

# Utility Looks for Leaks

Historic utility uses the latest technology to pinpoint problems.

Allentown, PA, has one of the oldest and most established water utilities in the United States. It was founded in 1820 by the Northampton Water Company and was purchased by the City of Allentown in 1869. Today, the Allentown Bureau of Water Resources serves 34,000 customers and provides high quality water services to 106,000 people (with an average daily demand of 20 mgd) within the city as well as most of Salisbury Township and portions of South Whitehall and Hanover (Lehigh County) townships. In addition, Whitehall Township Authority relies on Allentown during peak demand periods. The bureau is responsible for water treatment, water distribution, sewage collection, sewage treatment, and stormwater, and employs 22 water filtra-

tion employees and 48 water distribution employees.

This water system derives water from four main sources: the Little Lehigh Creek, the Lehigh River, Schantz Spring, and Crystal Spring. The bureau owns and operates a 30-mgd water treatment plant that includes coagulation/flocculation, lamella plate clarification, and dual media high-rate filtration for surface water. All sources are disinfected.

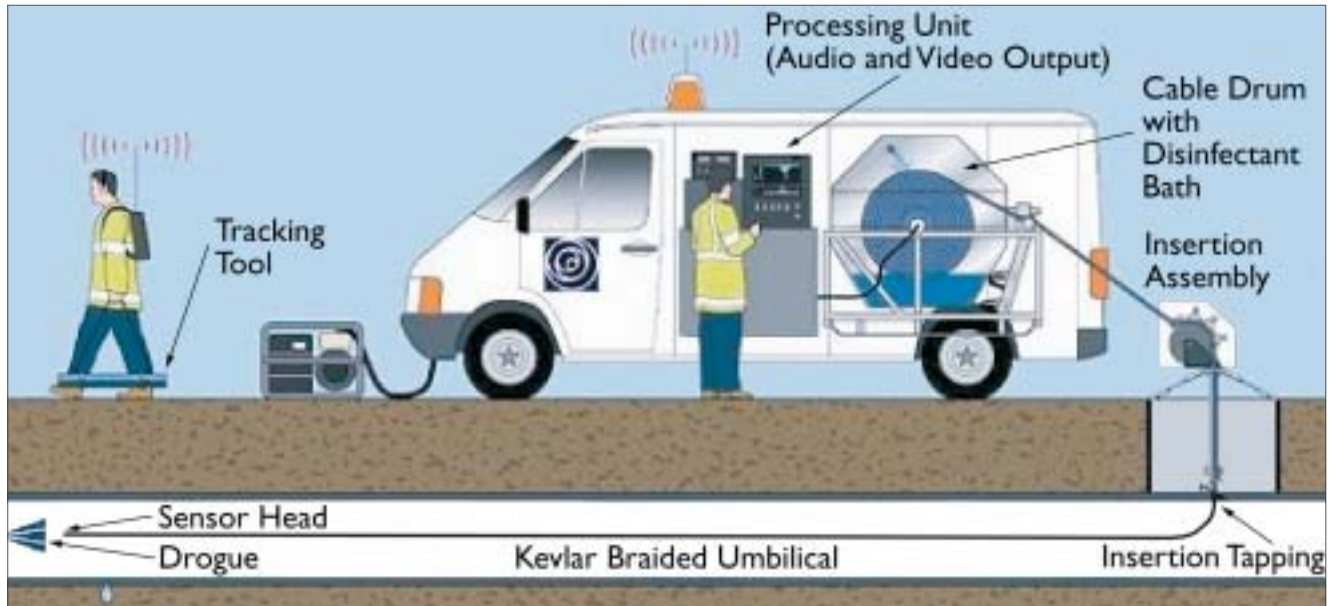
The treatment plant was upgraded from 1994 to 1997, when it went through a \$20-million modernization upgrade. Treatment facilities built in 1928 were converted into a water quality lab and administrative area. Treatment facilities built in 1958 were modernized with a completely new electrical system, computerized process con-

trol system, new flocculators, clarifiers, backwash equalization basins, and sludge thickeners. In addition, more instrumentation was installed for greater process control. In early 1995, the plant staff chose to set major quality standards at a level that is conservatively 50 percent more strict than the same federal and state regulatory requirements.

