Kentucky, USA
www.H2o-xpo.org

**Water Environment Federation
Technical Exhibition and Conference**
October 16–19, 2011
Los Angeles, California, USA
www.weftec.org

Pollutec Horizons
November 29–December 2, 2011
Paris, France
www.pollutec.com

Esri Partner Corner

GBA Master Series for Asset and Maintenance Management

GBA Master Series, Inc. (gbaMS), has released version 7.0 of its commercial off-the-shelf GBA Master Series software products for asset and maintenance management. Included with the release is the all-new gbaMS GIS Web Viewer application, created with Microsoft Silverlight and powered by Esri's ArcGIS Server.



This application is used to navigate map views; identify features and attributes of mapped assets; create service requests or work orders from the map view related to either selected x,y location or assets; and summarize and view record information related to asset inventory, condition assessment, service request and work order history, and preventive maintenance schedules.

Map services can be configured to the specific needs of each user or organizational division, allowing gbaMS GIS Web Viewer to be pushed through the enterprise with data and map behavior appropriate for each business function. gbaMS GIS Web Viewer links dynamically to personalized GBA Master Series web forms for service request and work order management, thus providing highly configurable maps and form layouts applicable to the varied functional requirements of all users.

gbaMS is focused on the development, implementation, support, and maintenance of enterprise systems for local government agencies and regional service authorities.

GBA Master Series products offer enterprise solutions for integrating with all ArcGIS products. The solutions assist with scheduling and tracking resources (labor, equipment, and materials) and activities (maintenance and repairs) and accounting for associated costs. GBA Master Series products also help manage water treatment and distribution, wastewater collection and treatment, storm water drainage, streets and roads, pavement, bridges, rights-of-way, traffic signs and signals, street lights, solid waste collection, parks and trees, facilities such as sites and buildings, and fleets including vehicles and equipment.

GBA Master Series-based computerized maintenance management systems (CMMS) are in current use by approximately 200 public-sector agencies across the United States. These systems are composed of customizable web, configurable desktop, and integrated mobile solutions. The modular design of the software, its scalability, and the flexible licensing options offered allow agencies to efficiently implement effective CMMSs that satisfy their specific functional and technical requirements.

For more information, visit www.gbaMS.com or contact info@gbaMS.com.

Esri Online

Community Speaks Up at Spatial Roundtable

Pull up a virtual chair at spatialroundtable.com and join the conversation of geographic information system (GIS) thought leaders as they address topics requested by the geospatial community.

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: [@esriteamwater](https://twitter.com/esriteamwater).

Access the Water Resource Center

This website is for the ArcGIS water, wastewater, and storm water utility community. It provides useful templates and best practices information, enabling you to implement ArcGIS to manage your water utility information, perform your daily operations, and support your long-term planning. Visit resources.arcgis.com/content/water-utilities.



gbaMS GIS Web Viewer Application

Esri International User Conference: Where Technology Sparks Your Imagination

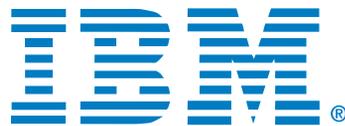
However you use GIS, the Esri International User Conference (Esri UC) offers ways to do it better. This year's event will be held July 11–15 in San Diego, California. For professionals in the water, wastewater, and storm water industries, Esri UC offers sessions and technical demonstrations in mobile GIS, climate change, metering, treatment, hydraulic modeling, and more.

This one-of-a-kind event is your opportunity to explore the power of geospatial technology and join a thriving community of GIS professionals who are passionate about their work. Find out more at esri.com/uc.



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Improving Efficiency and Quality of Spatial Data with GIS

By Emily Norton, City of Woodstock GIS Analyst, and Timothy Poe, GISP, City of Woodstock GIS Manager

The City of Woodstock, Georgia, purchased an Esri Small Government Enterprise License Agreement (SGELA) at the beginning of the 2008/2009 fiscal year. Since then, the SGELA has played a crucial role in the success of the city's GIS Division by enabling it and other departments to accomplish more work with fewer resources while improving the overall quality of spatial data.

The SGELA has been especially critical in improving the accuracy of the city's storm water utility billing process and updating the mapping of the storm water and sani-

tary sewer systems. Rather than employing consultants to complete the work, the City of Woodstock decided to take advantage of its newly purchased SGELA and the GIS Division's close relationship with Kennesaw State University's Geographic Information Science degree program. The city hired highly motivated and skilled interns from Kennesaw State University and Gainesville State College to complete the projects. The GIS Division was able to recycle 18 legacy workstations into 4 functional workstations. The SGELA allowed the city to deploy ArcGIS software on

each workstation to allow the interns to take advantage of the full functionality of GIS technology from Esri.

