One Technology, Many Solutions:
Enabling Water Resource Management in the South

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At first glance, the Gwinnett County Department of Public Utilities (GCDPU), San Antonio River Authority (SARA) and South Florida Water Management District (SFWMD) are quite different from each other. GCDPU manages water-resource and water-quality issues for a 400 square-mile area of Gwinnett County, Georgia, among other public utility responsibilities. SARA is responsible for the health and welfare of the 240-mile San Antonio River and those citizens that live along its boundaries. The SFWMD manages water resources in 16 counties, including the Everglades.

While different in scope and scale, these entities have one thing in common: each is in the midst of a water resource management project built around the ArcGIS Hydro data model (Arc Hydro). Developed by ESRI and the Center for Research in Water Resources (CRWR) under the guidance of David Maidment of the University of Texas, Austin, Arc Hydro is a "data model" for storing and managing information about water.

PBS&J is working with each of these organizations to bring water resource information together in new ways. From hydrologic and hydraulic flood models to water quality systems, Arc Hydro data can be used to track where water has been, how it is moving, and to predict where it is going for virtually any scenario. Able to manage multiple large GIS-based datasets and store results from complex hydrologic models, Arc Hydro is a synthesis of geospatial and temporal data that supports hydrologic modeling and decision-making.

Managing Growth for Public Utilities: GCDPU

Located just north of Atlanta, Gwinnett County is one of America's fastest-growing counties. The region's current population is over 700,000 within its 437 square miles, which include over 40 distinct watersheds. For years, GCDPU engineers have maintained individual, extraordinarily detailed hydrologic and hydraulic models for each of these watersheds. As the population continues to grow, these models are increasingly critical for sound public policy and decision-making.

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GCDPU sought a way to integrate and display these models in one system to support county planning activities. With its consultants, the agency developed a county-wide Arc Hydro database. Gwinnett-Arc Hydro supports the hydrologic and hydraulic models for each watershed, populates the database framework for the Chattahoochee, Ocmulgee, and Oconee basins within Gwinnett County, and even, at a future date, will include dam breach and water quality models.

The Gwinnett-Arc Hydro data model displays information for the three basins as a whole, but each watershed model and its associated GIS data are managed independently. Thus, while GCDPU engineers manage their models individually, they can see a complete regional picture.

Because Arc Hydro emulates hydrologic systems, new data types such as time series of rainfall and temperature can be easily added to Gwinnett-Arc Hydro. Adding new data and new models will become a streamlined process, freeing resources to perform more advanced analyses that aid in the decision-making process.

The goal is for the database to be

A portion of the 1,800 miles of canals and levees maintained by SFWMD.

continually updated from multiple sources such as regional reports, FEMA studies, or environmental permit information, so that it becomes a near-real-time water management planning and response tool.

When It Rains, It Floods: Watershed Management by SARA

The San Antonio River is more than 240 miles long and flows through five counties. It comprises six major watersheds, with numerous jurisdictions, agencies, and organizations dependent on the river's quality and quantity.

To manage this critical resource, SARA, the City of San Antonio, and Bexar County jointly created the Bexar Regional Watershed Management (BRWM) program, a collaborative, regional approach to flood control and storm water management, including both water quantity and quality. The goal is to develop a single, comprehensive system to assist in flood mitigation planning, capital project prioritization, and floodplain management, and help manage water quality in storm water runoff and ambient waters.

