

# Selecting Multi-Function Survey Tools

Rural Alabama county creates a GIS system to serve governmental agencies and the engineering/surveying community.

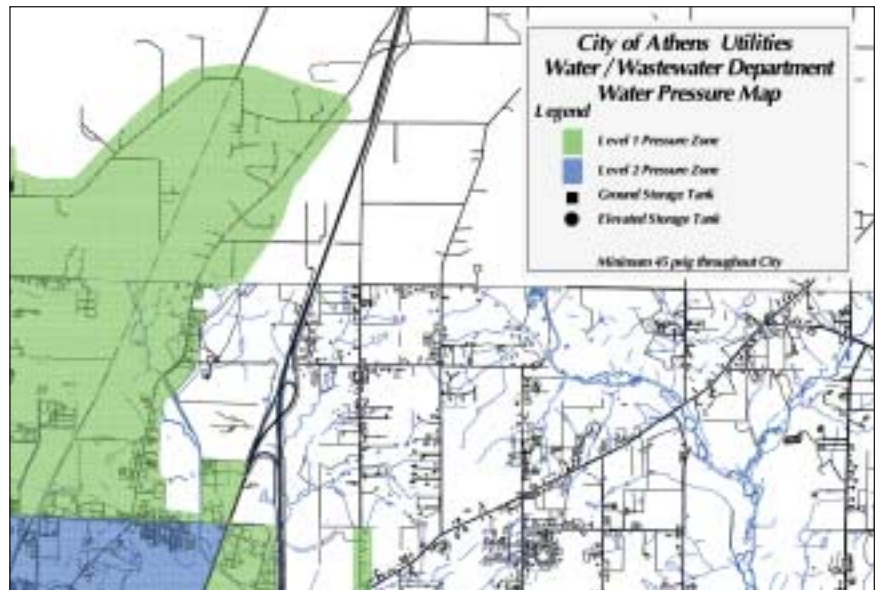
By Richard Rybka

As cities grow, development spreads, and the economy flourishes, GIS systems are rapidly becoming an important part of municipal resources throughout the nation. But the creation and use of these vital information systems is not limited to urban areas. Recently a rural county in north Alabama began the task of creating a GIS system to serve governmental agencies and the engineering/surveying community. Teaming up with a high level technology partner, it became a pioneer and model for future development of systems in Alabama.

Limestone County is situated at the northernmost part of the state, bordering Tennessee. Except for development along the Interstate 65 corridor, the county is still primarily rural. Athens is the county seat and main population center. Athens' location along the Interstate, as well the urbanizing influences of neighboring cities, creates an interface of rural and urban lifestyles. Huntsville, Decatur, and Florence are located within a 40 mile radius. The proximity of Huntsville, a major node for aerospace and aviation engineering, enables Limestone County to access leading-edge technologies for geospatial applications.

## Sharing Information: The Key to GIS Success

Limestone County has a diverse base of agencies that will benefit from an integrated GIS network. With the desire to meet the individual needs of these agencies, ensure a seamless interface between the databases, and reduce the



*Although Limestone County is still primarily rural, this Limestone County Water Pressure Map provides details on two pressure zone levels as well as the location of both ground storage and elevated storage tanks.*

overall cost involved for each participant, a Geographic Information Systems Committee was formed. The committee's mission is the strategic implementation of a county-wide GIS database.

To better understand GIS operating parameters and formulate a cohesive plan for implementation, Athens contacted GTAC—the Geospatial Training and Application Center—in September 2003. GTAC is located at the U.S. Space and Rocket Center in Huntsville. This initial effort put them in contact with Ms. Chris Johnson, GISP, Vice President of GTAC. Johnson became the liaison to the committee, working closely with it to develop its strategic plan. A consortium was formed to maximize cooperative efforts.

In her overview of the Limestone

County GIS project, Johnson summarizes the advantages of the consortium approach: "Since the information needs of different GIS applications overlap and data created by one organization can often be used by others, data sharing can help reduce costs for GIS application development and yield considerable benefits and efficiencies."

A county-wide flyover was done in December 2004 that provided an up-to-date base of existing geographic information. During and following the aerial flights, monumentation based on the Alabama State Plane West coordinate system was set on a grid throughout the county. New standards were set for survey documents and construction as-builts, requiring them to be referenced to the coordinate system. This will facilitate database management as new

*Bedsole's truck is designed to hold all the tools for GIS mapping and survey tasks.*

roads, utility system expansions, housing developments, and commercial sites are constructed.

## An Example of Participation

Athens Utilities owns and operates natural gas, electric, potable water, and wastewater systems that serve Athens and fringe areas surrounding it. The Water Services Department of Athens Utilities directly oversees the operation, maintenance, and expansion of water and wastewater facilities.

