by Pete Koenig

New uses for GPS data help cities/RWDs be more efficient

Kansas Rural Water has been involved with GPS mapping since 2002. Recently, new technologies have become available to allow additional uses of the data that was collected years ago. This is possible because the GPS coordinate of a feature in a water system will never change unless the feature is moved. If a valve is replaced and the new valve is installed at a different location, then a new GPS coordinate needs to be collected. But if a valve or meter or any other feature is never moved, then the GPS coordinate will never change, regardless of when the coordinate was collected.

One technology utilizing GPS information is radio read meter or automated meter reading (AMR) systems. AMR allows for utility staff to walk or drive past a meter with a handheld or vehicle-mounted receiver; the meter reading is transmitted to the receiver. This type of meter reading can save time and ensure accuracy by eliminating transposition errors. In urban areas, or areas of more concentrated populations, it is even possible to mount an antennae to the top of a City Hall or water tower and 'turn it on' once a month when it's time to read meters. The AMR unit sends a 'wake-up call' to the individual water meters; the meters transmit current readings and a computer records the information. The billing software can then catalog and organize the meter reading information that has been downloaded and bills are generated. In a city a fixed antennae location or a handheld unit are adequate because of the concentration of the customer meters. In a rural water district, there may be miles between customers with the systems often covering parts of several counties. To visit every meter, a person could be required to drive as many as 800 miles or more. Travel time, just to drive 800 miles at an average of 40 mph, is 20 hours. This, of course, does not take into account the amount of time to exit a vehicle, then to locate the meter, read the meter and get back in the vehicle. If a large, rural system has 1,300 meters, and an average of five minutes is allowed per reading, that's another 108 hours. There is an untold amount of time that is spent climbing fences, dodging pets, trudging through mud and livestock pens, conversing with people along the route, cleaning out flooded pits and cleaning lenses to allow for reading the meters. If one additional minute per meter were added for these types of scenarios, this large example system would require more than 150 hours to read the meters. That's 19, eight-hour days or almost four weeks. Reading meters therefore is a full-time job for someone. In comparison, if this example utility had an AMR system installed, those hours could be reduced significantly! By simply eliminating the amount of time that an individual has to exit and enter the vehicle, find and read the meter and deal with all of the variables that accompany reading meters, the time involved would only include the amount of time it would take to drive past each meter. That total would be 20 hours at 50 mph! That's only three days compared to 19!

Pete Koenig
GPS Mapping Coordinator

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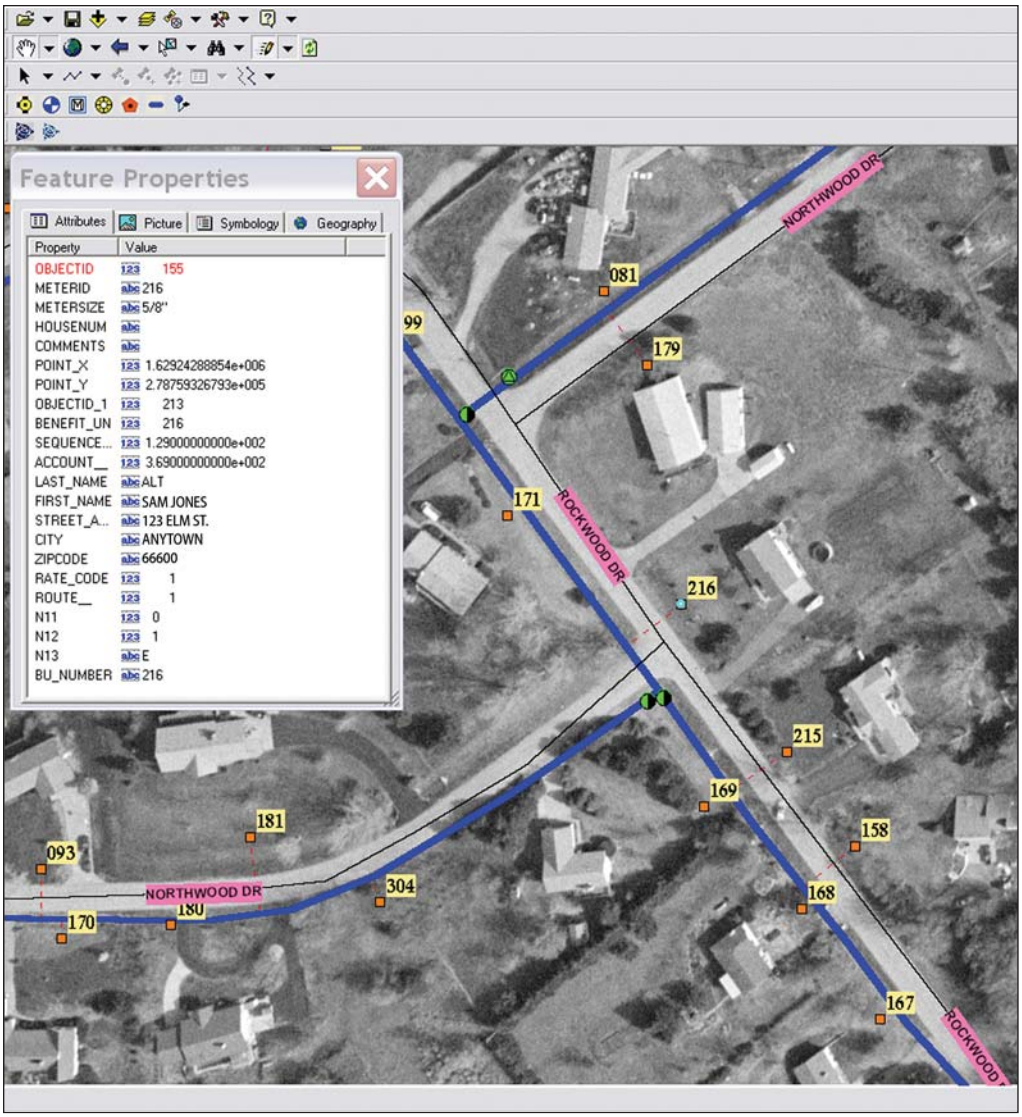
Locate on the go