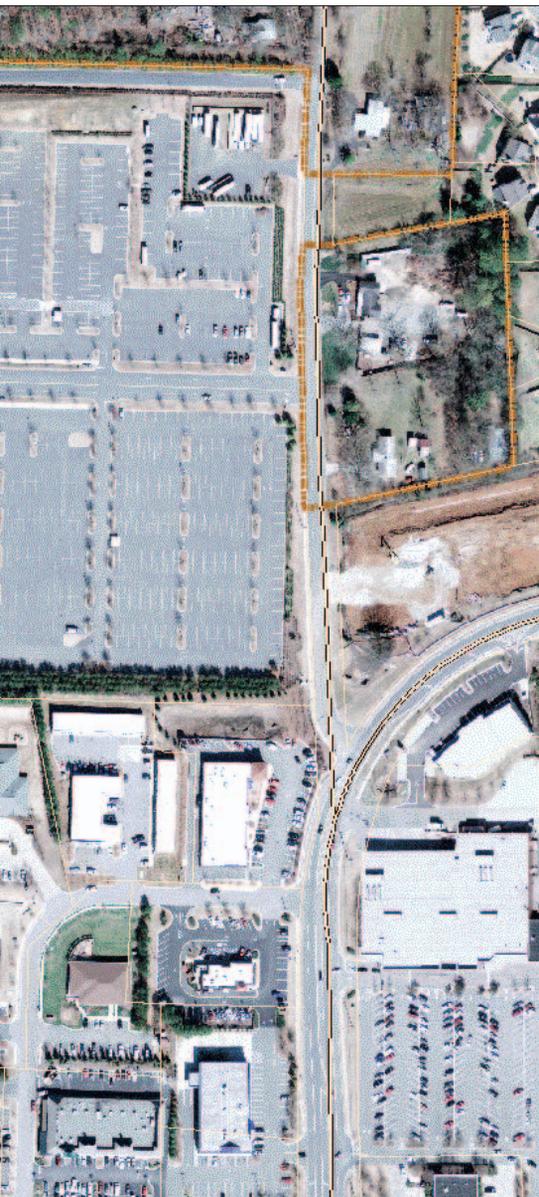
The projects involving the use of geospatial technologies were twofold. First, the intern team reviewed the storm water billing process and corrected errors in impervious surface measurements and parcel classification. During the process, they found 348 tax parcels within the city that were not being assessed for city property taxes. As a result of the project, the team discovered an estimated \$1 million in additional annual revenue for the



The storm water web app is shown here without the impervious surfaces.



The storm water web app reveals impervious surfaces.



city. The entire project was accomplished in less than three months at a total cost of less than \$25,000. Second, to update the storm water and sanitary sewer systems infrastructure, ArcGIS software was deployed on an Xplore tablet coupled with Leica's Mobile Matrix and GPS gear to allow the intern team to collect survey-quality data for future development of a flow network model. Overall, the utility billing project and infrastructure project were highly successful, and both projects represented a huge cost savings for the city as well as an excellent educational experience for the interns.

The SGELA has also enabled the city to cut costs significantly by deploying ArcGIS Server enterprise web mapping to internal customers. For example, when a police crime mapping application malfunctioned, the GIS Division deployed a fully functional web editing application within five hours. Over the next week, the police crime analyst made several requests for this application, which enhanced the police department's mapping capability.

The ability with ArcGIS software to edit versioned data through web applications has met the data integrity and security needs of the GIS Division. It also meets the practical usability needs of the police department's crime analyst and allows the city to provide up-to-date crime maps to zone commanders and other police management.

Similar web mapping applications have been deployed to further enhance public safety and to deliver additional cost-saving solutions to city departments. For instance, the GIS Division has developed a web mapping application to aid the fire department in tracking hydrant location and maintenance records. This has helped the fire department uphold public safety and maintain its excellent Insurance Services Office (ISO) Public Protection Classification (PPC) rating, resulting in cheaper insurance rates for Woodstock's residents and business owners.

Additionally, a multidepartment task force has been able to remotely edit and track vacant buildings to aid in city planning, firefighting, policing, and code enforcement. The ability to remotely edit a single versioned data source has eliminated the extensive data duplication and associated systemic bottlenecks to data acquisition and distribution common under the old paper-based system.

The SGELA has helped the City of Woodstock produce and maintain high-quality data while minimizing both labor and capital costs. The SGELA has improved work processes and lowered overhead costs within the GIS Division, and the web mapping capabilities have significantly increased data access and usability and have simplified processes for nearly every department in the city.

For more information, visit esri.com/water.

GIS and Hydraulic Modeling to Support City of Ocala's Integrated Water Resources Plan

By Jeff Halcomb, City of Ocala, FL; Ed Earnest, City of Ocala, FL; Kevin Laptos, Black & Veatch; Eva Sinha, Black & Veatch; and Kenny Blanton, Black & Veatch

The City of Ocala, Florida, provides drinking water, wastewater, and reclaimed water services to a population of approximately 50,000 people. The city recently prepared an Integrated Water Resources Plan (IWRP) to identify needed water system improvement projects and coordinate their future implementation. The IWRP addresses various issues within the city's territorial service areas, including growth, demands, and infrastructure requirements, and provides phased capital improvement plans (CIP) and master plan reports as a guide for efficient investment in the city's drinking water, wastewater, and reclaimed water infrastructure.