Jonathan Bedsole, Water Services Staff Engineer, is primarily responsible for reviewing site development plans and subsequent inspection of new installations during construction to ensure compliance with city standards. When the consortium was formed, Bedsole was assigned the responsibility for developing a methodology to create a GIS database for his systems.

Mapping existing features for the initial database represents a sizable challenge. Serving about 9,500 water and 5,200 wastewater customers, there are myriad lines, valves, hydrants, manholes, pump stations, and treatment plants that need to be located. The water and wastewater systems of Athens are not static; with development occurring in almost every sector, these systems are in a constant state of flux. The staff of Water Services is limited to a few individuals with administrative and superintendence responsibilities. This leaves Bedsole in the primary position for not only developing the strategy for GIS database implementation, but also for collecting location data on existing facilities.

In devel-

oping his strategy, Bedsole saw the opportunity to accomplish other tasks that would facilitate his continuing management of the two systems under his control. In addition to his review and inspection duties, he is also responsible for designing expansions to serve new development areas. To enable these tasks within the wastewater system, he needs precise location and elevation data for modeling and design purposes.

When Water Services began the GIS project, it had no land survey instruments other than a simple level. Bedsole needed tools that would enable him to acquire data to meet his dual objectives—GIS and modeling and design. Typical sub-meter GIS data collection systems would be adequate for the collection of existing feature locations on the water system. Submeter GIS would not, however, obtain precise location and elevation data critical to modeling and design of the wastewater system. He determined that “survey grade” instruments would be required to accomplish these tasks.

## Selecting the Right Tools

As a municipal employee, Bedsole is bound to make major equipment acquisitions under procedures that ensure a public, competitive bid. He decided to research available products and technologies that would provide the

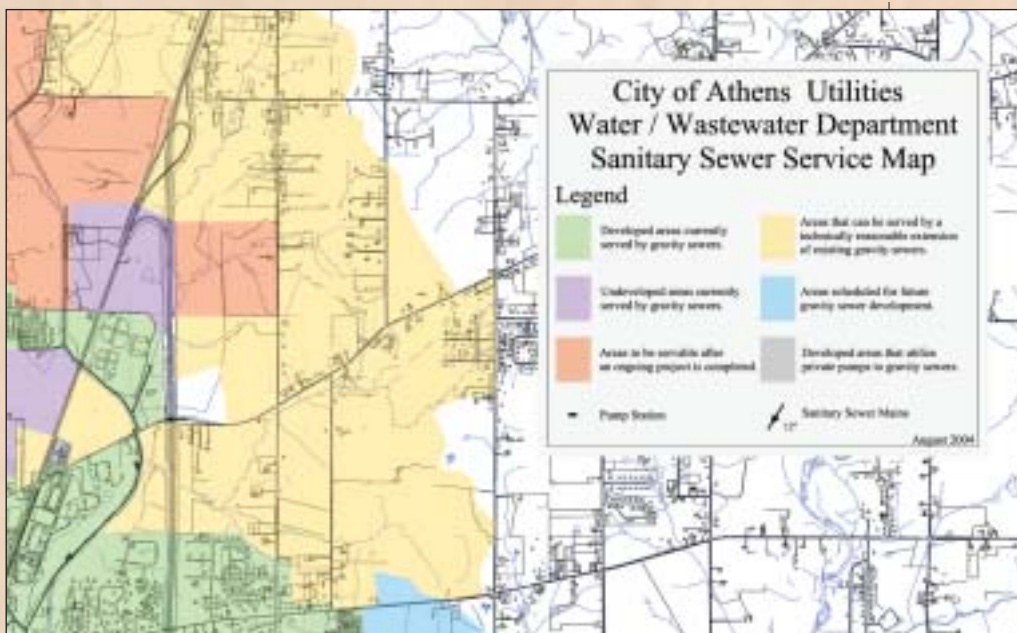
functions he requires, and then write a specification to describe them.

A GPS survey system provides horizontal and vertical accuracies to within a tenth of a foot. This is adequate for most of the mapping work. A higher precision instrument is required for data collection to be used for wastewater system purposes. Additionally, property and easement boundaries need to be accurately located on the ground to enable precise placement of new installations. For these two reasons, Bedsole determined that he needed an optical survey instrument and a GPS survey system. He also needed a field computer and operating software that would enable easy use of these two systems.

Bedsole's search led him to three competitive manufacturers of survey products. He requested demonstrations from each manufacturer's supplier. After studying the advantages of each brand and working with them in the field, he was satisfied that all would meet his requirements. Looking ahead, Bedsole also wanted the ability to use cell phone communications with his GPS survey system. CORS (Continuously Operating Reference Station) networks are being constructed throughout the country. These systems enable users within a network to perform survey tasks in the field without setting up a base station. He wrote his specification to include this feature.

