PROACTIVE INFRASTRUCTURE

Leak detection vendor Jim Fay demonstrates the use of an acoustic monitor with a ground microphone to training attendees and instructor Dave Hughes. The small jet of water coming from the hydrant generates an audible leak noise.

Best practices for infrastructure management & maintenance

By Gary A. Naumick

Effective water and wastewater infrastructure management is increasingly important in a world where timely maintenance can save utilities valuable resources and money. The facts are as clear as the water we drink: U.S. water and wastewater infrastructure is in desperate need of repair. The price tag for the critical upkeep and replacement of infrastructure is high—estimated to be at least $1 trillion over the next 25 years. Equally compelling is a World Bank report showing that approximately 35% of the world's water supply is lost due to leaking pipes.

Managing water resources is complex, demanding constant vigilance to ensure water quality, as well as a long-term view for a sustainable water future. American Water has developed a comprehensive approach to integrated water resource management, which entails optimizing man-made assets and protecting the natural environment.

Comprehensive Planning Studies

In its long-term planning, American Water evaluates quality, quantity, growth needs and alternate sources of water supply, as well as transmission, distribution condition and capacity. Weather conditions can have a pronounced effect on supply sources. In order to ensure that the company has adequate sources of water, it prepares comprehensive planning studies (CPS) and maintains drought and contingency plans to minimize the potential impact on service through a wide range of weather fluctuations and other potential events such as power outage or equipment failure.

In connection with supply planning for most surface or groundwater sources, the company employs models to determine safe yields under different rainfall and drought conditions. Surface and groundwater levels are routinely monitored for all supplies, so that supply capacity may be predicted and mitigated as needed through demand management and additional supply development.

Through the CPS process, American Water regularly evaluates water systems to assess:

- Quantity and quality of available supplies;
- Adequacy and effectiveness of treatment processes and waste handling systems;
- Adequacy and efficiency of distribution pipeline networks and pumping facilities in delivering safe, adequate water while minimizing water losses; and
- Proper permit maintainenance to ensure legal authorization of withdrawal of supplies from both groundwater and surface water sources.

The goal is to maintain CPS and/or targeted studies for all water systems serving 500 or more customers.

Ongoing attention to the maintenance, repair and replacement of water infrastructure is necessary to ensure safe, clean water and efficient, sustainable water use. For example, water management through detection and repair of leaks contributes to reduced water losses (and thus, reduced energy use and cost). In areas where water resources are relatively scarce, reducing water losses can be a preferred solution to developing new sources of water.

Corrosion, fluctuating water temperatures, soil movement, vibrations and water pressure changes are just some of the factors contributing to water leakage. Not only do leaks account for lost water, but they also can allow contaminants into the system that can endanger public health. Recently, attention has been shifting to larger mains with the idea of applying some of the latest advances in condition assessment tools, as larger mains have the potential to cause more severe interruptions and damage if they fail.

Leak Detection

American Water performs leak detection surveys on an ongoing basis, tailored to the severity of leakage and the cost of water loss. Valves are regularly operated and hydrants are inspected, and both are examined through acoustical checks to locate leaks. All of its regulated state operations use acoustic leak correlators to pinpoint the location of leaks. Leaky pipes are prioritized for replacement as needed to improve system performance and efficiency.

For example, New Jersey American Water's experience with continuous acoustic monitoring leak detection over the past five years has been a success for water conservation. In 2006, New Jersey American Water began deploying and utilizing continuous acoustical monitoring (CAM) technology to assist in monitoring its distribution system for leakage. Over a period of approximately 18 months, the company deployed 4,867 monitors, including 3,564 radio-version monitors (requiring a drive-by collector unit) and 1,303 advanced metering infrastructure (AMI) monitors that return daily data. The company currently is utilizing CAM technology in six municipalities within the Essex Passaic Region in northern New Jersey. This region was selected for this technology because it met the following

criteria: potential for lower, non-revenue water; marginal cost of water production; age of its infrastructure; and abundance of areas where leaks do not surface immediately.

The CAM technology is installed on the customer service pipe inside the building next to the water meter or within the meter pit chamber located at the curb, with no disruption of service to the customer.

With the CAM system, data from the monitors can be gathered either daily, weekly or monthly, depending on the type of monitor installed. With AMI technology, the data is available daily and is gathered automatically from the AMI system and displayed for New Jersey American Water by the vendor through the Internet. With radio monitors, the data generally is gathered monthly during the monthly meter reading process, utilizing a data collector carried by the meter reader, although the data is still available and can be collected daily with additional driving if needed. Once the data is gathered, it is uploaded and analyzed through a website.

In six years, New Jersey American Water has repaired 247 leaks with an estimated flow of 3,040 gal per minute or 4,377,600 gal per day as a direct result of leak detection with the CAM system. More than 90% of the leaks that were located as a result of the CAM system were not surfacing and there was no obvious indication of a leak. Had these leaks gone undetected, they still could be running today, or they may have resulted in catastrophic failures potentially resulting in disruption to customers and high liabilities to the company. With the CAM system in place, New Jersey American Water is improving the location awareness of a leak and the reduced repair time. This reduction in leakage will have a positive impact on non-revenue water, potential liabilities and operating expenses, and also helps to reduce the company's carbon footprint.

Proactive Practices

To provide the most effective results, CAM technology needs to be part of a sustainable and comprehensive water loss management plan that includes continuous and accurate water audits, ongoing proactive leakage surveys and, most importantly, a well-equipped and a well-trained leak detection staff.

For example, several Pennsylvania American Water systems use CAM technology, including the Uniontown, Pa., system, which will be a testing site for two second-generation CAM devices. These devices may be even more effective in identifying leaks, especially on nonmetallic pipe. California American Water has more than 4,000 CAM units monitoring the Monterey water system to reduce water loss in a system where water resources are particularly scarce and expensive.

This aggressive move to automatic meter reading and the use of intelligent meters, transmitters and data management will provide additional safeguards for customers in spotting high water consumption, with more timely reading and alarms to alert the utility to potential wasted water use. Ultimately, American Water is looking to more intensive water use monitoring for its customers as the technology moves forward.

The amount of water lost in the U.S. can exceed more than 1 trillion gal per year. It is essential for water resources to be managed well—not only because of its increasingly scarce supply, but also because of its embedded energy and the greenhouse gas footprint it represents. Although in many parts of the country water might be considered the least expensive utility commodity, water loss is still very costly to customers and water utilities. WWD

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