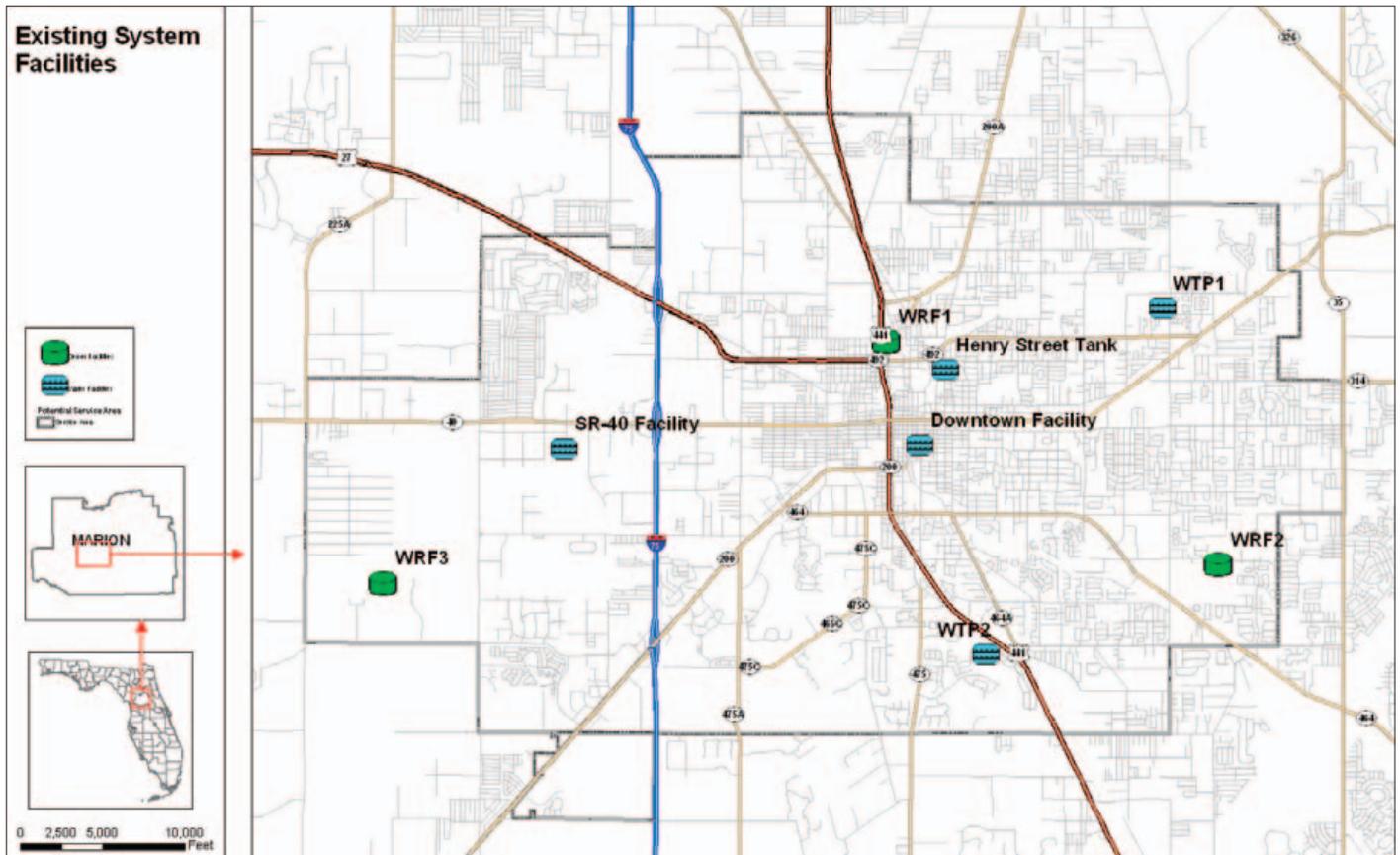
The city used ArcGIS technology as a framework for gathering and organizing spatial data, which was used for visual display and data analysis. With much of the drink-

ing water system data in a GIS, the hydraulic modeling required by the IWRP for the drinking water distribution system was performed using WaterGEMS, a GIS-based modeling program. Hydraulic modeling was used for performing distribution system deficiency analyses and identifying recommended system improvements for the planning years, which will supply customers with adequate system pressures at reasonable pipeline velocities and head losses and will improve available fire flows.