*Bedsole shoots a backsight with Topcon's GTS 235W wireless total station.*





*With the ongoing advances and ease of use of surveying, GIS, and mapping equipment, sophisticated mapping, such as this Limestone County Sewer Service Map, is available to local governments regardless of staff size.*

Following municipal procedures for competitive bids, Bedsole sent proposal requests to the three suppliers. Additionally, the bid was posted in several public locations and advertised in local newspapers. When the proposals were opened, Hayes Instrument Company, Shelbyville, TN, was the low bidder. Hayes' proposal was based on supplying survey instruments and related operating equipment from Topcon America Corporation

(www.topcon.com). Bedsole recommended acceptance of Hayes' proposal for Topcon products to John Stockton, Manager of Water Services. The recommendation was subsequently forwarded to and approved by the city council, and a purchase order was issued to Hayes.

### Putting the Tools to Use

Roger Wheeler, sales representative with Hayes, delivered a Topcon HiPer Lite GPS system and a GTS 235W wireless total station to Bedsole in June 2004. Because

Bedsole's experience with survey equipment was extensive, Wheeler's orientation focused on familiarizing him with the operation of the new instruments.

Following the orientation, Wheeler helped Bedsole set a control point in the parking lot of Athens Utilities' headquarters. Bedsole is establishing a grid of control points throughout the extent of his systems based on the Alabama State Plane West coordinate system. This preliminary work will allow him to survey locations quickly by eliminating the need to reference his GPS base station each time he sets it up. He is

locating these control points at secure locations in or close to municipal facilities, deterring possible theft of or vandalism to an unattended GPS base antenna.

Over the next few months, Bedsole had the opportunity of use the HiPer Lite and GTS 235W on a variety of field tasks. One task involved checking for a potential conflict between a proposed wastewater main extension and construction of an earth berm for a municipal stormwater control project. He also used both instruments to establish the existing locations of 24- and 8-in. water lines and site conditions relevant to their relocation. These relocations were required for a culvert replacement project along a state highway. During these field missions and other similar experiences, Bedsole began to appreciate several advantages of his new survey equipment.



*Jonathan Bedsole, staff engineer for the Water Services Department of Athens Utilities, is a very busy man.*

The most important advantage is the seamless interface between Topcon's GPS and total station operating systems. He carries both systems in a secure storage area built into his truck. He frequently changes between the GPS and total station instruments to accommodate field conditions or data collection requirements. Topcon's integrated systems allow use of the same field computer, software, and database for both instruments.

The GPS system features wireless Bluetooth communication between Bedsole's field computer and either the GTS 235W total station or the HiPer-Lite GPS system, eliminating cables that are subject to wear and damage. Sometimes important cables are left behind, necessitating extra trips. The GPS system also uses the same unit for the base and rover antennas. The software configuration of each one determines its function. When a CORS network or a remote base station is established in the Athens area, the base unit can readily be converted to a rover. This will enable use of two rovers for field data acquisition, speeding up the process considerably.

### Starting the Database, Keeping it Current

After procuring the proper equipment, work on data acquisition began. Due to the staffing structure of Water Services, Bedsole is the only person currently available for this task. He works it into his regular routine of design and inspection duties. He performs his own surveys on new construction so that they will be referenced to Alabama State Plane West coordinates and can be easily merged with the GIS database.

Bedsole has formulated a plan to speed up this task. He intends to hire a co-op student who will use the HiPer Lite GPS survey system to collect location data only. The acquisition of attribute data for each feature—function, size, and condition—requires more knowledge of system design and construction. Bedsole will perform this task himself, along with his field superintendents.

Bedsole anticipates that the initial phase of database construction will take three to four years to complete. While



*Topcon's HiPer Lite GPS survey system enable fast, accurate mapping of utility features for the GIS database.*

mapping of existing facilities is occurring, the thrust of urbanization will be creating new facilities at a rapid rate. The GIS systems used by Water Services and the other Limestone County participants will change daily. Through careful analysis of the tasks required for GIS database implementation, consultation with the experts at GTAC, and a comprehensive study of the engineering needs of his department, Bedsole has formulated a plan of action that addresses the implementation of the GIS database and accommodates the future growth of his systems.

The benefits of this learning experience go well beyond the geographic boundaries of Limestone County and Athens. In her summary of the project, Chris Johnson points out the far reaching impact: "The innovative model for data sharing and partnerships built through the diligent work and cooperative efforts of the Consortium has enabled the City of Athens and Limestone County to become a model for statewide data sharing initiatives." **GE**

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