

One Billion Gallon Water Challenge Update

STOPPING LEAKS WITH ACOUSTIC SENSOR NETWORKS



ISTC launched a One Billion Gallon Water Challenge in 2014 to promote water conservation measures by businesses, industries, communities, and the general public in Illinois.

ISTC has made a commitment to fund projects and conduct field-based research with industries, municipalities and universities that result in measurable and meaningful water savings. We are currently funding projects with the following partners: Carus Corporation, American Water, Loyola University, City of Urbana, Illinois Water Survey, and the Illinois Green Economy Network.

AMERICAN WATER AND ECHOLOGICS

ISTC has partnered with American Water and Echologics to validate the efficacy of an advanced leak detection technology based on acoustic monitoring within the Metropolitan Chicago area. This study is important on a number of fronts:

- 1) It promotes water conservation in an area of the state where the availability of water could become a future bottleneck to economic expansion due to restrictions placed on withdrawals of water from Lake Michigan;
- 2) It is located in a large population center of the state and surrounded by a number of municipal utilities that stand to benefit from the experiences and lessons learned from this field research;
- 3) It promotes emphasis on greater operational efficiency within private and public utilities; and
- 4) It is an example of a public-private partnership that seeks to deliver major societal benefits.

HOW ACOUSTIC MONITORING WORKS

Acoustic monitoring detects leaks by monitoring the sound signatures of water flow. The location of the leaks is determined by using multiple sensors and sophisticated signal analysis. The sensors themselves are relatively small and can

fit in within fire hydrants as shown in (Figure 1).

A wireless network of 79 sensors was installed in August 2014 in the city of Des Plaines' Waycinden Water District (Figure 2).

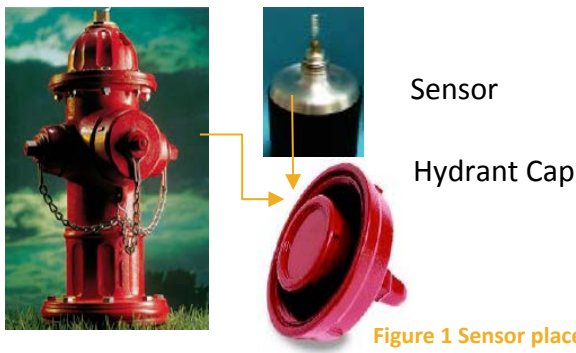


Figure 1 Sensor placement

CASE STUDY HIGHLIGHTS

Key statistics:

As of January 2015



\$12,000 cost avoided by early detection



3.25 Million non-revenue gallons avoided

About the Waycinden water district

Water in the city of Des Plaines' Waycinden district is purchased from an adjacent water utility that provides water from Lake Michigan. Stopping water loss is critical because this water is significantly more expensive than the cost of water production from a groundwater source for American Water.

Annual Water Use: 255 MM Gallons

Customers served: 750

% Non-revenue water: 20

Anticipated Savings: 20 MM Gallons

AMERICA'S WATER

- The American Society of Civil Engineers estimates that there are 240,000 water main breaks every year.
- American Water Works Association estimates water loss at 10 percent of production.¹
- Annual water loss amounts to \$2.8 billion per year.²



U.S. WATER INFRASTRUCTURE

History

- ✓ The U.S. treated-water system is comprised of 880,000 miles of piping. In 1796, private suppliers began delivering water to Boston residents via wooden pipes bound in steel.¹
- ✓ Cast iron was favored for water piping systems through the later 20th century.¹
- ✓ Cities and communities across the country are facing billions of dollars in repairs and updates to these aging distribution systems.



Today

- ✓ The American Society of Civil Engineers (ASCE) grades America's aging water infrastructure a D (poor/at risk).³ Illinois scored little better at C-.⁵
- ✓ Almost a quarter of Chicago's 4,400 miles of water mains are more than 100 years old.
- ✓ Without intervention to repair these aging pipes, more neighborhoods are going to experience major main breaks.⁴

Water Main Break Floods Streets In Little Village

April 22, 2014 9:00 AM



SENSOR NETWORK



Figure 2 Green dots are hubs located on tanks, red dots are relays, blue dots are sensors, and the yellow dot indicates a logger that didn't work and is being replaced.

KINCAID CT LEAK

In September, the acoustic monitoring successfully identified a leak that was draining into a storm sewer. Water from this leak was unlikely to surface. It could have taken more than six months for the break to grow large enough to be detected. With monitoring, the leak was identified and repaired within 12 days with minimal damage to surface features.



Figure 3 Digging trench for Kincaid Ct leak.

It is estimated that this leak would have lost approximately 3.25 million gallons of water over 90 days. The software identified the location of the leak within 20 ft. of the actual location allowing the digging of a very small trench (Figure 3). Early intervention helped avoid costly demolition and reconstruction of surrounding pavement that could have been necessary if the break had been allowed to grow.

MOVING FORWARD

The study will continue to collect data over the winter months and into summer of 2015. It will collect details on the number of leaks detected, avoided water loss, and avoided costs. While still early, the results to date suggest that taking advantage of advances in sensor technologies and signal analysis can provide substantial benefits to avoiding both water and economic loss.

For additional project details or on how you can participate in the One Billion Gallon Water Challenge contact:

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PROJECTS FUNDED IN CURRENT FY2015 RFP CYCLE

- Carus Corporation –Carus is working to recycle the non-contact cooling water that is utilized by their crystallizer vacuum system to displace the use of City water. Successful recycling of this non-contact cooling water would save 47 million gallons of city water annually.
- American Water – This project is using advanced continuous acoustic monitoring technology that will alert the utility to water leaks literally when they begin rather than when they surface. At the same time, the metering of the system supply will serve to both quantify leakage and determine the extent of non-revenue water losses.
- Loyola University – The University is piloting and evaluating a series of water conservation measures in its campus facilities including engaging students and employees with behavior-focused water conservation measures. Best practices learned will be shared with other Illinois colleges and universities.
- City of Urbana – The city is testing the implementation of a sensor-based irrigation system to reduce water use. If effective, will serve as a template for other communities.
- Illinois Water Survey – This project is evaluating the claims of a technology offered by the Water Conservation Technology International (WCTI) company that cooling towers can be efficiently operated with very little water loss under a specific operational regime.
- Illinois Green Economy Network – This project involves hosting a water audit webinar and several water audit training workshops at various college locations to identify opportunities for increasing the efficiency of water management on college campuses across Illinois, with special emphasis on community colleges.

References:

1 EPA. Office of Water. Distribution System Inventory, Integrity and Water Quality. 2007.

http://www.epa.gov/ogwdw/disinfection/tcr/pdfs/issuepaper_tcr_ds-inventory.pdf

2 Boston Water Commission. http://www.bwsc.org/ABOUT_BWSC/systems/water/Water_history.asp

3 American Society of Civil Engineers 2013 Report Card for America's Infrastructure. <http://www.infrastructurereportcard.org/a/#p/drinking-water/overview>

4 <http://chicago.cbslocal.com/2014/04/22/water-main-break-floods-streets-in-little-village/>

5 American Society of Civil Engineers, Illinois Section [2014 Report Card Update for Illinois' Infrastructure.](#)

istc.illinois.edu/water