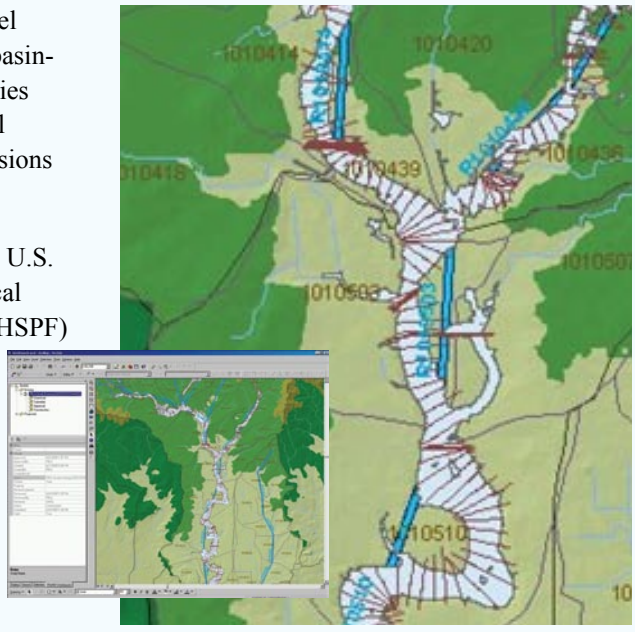
BRWM and its consultants developed an Arc Hydro-compliant Regional Watershed Management System (RWMS), which included an inventory and assessment of flood and water-quality data and models. Because all the flood models were similar, detailed watershed model data could be integrated into a basin-wide geodatabase with capabilities to extract subsets of the regional model and re-insert updated versions into the regional framework.

The agencies also agreed on the U.S. Geological Survey's Hydrological Simulation Program – Fortran (HSPF) as the standard water quality model for the basin. While more complex than the Gwinnett County solution, standardizing the hydrologic, hydraulic, and water quality models allows much greater control and automation of the model review process, integration of flood models with water quality data, and maintenance of regional models for automated prediction of flooding risks by running the models in GIS with real-time rainfall predictions. Overall, this system provides spatial, time, and flow linkages between selected flood models such as HEC-RAS and HEC-HMS models, and water quality models, such as HSPF and QUAL-TX.

The RWMS will make it possible for SARA to keep all of its GIS-based models updated. Program members can use the information independently for flood mitigation planning, identification, and prioritization of water-related capital improvement projects, floodplain management, and flood-alert system development. The management system will also be used to manage and update Federal Emergency Management Agency (FEMA) flood maps.

Watching Water Move in Real-Time: SFWMD

The South Florida Water Management District (SFWMD) operates and maintains approximately 1,800 miles of canals and levees, 25 major pumping stations, and about 200 larger and 2,000 smaller water control structures. The area of responsibility spans 16 counties and 17,930 square miles with a population of more than six million residents.



The Regional Watershed Management System for the San Antonio River enables a collaborative, regional approach to water management.

PBS&J, in collaboration with CRWR, ESRI, and DHI Water & Environment, is developing a set of concepts, database extensions, and tools called Geospatial Time Series Management (GTSM). When integrated into ESRI's Arc Hydro geodatabase, GTSM translates water-related data, such as levels and flows from SCADA and rainfall from radar rainfall and rain gauges, into a single GIS-driven water resources information system, accessible to the entire water resource management team.

GTSM links data from lakes, canals, control structures, monitoring points, and drainage basins together into water control units. Most importantly, the spatial data are linked to time-series data, thus providing the ability to translate modeled and measured rainfall, evapotranspiration, heads, and flows into volumes. Measured and predicted volumes provide system status and projections using water balancing. By integrating historic and predicted data, GTSM can compare measured watershed performance to predicted responses over short or long time periods. This is the foundation for performance monitoring, decision support, and adaptive management.

Overall, GTSM will help SFWMD operators make more informed decisions by providing integrated operational and scientific data for watershed management, hydroperiod analysis, operations decision support, and hydrologic and hydraulic modeling activities.

National Impact

While these examples illustrate how Arc Hydro has helped organizations improve their water management abilities, the real value of the Arc Hydro data model may be its common framework that can help organizations collaborate and converge critical information. It could be a much-needed catalyst for developing a national water data standard, one that will help federal, state, and local agencies effectively manage water resources, water quality, and water-related disasters on a much broader and more accurate scale.

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