

well as update the utility's water infrastructure records."

The project area encompassed 22 square miles and included 17,871 customers and 263 miles of water main, among other system features. GIS data collected for this project included distribution valves, hydrants, fittings, control valves, production wells, storage tanks, meters, pumps and pump stations, water main services, and more. Each of these features includes attributes such as installation date, dimensions, manufacturer, work order, material, and diameter. The GIS software used on the project was ESRI ArcInfo and ArcSDE 9. Microsoft SQL Server was used as the relational database management system.

A distinctive aspect of the project was R.A. Smith's development of several queries to verify feature attributes and make sure that various components match up correctly. For example, an eight-inch water main matches up to an eight-inch valve. These queries were critical in helping to meet the utility's 98 percent accuracy requirement. The utility also required a horizontal precision tolerance of three feet throughout the conversion process. This tolerance gives field personnel the confidence level to rely on the GIS data and ability to quickly and easily locate system features while performing system maintenance and repair.

The project is also unique because it changes how work is performed in the field. The GIS was designed to assist field staff with locating specific water mains and their attributes quickly, even for those personnel with limited knowledge of how to navigate the GIS or use the software program. Because the program was extremely user-friendly, it increased the staff's enthusiasm for high-tech assistance.

System Applications

Instead of measuring to ascertain where to dig before doing any type of maintenance, water utility staff can quickly and easily lo-



This GIS image of the Waukesha Water Utility's water distribution system shows the complexity of the system and the connections to hydrants, valves, and services.

cate system features and attributes with a few clicks of a button on the computer. The Waukesha Water Utility GIS can also be used for regular maintenance scheduling such as hydrant flushing.

Another maintenance tool that the utility plans to use in the future is Azteca Systems' Cityworks. The GIS-based asset management tool can be used to set up a work order schedule for regular maintenance. The work orders are sent electronically, and the system automatically updates daily.

As contractors deliver final as-builts to the utility, the features need to be appended to the existing database. Once incorporated, the data can be considered for general viewing, maintenance, and additional expansion.

The GIS data was recently used in the creation of a computerized water model to analyze water system pressures and flows under varying conditions. This program has been extremely useful during the utility's recent planning and reporting efforts.

From this experience, we can share several critical lessons with water utilities that are interested in developing a GIS for their water distribution system:

- Allocate the time and resources to collect all the data you want and can afford in the GIS in a designated amount of

time so that the temporal data does not conflict during data conversion.

- Develop consistent data standards for contractors.
- Use GPS to speed the data collection process.
- Ensure that all field data collection is performed accurately and consistently.
- Maintain good records.
- Allocate the resources to quality check the data.
- Communicate openly and frequently to ensure the project's success when working with a conversion vendor for the data conversion.

The Waukesha Water Utility GIS project was recognized by the American Council of Engineering Companies (ACEC) of Wisconsin in its 2005 Engineering Excellence Awards program in the category of surveying and mapping. This GIS can serve as a model for other utilities that face water supply issues and want to better manage their data.

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