I'm not writing this article to promote AMR. My purpose is to inform people of the uses of GPS data within AMR and other technologies. A GPS coordinate is a fixed point. Every meter has a GPS coordinate and when the coordinate is known, it can be tied to a unique identifier like the benefit unit number or serial number of a meter. So, with a geo-rectified map as a background, those meters can be displayed on a computer screen in their 'real-world' location in reference to the other meters in the water system. A meter reader can drive through the countryside and literally watch the symbols



This screen shot of ArcPad software shows what the operator would see when navigating back to meter number 216 (highlighted, in the middle of the picture). Notice the callout box of information about that unit.

disappear from the screen as the meter readings are being received. This all seems 'easy to do' in today's X-box and Playstation world, but it is difficult to couple mapping software with AMR software with billing software and make it all operate in real time on a laptop computer while driving 50 mph on a gravel road in Kansas! Mapping software, like ESRI's ArcPad, is good at allowing a user to collect GPS data, edit the data, enter attribute information about the features and navigate to previously collected points. AMR software is very efficient at 'waking up' an AMR unit, receiving a signal, cataloging the reading and doing it all at highway speeds. Billing software is good at determining consumption, comparing current readings to previous readings to identify possible leaks or over usage and generating billing invoices. There is currently no software platform available that

incorporates the three disciplines and allows someone to utilize the functionality of each in the field. I foresee the day when system personnel will be able to drive down a road, receive meter readings via AMR, identify the geographic location of their entire system infrastructure on a laptop computer, be warned if a customer's usage is unusually high compared to last month's reading and locate system infrastructure (including valves and water lines) with sub-meter accuracy in real-time. This digital interactive map and management tool could also be layered atop a high-resolution aerial photograph of the water system for more accurate identification of the driver's location. As stated by one vendor in the industry, "Getting the hardware and software for such an application is not the hard part – getting them to talk to each other in real-time is the trick." Eventually, there will probably be a software package available that allows the integration of AMR, billing and mapping software, making system management more efficient and less time consuming.

Another application that can utilize GPS data is the process of locating infrastructure. Underground utility locating is a beneficial service to contractors, private citizens and other utilities. The ability to locate system infrastructure accurately is important in preventing damage and having customers be without water service. With today's advances in GPS data collection equipment and accuracy, locating existing infrastructure is becoming less time consuming and highly accurate. Hopefully, the days of going to a field and probing in hard soil for hours in order to find a 4-inch main are coming to an end. Today, data can be loaded onto a mapping grade (or better) GPS unit in order to locate buried infrastructure. The accuracy of today's mapping grade equipment can allow for a person to navigate within one foot of a previously collected point or line. If a system does not have the finances to invest in mapping grade equipment, free viewing software is available that allows a user to measure off of visible features from a high resolution aerial photograph on their personal computer. This allows system personnel to take a measurement from the office computer into the field and find infrastructure. 'Guessing,' based on construction prints and plans, could

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This photo of a laptop screen was taken by Rural Water District 1, Harvey County. Despite a little glare, it shows an example of how automated meter reading technology is combined with GPS data and utility billing. The 'green dots' represent water meter locations and the yellow vehicle identifies the location of the meter reader. As meter reading signals are received by the computer inside the district's vehicle, the icons disappear. Meter readings for those that remain have not been collected.

The equipment used is by Sensus Technologies. The billing software is by Thoroughbred Systems. Data was collected by KRWA. The data was imported into meter reading technology in a matter of a few seconds for nearly 1,000 customers.

become a process of the past as well as witching with copper wire or pliers.

Professional locating services can also utilize GPS data in issuing locate requests. The Kansas One Call Center is able to accept polygons that surround system infrastructure, and generate locate 'tickets' based upon whether a contractor's request for excavation falls within those polygons. A simple polygon can be created around a water line that allows a 5-foot buffer, potentially reducing the number of locate requests sent to utilities. The buffer can be established at any scale, depending how confident the utility is about the digital files of the system. For example, if a manager is not confident about the location of a waterline in a certain part of the system, a 20-foot buffer, or 30-foot buffer or greater can be created around that section of line, whereas in a part of the system where GPS data was collected over a visible trench, a more exact, smaller buffer can be created to reduce the number of locate requests.

GPS data for a water system is a 'mobile map.' Anyone, from an engineer to a customer can 'take a look at it' if they simply have a computer and free viewing software which can be downloaded from the Internet. Sharing the data can be instrumental in providing assistance during times of need. Several different departments from the local, county and state levels can easily access digital data in times of an emergency without having to wait on another department. Valuable time can be saved organizing rescue parties, providing relief, directing personnel and equipment and providing general assistance.

The format of digital GPS data allows utility personnel to manage their systems more efficiently. Since so many utilities are having digital data collected of their infrastructure, many more applications are being developed that will allow the utilization of such data to maintain system integrity and operation. The technology is advancing, but quality data remains constant.

The 2009 KRWA conference will have more information on the topic of GIS/GPS. I hope you will plan to attend.

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