The IWRP calls for developing a secondary source of treated drinking water for supply reliability, upgrading and/or expanding water reclamation facilities (WRFs) to meet total nitrogen treatment requirements (new requirements are necessary to comply with a proposed Springs Protection Program), in-

stalling approximately three miles of drinking water main and approximately five miles of reuse main to augment the existing distribution systems, and retrofitting various neighborhoods for the expansion of the reclaimed water distribution system.

GIS data was available to support preparation of the IWRP, including property tax parcels, municipal and service area boundaries, existing and future land-use mapping, city zoning mapping, street centerlines, ground elevation contours, transportation analysis zone (TAZ) mapping, and aerial photography. In addition to the GIS data, CAD mapping of the city's drinking water and reclaimed water distribution system pipeline networks and customer service address and consumption data for each account were also available and imported to GIS for analysis.



City of Ocala—Existing System Facilities



Example of Reclaimed Water System Retrofitting Analysis

Reclaimed Water System Retrofitting Analysis

Many city customers rely on the drinking water system for nonpotable uses, such as irrigation, which could otherwise come from the reclaimed water system. To reduce demands on the drinking water system and maximize drinking water supply capacity available for potable water uses, a retrofitting analysis was conducted. The purpose of this analysis was to identify locations within the city where irrigational demands could be supplied by the reclaimed water system rather than the drinking water system and estimate the quantity of irrigational demand associated with these locations.

ArcGIS technology was instrumental in conducting the retrofitting analysis. The average irrigational consumption requirement for each location identified as a potential site to be supplied by the reclaimed water distribution system was estimated based on the property tax parcels. Total land area of the parcel, land-use code, and residential/commercial square footage data was used to estimate the land area available for irrigation. An irrigation-consumption-per-acre unit value was applied to the land area to estimate total irrigation requirements for each property parcel. Estimated irrigation consumption for each property parcel within a potential site was added, and the total consumption was used as the basis for sizing the diameters of

reuse mains. The analysis process, using available GIS data and tools, provided accurate results in much less time than could have been obtained using previous methods such as calculations based on CAD or paper maps and spreadsheets.

Drinking Water System Model Pipeline Network Development

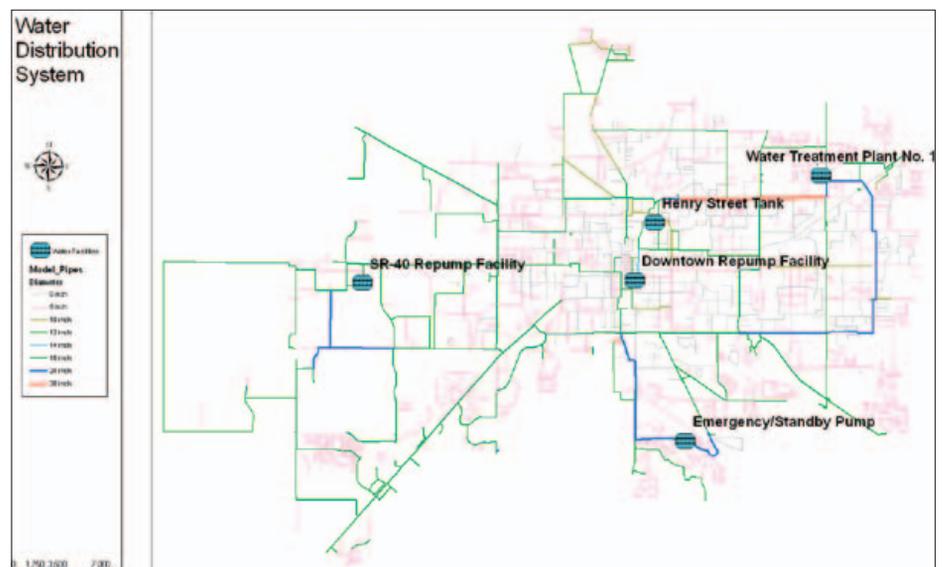
Since much of the drinking water system data was in the GIS, the distribution system hydraulic modeling required by the IWRP was performed using WaterGEMS for ArcGIS. The CAD mapping of the pipeline network was imported into the hydraulic modeling software as the starting point for developing a hydrau-

lic model of the drinking water distribution system. Once the CAD pipes were imported, network connectivity verification tools available in the modeling software were utilized to correct pipeline connectivity errors that existed in the CAD mapping and verify that all pipes were properly connected. Ground elevation contours were then referenced by the modeling software to automatically assign elevations to all model nodes. This provided a more accurate and less time-consuming process compared to the traditional method of manually interpolating node elevations from contour maps one by one and entering the elevations into the model.