This goal requires thorough and efficient asset management in water distribution. That is why immediately after suspecting a leak in one of its pipelines, the bureau contracted with the Pressure Pipe Inspection Company (PPIC, [www.ppic.com](http://www.ppic.com)) in August 2005 to inspect the East Side Transmission Main using Sahara Leak Detection Technology. The inspection was conducted in eight different areas on pipeline constructed of 30- and 36-in.



*Sahara System set up on the East Side Transmission main in Allentown, PA.*



*The acoustic sensor element is permanently encapsulated in chloroprene rubber, which has been specially compounded to ensure acoustic impedance. The drogue chute, attached to the sensor at the end of the cable, ensures correct deployment of the equipment within the pipe by providing the force to pull the sensor through the pipe. The tethered umbilical cable is neutrally buoyant in water. The insertion mechanism accommodates the introduction of the system into a live under-pressure pipeline through a two-in. tap. The cable drum is a stainless steel framed, hydraulically operated, and completely encased spooling machine. Both audio and visual data are delivered to the operators.*

diameter steel. The overall inspected distance was 14,891 ft. Analysis of the data obtained during this inspection revealed the locations of ten leaks instead of the one expected.

The leaks have since been repaired. According to the bureau, these repairs have saved the city 500,000 to 600,000 gpd of water, or over 182 MG per year. At Allentown's 2006 consumer water prices, this is over \$487,000 worth of water per year. On top of these savings, the water department had internal savings of \$22,000 annually in chemicals and power used to treat water that would have been lost without the repairs.

While different pipe types have different failure modes, leakage is a common characteristic of pipe whose structural or mechanical integrity has been compromised. For large diameter cast iron pipe, for example, longitudinal breaks and bell shear lead to pinhole leaks, as does corrosion through pitting and casting flaws. Ductile iron can experience corrosion through holes. Corrosion through holes in large diameter steel pipelines can be detected as well as imperfections in welded joints.

The Sahara method can accurately pinpoint leaks in any type, size, or material of trunk main or aqueduct, includ-

ing those greater than 12-in. in diameter. Over 1,000 surveys have been conducted using the system, which can find the location of leaks as small as 0.25-gal/hr. While Sahara cannot be used to detect wall thinning, embrittlement, or pitting, it can be used to find holes or joint leakage.

The Sahara system detects leaks in a pipeline by sensing the noise generated by a leak. As the sensor head travels along the pipeline, sounds within the pipe are picked up by the hydrophone in the sensor head. The system feeds the signal from the sensor head through the cable into the cable drum, which passes through contactors in the slip ring to the interface processing equipment for interpretation by the software and the operator.

The operator is able to listen to the signal from the sensor and visually monitor the signal using specialized spectrogram software on a computer. The initial indication of a leak is when the operator hears the distinctive sound generated by the leak, which is then verified by the spectrogram. The sensor head is fitted with a tracking device so that when a leak is detected, the operator can position the sensor at the leak and a second operator can locate the position of the sensor head from above

ground using the system's PipeSpy 2000™ tracking device. The PipeSpy system consists of a low frequency transmitter held at the surface that emits a signal that the Sahara sensor in the pipe receives, indicating leak location through communication between the two operators. The depth of detection has been proven to over 30 ft. The combination of the detection system and the tracking device allows leaks to be detected and located accurately to within less than one ft at a distance of up to 1.2 miles from the insertion point.

At the conclusion of the inspection, a report is provided that includes:

- A spatially enabled ESRI (www.esri.com) GIS database. The leak location data contained in this database is accessible through a software application provided by PPIC at no charge.
- A listing of all identified leaks, identified by distance from the insertion point and GPS coordinates.
- The estimated magnitude of each leak.
- Distribution plots showing the location of the distressed pipe sections along the length of the inspected portion of the pipeline.

