

# GPS improves utility management operations

by Corey Willson, 3M Dynatel, Texas, USA

*GPS offers strong promise for improving utility construction, maintenance and facility management operations.*

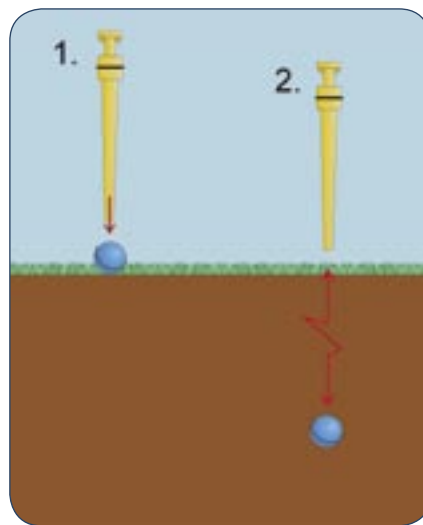
**G**lobal positioning technology is gaining increasing importance for public utility resource management because of its capability to support accurate and cost-effective mapping of field facilities. A GPS receiver detects signals from orbiting satellites and uses triangulation to calculate the latitude and longitude of individual locations.

Precise GPS mapping can replace traditional schematic maps that may be incomplete, inaccurate, and difficult to maintain. This effort can be done efficiently in conjunction with utility construction and maintenance activities, and the resulting data supports the preparation and continuous upgrading of infrastructure records.

Charlotte County Utilities in Charlotte County, Florida, USA is one municipal operation that is preparing to adopt GPS capabilities for the management of their water/sewer facilities. This utility is located in a region of explosive growth, and crews are working to provide water and sewer services to hundreds of thousands of new single family home and apartment lots.

During 2004 Charlotte County adopted a new underground utility marking process that allows it to remotely locate and identify facilities by means of buried markers and remote locators. The next phase of Charlotte County utility construction will involve the incorporation of GPS coordinates for each of these underground markers.

As a new water or sewer line is placed, marker balls are placed along the pipeline and at each feature and change in the route, including pipe deflections, Ts, junctions and service points. Contractors use a portable marker locator to program important details into the marker memory just before it goes into the ground; such as



*Fig. 1: The marker locator is first used to program an ID marker ball (1), and then to locate and interrogate the marker (2).*

the pipe type and size, the year it was installed, fitting type, and depth below the surface.

Later, when a locator sends out a search signal, the buried marker responds with stored data, which is displayed on the locator panel. On straight pipeline runs ball markers are placed over the pipe every 46 m to mark the route, and this gives contractors fast, accurate access to sewer and water lines at any intermediate point.

Florida One-Call crews also place ID marker balls during routine work to locate mains and other buried components. This allows the utility to take advantage of One-Call excavation efforts to record underground details and add new field data to the county's permanent facilities record.

Charlotte County uses Geographic Information Systems (GIS) mapping for utility resource management. Information from the ID marker locators is downloaded at the end of

each workday and added to the GIS database. As GPS data is collected in the field in the future, marker longitude and latitude coordinates will be added to a new layer in the GIS mapping database.

GPS data entry and management capabilities are included in marker locator software that is already in use with this Florida county's 3M underground ID marker system. The software provides for obtaining and transferring GPS coordinates for underground markers by one of two methods, depending on the type of GPS equipment being used (see Fig. 1).

Mode 1 collection stores GPS data along with marker information on the 3M marker locator for eventual transfer to the mapping database, while Mode 2 sends marker information to the GPS where it is combined with latitude and longitude values and then passed on to the mapping database.

The GPS data will also be valuable for computer-aided drafting system operations for facilities drawings. Recorded marker coordinates can be used to auto-create points for the CAD system, resulting in precise and complete as-built drawings. This paperless, electronic approach to field records will reduce the possibility of error and speed the process of creating and updating CAD records. A 75% reduction in record keeping time with GPS input, compared to conventional surveys and hand-marking of prints in the field, is anticipated.

Records will include not only location details but full feature attribute data, allowing for data mining (i.e. rapid search and identification of specified features on particular sections of the water/sewer network). Predictive and preventive maintenance work is expected to benefit greatly from this improved level of data accuracy and access.

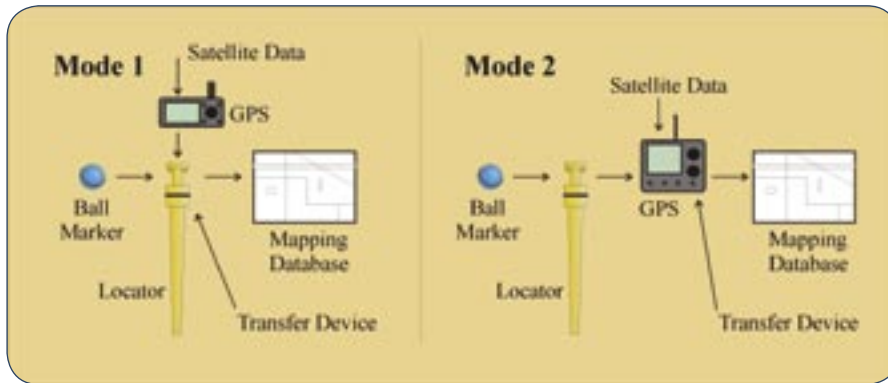


Fig. 2: Marker data and GPS coordinates can be recorded, stored and forwarded in one of two modes, depending on the GPS equipment in use.

The mapping grade GPS receivers have a positional accuracy of approximately 1 m while less costly consumer grade units have a resolution of around 3 m. This lower value is sufficient for useful mapping in conjunction with utility markers because marker locators can pinpoint a buried marker with such accuracy that the ball can be dependably excavated with a post-hole digger.

Charlotte County Utilities plans to adopt satellite positioning with the use of inexpensive GPS receivers having sufficient memory to handle the marker data and coordinates, pairing them with 3M marker locator devices. The two devices will communicate in a standard data format by means of an RS-232 connection. At the end of each day, data from GPS-equipped locators will be downloaded into a file to support mapping, spreadsheet and sortable database applications. It is expected

that this new level of detail will improve the efficiency of utility maintenance scheduling and field work.

For day-to-day work, an operator will be able to scan stored waypoints in the GPS unit to reach the vicinity of a marker of interest, and then click on that item to confirm what is at the location. This will be a useful orientation tool in preparation for digging, or to establish a bearing in order to locate something else.

The county plans on placing 1,5 million linear metres of pipeline over a five-year period. With this new GPS-supported underground marking technology, a single person will be able to handle the field mapping for this utility expansion in one step, placing markers, programming pertinent data in the marker, recording GPS coordinates, and

creating a downloadable record of the day's work as the pipe is laid. Mapping work can be accomplished on the fly, and there will be no need to return to that location at a later time.

Since the press of new construction and underground marking in Charlotte County currently takes precedence over marking older, established facilities, it may be some time before all of the area's water and sewer facilities can be fully marked. In the meantime, GPS marker mapping will give maintenance crews the ability to plan ahead, scheduling more time for work to be done in areas where markers have not yet been placed.

The digital nature of marker and GPS records will make it possible to frequently update maps that are stored on laptops used in the field - using wireless or plug-and-sync connections at the end of a shift. In this manner, working crews will have timely access to maps that include details of work done as recently as the previous day.

GPS marking will also allow utilities such as Charlotte County to more accurately age their infrastructure because they have a data/time stamp on every marked location along with the project name and date of construction. This level of detail will make it easier to conform to government inventory and costing requirements.

Contact Corey Willson,  
3M Dynatel, cmwillson@3M.com ©