Drinking Water System Model Consumption Allocation

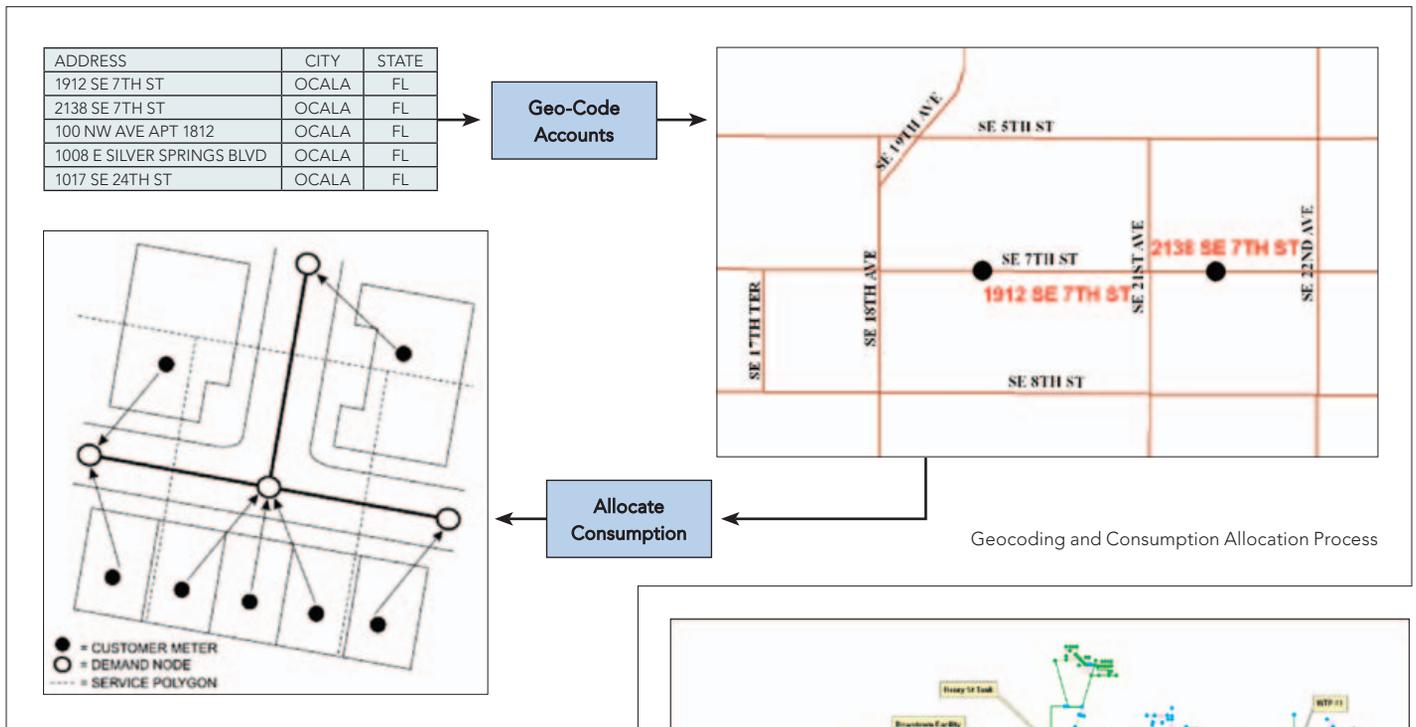
GIS tools were also used to allocate consumption to model nodes by geocoding customer accounts using the service address to establish a spatial distribution of base-year consumption within the water service area. Geocoded customer accounts and associated water consumption data were then allocated to the nearest model nodes by using LoadBuilder

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Drinking Water Distribution System Pipeline Network

GIS and Hydraulic Modeling to Support City of Ocala's Integrated Water Resources Plan



in WaterGEMS to establish a highly accurate representation of base-year consumption in the model.

For each individual TAZ, the projected consumption was calculated using GIS by distributing the projected consumption among the TAZs based on the projected population distribution. The increase in consumption for each TAZ was then automatically distributed equally to model nodes located within the TAZ using GIS and added to the base-year demand in the model.

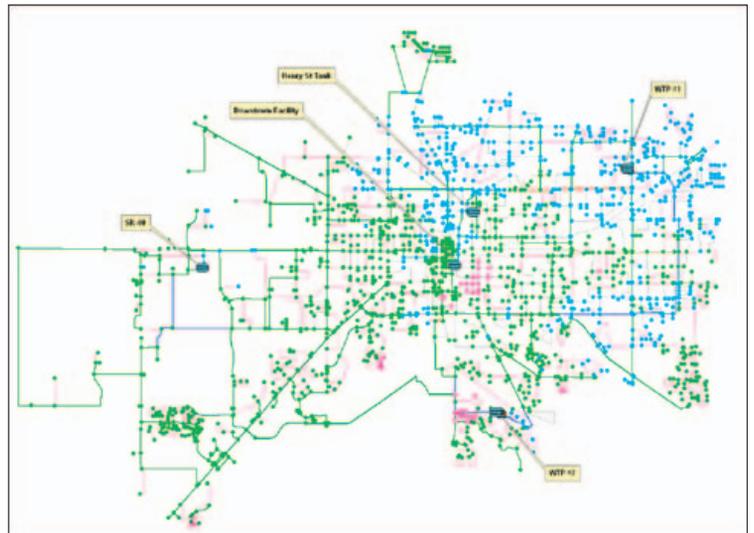
Drinking Water System Hydraulic Analyses

The resulting WaterGEMS hydraulic model was then calibrated and used to create scenarios representing future planning years 2008, 2013, 2018, and 2028. For each planning year, hydraulic analyses were conducted for the peak hour demand, minimum hour demand, and maximum day demand with fire flow.

Color coding tools provided in the modeling software and GIS mapping functions provided a significant time and effort savings when compared to previous methods of illustrating model results before models became graphical and were integrated with CAD and GIS.

Drinking Water System Improvement Presentations

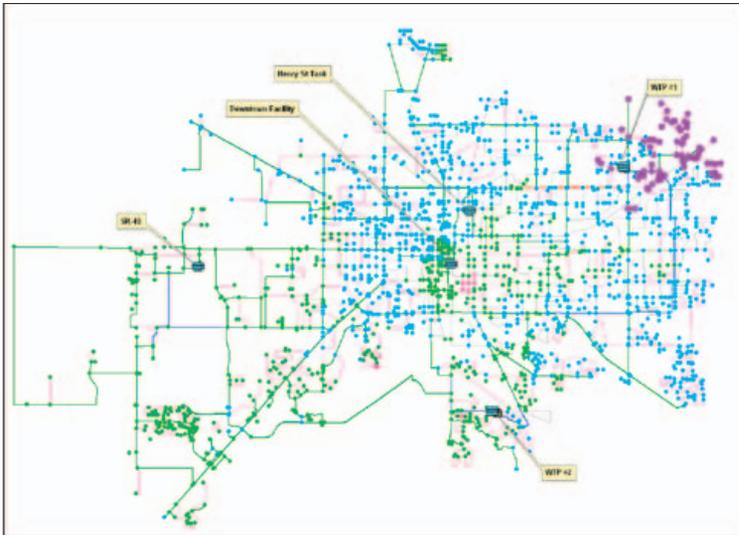
Transmission and distribution main improvement projects were identified after review of the hydraulic analyses results for the various planning years and the potential route options. Overlaying the main improvement projects on the aerial photography greatly facilitates understanding the route. Potential ob-



Predicted Pressures—2028 Peak Hour Demands



Predicted Head Loss Gradients—2028 Peak Hour Demands



2028 Minimum Hour Scenario—Predicted Pressure

structions or obstacles that may be encountered during design and construction can be identified. Tasks are performed quickly with GIS, compared to previous methods involving drawing proposed mains directly on aerial photographs.

Conclusion

The combination of GIS and hydraulic modeling proved to be effective tools in analyzing the city's drinking water system and identifying and presenting required drinking water system improvement projects. Many of these applications involved analysis of a single system.

ArcGIS served as an effective tool for performing analyses impacting multiple systems through the reclaimed water system retrofitting analysis and thus directly supported integration of the city's system planning activities.



Selected Pipeline Improvement Projects

Water/Wastewater User Group Committees

National

Beth Degironimo, Chairman, Mohawk Valley Water Authority, NY
 James Bates, Louisville Water Company, KY
 Doug Rulison, Orange County Sanitation District, CA
 Kathryn Browning, Municipality of Anchorage, AK
 Jon Henderson, City of Bozeman, MT
 Phil Oswalt, Montgomery Water Works and Sanitary Sewer Board, AL
 Kent Lage, Johnson County, KS
 Deborah Viera, Dade Water and Sewer Department, Miami, FL

Partner Council

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 Alan Hooper, CDM
 Steve Line, RedZone
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 Bo Nielsen, DHI
 Andy Moore, CH2M HILL
 Michael Samuel, Nobel Systems
 Ali Diba, Spatial Wave
 Chris Stern, Trimble

International

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 Krystyna Jastal, Boytom Communal Enterprise Co. Ltd, Poland
 Patrick Verduyssen, PIDPA, Antwerpen, Belgium

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 Dave Varela, City of Chandler

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 Mike Brown, Las Virgenes Municipal Water District
 Albert Lin, Long Beach Water Department
 James Ollerton, Elsinore Valley Municipal Water District
 Nadeem Shukat, City & County of San Francisco

California Partner Council

Yazdan Emrani, Advanced Infrastructure Management, Inc.
 Erick Heath, MWH Soft
 Don Rhodes, iWater
 Paul Hauffen, IDModeling, Inc.

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Macon Water Authority Improves Asset Reliability

By putting this initiative into place for all its facilities, MWA will be driving a culture of reliability and continuous improvement.

The ARM Model

MWA's ARM consists of four basic elements: work order identification and control, scheduling, planning, and materials management. Together, these four elements lay out the interactions of all departments as they identify and request work, prioritize the work to determine the most appropriate response, plan the work to improve craft efficiencies, and schedule the work to ensure that it is completed at the best time with the correct resources. In addition, the ARM provides measurement of the work management processes. Key performance indicators (KPIs) are now used to monitor, evaluate, and identify what is working well and where process improvements are needed.

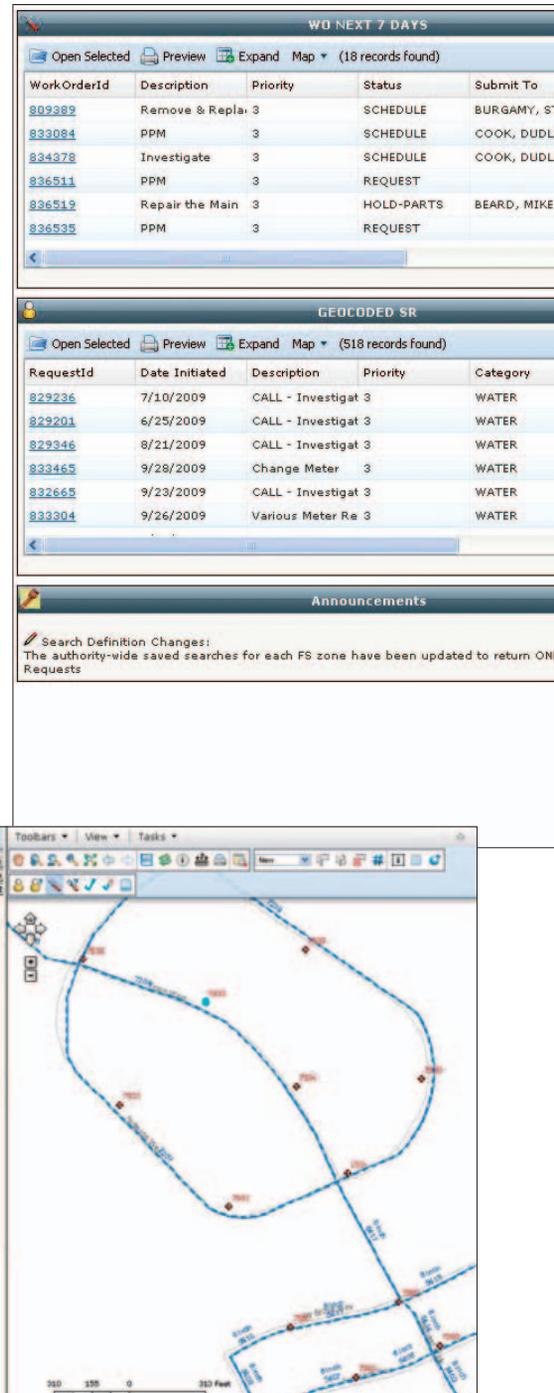
CMMS Use and Importance

To sustain the ARM Initiative, a robust computerized maintenance management software (CMMS) package must be used. The CMMS provides the functionality for generating work orders, planning, scheduling, collecting asset costs and history, managing repair parts inventory, and producing metrics.

In addition to the new system capabilities that will improve its asset reliability and

maintenance productivity, MWA will implement improvements to its existing GIS that will allow access to mapping data to greatly benefit customer service, water distribution and sewer conveyance, engineering, and plant operations.

Modifications to its GIS will reduce the load imposed on the GIS department with the current method of supplying data to the staff.

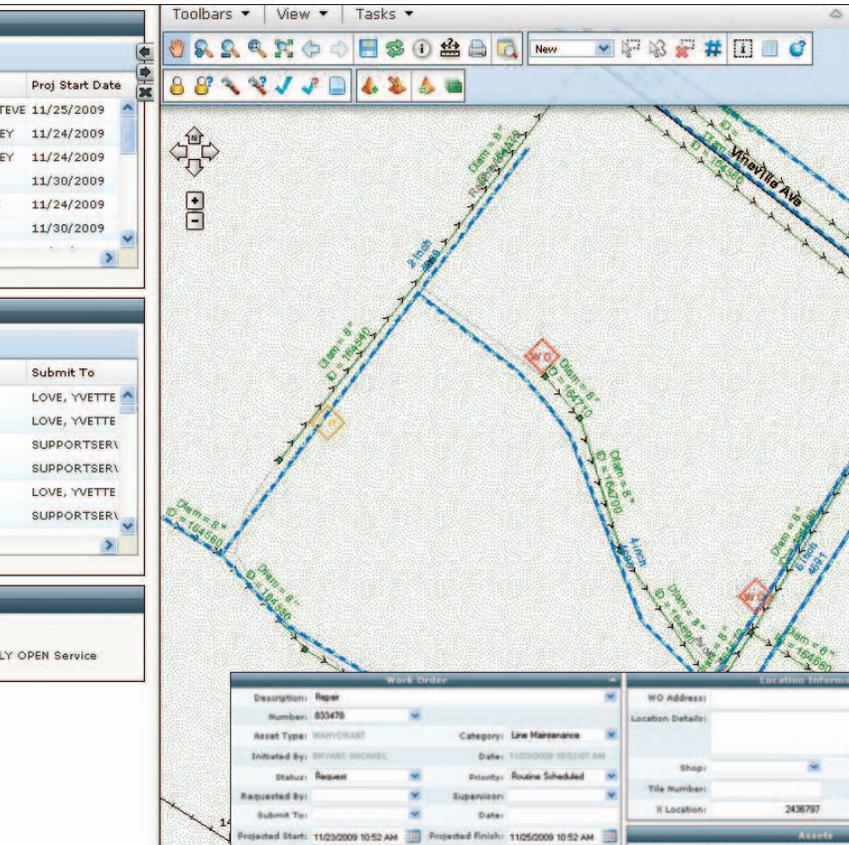


One way to create a work order is through the map.

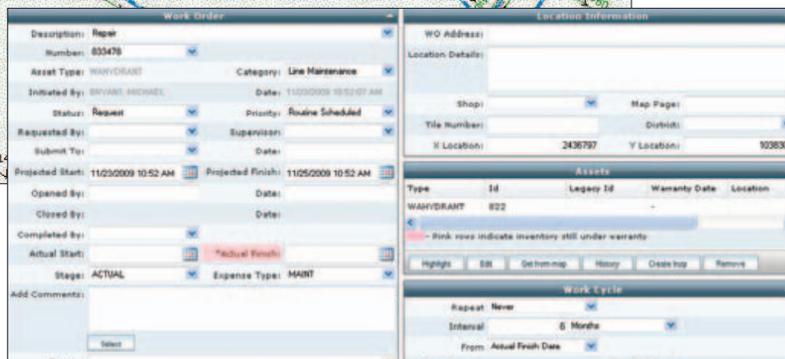
Lastly, teamwork is a critical component to the success of this initiative. MWA employees understand that the ARM Initiative is an organization-wide program and not just a maintenance or planner program. Staff also understands that operations, engineering, and warehouse departments are integral to the success of this initiative. Efficient communication and interaction between all departments is

an important and necessary aspect of this improvement initiative.

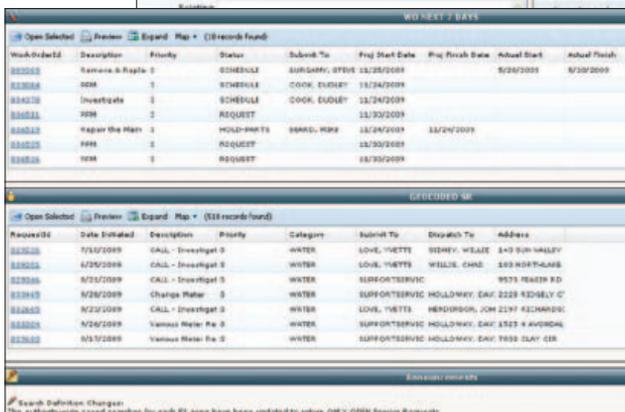
By concentrating on asset performance and workforce productivity improvements, the ARM Initiative will fully enable MWA to increase capacities and service levels and further extend the life of its equipment and assets.



The map also displays event layers that reflect the location of service requests or work orders.



This is a full-form view of a work order.



The inbox holds saved searches, which allow users to quickly find their work.

Water/Wastewater User Group Committees (continued)

Northeast

Gilbert Osei-Kwadwo, Fairfax County Wastewater Management, VA
 Nancy Pullen, Boston Water and Sewer, MA
 Sigi Sharp, Washington Suburban Sanitary District, Washington, DC
 Dave Ward, Loudoun County, VA

Northeast Partner Council

Ryan McKeon, Wachs Water Services, MD
 Ed Singer, Timmons Group, VA
 Ron Wallace, IBM, NY

Mid-America

Becky Mckinley, Chairman, Hammond Sanitary District, IN
 Will Allender, Colorado Springs Utilities, CO
 Bruce Butler, Butler County, OH
 Jeffrey Duke, Northeast Ohio Regional Sewer District, OH
 Dave Krenek, City of Fountain, CO

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 Nicole Schmidt, GBA Master Series, MO
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 Scott Rebman, RJN Group, IL
 Tom Delaura, Westin, MI

Pacific Northwest

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 Dale Bertelson, Clean Water Services, OR
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Elizabeth Marshall, Marshall, WA

Southeast

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 Ron Hawkins, Orlando Utilities Commission, FL
 Joel Watson, Spartanburg Water System, SC
 Veronica Owens, JEA, FL
 Alan Lee, Opelika Utilities, AL
 Matt Sanders, Mobile Area Water & Sewer, AL

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 Mark Nelson, Jones Edmunds & Associates, Inc., FL
 Karyn Tareen, GeoCove, FL

AWWA Liaison

Paul Olsen, American Water Works Association, CO

WEF Liaison

Jack Benson, Water Environment Federation, VA



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