NON-SURFACING LEAKS

THE KEY TO REDUCING REAL WATER LOSS IN WELL RUN UTILITIES

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BACKGROUND

The *2021 Infrastructure Report Card* published by the ACSE gives the United States drinking water system a grade of C-. One of the reasons for this grade is the ageing of the underground potable water distribution pipe mains. Much of this piping has reached the end of its design life and should be replaced. But, this is costly, and only about 1% of the 2.2 million miles of pipelines are replaced each year. In the March 2018 study, *Water Main Break Rates in the USA and Canada: A Comprehensive Study*, it is reported that between 2012 and 2018, overall water main break rates increased by 27%, from 11 to 14 breaks per 100 miles per year.

The water main break rate catalogs only surfacing events. Based on an analysis of over 400 leak detection projects performed in North America over the last five years, there are at least five times as many non-surfacing main leaks as surfacing leaks. In addition, there are twice as many service line leaks as there are main line leaks. These non-surfacing leaks contribute most to recalcitrant real water loss from water systems. These leaks can last for many months or years before they surface, sometimes with catastrophic results, as in the 2014 90-year-old 30-inch main break at UCLA that dumped 8 to 10 million gallons of water on the campus. Finding and fixing these non-surfacing leaks is a cost-effective way to prevent water main bursts and reduce real water losses in utility systems.

HISTORY

Seminole County, located in central Florida, has a population of 422,000 residents and manages a very well-run system exhibiting a non-revenue water (NRW) rate of 11.9%. This is well below the 16-20% average of systems in the United States (Figure 1). Notwithstanding the low NRW level, Seminole County is interested in lowering its overall real water loss. Seminole County exhibits several characteristics that make locating and pinpointing leaks using traditional methods difficult. First is its low NRW rate. Utilities with low NRW have fewer and smaller leaks than the average utility, making them harder to find. The pipe asset base in Seminole County is over 90% PVC. It is harder to acoustically pinpoint a leak on plastic pipe than on metal pipe due to the sound transmission properties of the material. Sound travels less far in plastic pipe and has a lower pitch and intensity making it more difficult to detect using handheld acoustic correlating devices. In addition, the groundwater levels are high in this area, decreasing the ability to detect an acoustic leak signal from a leaking pipe.

To identify the location of non-surfacing leaks so they can be pinpointed and repaired, a new technology called 'Recover' was developed by ASTERRA, formerly known as Utilis.

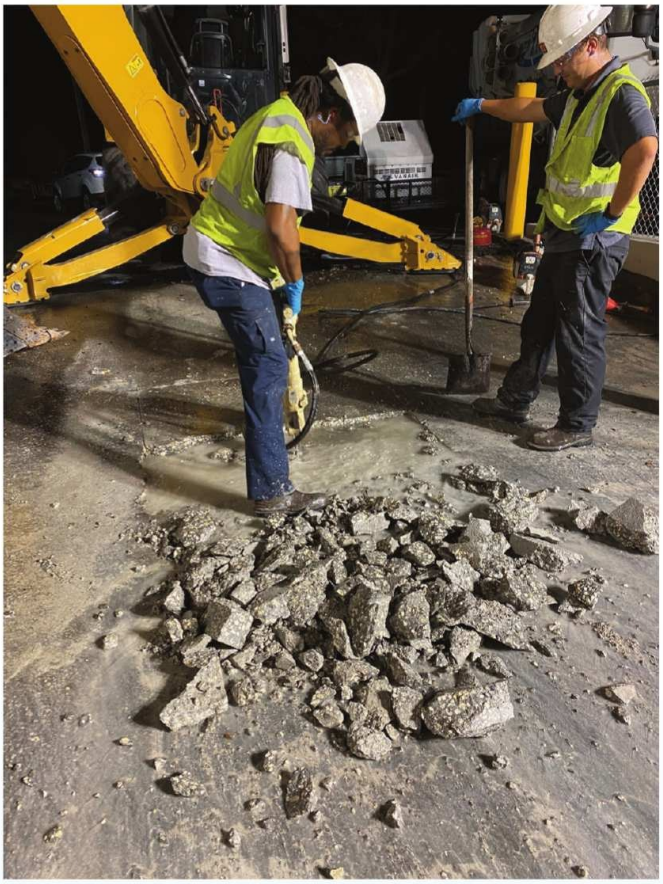
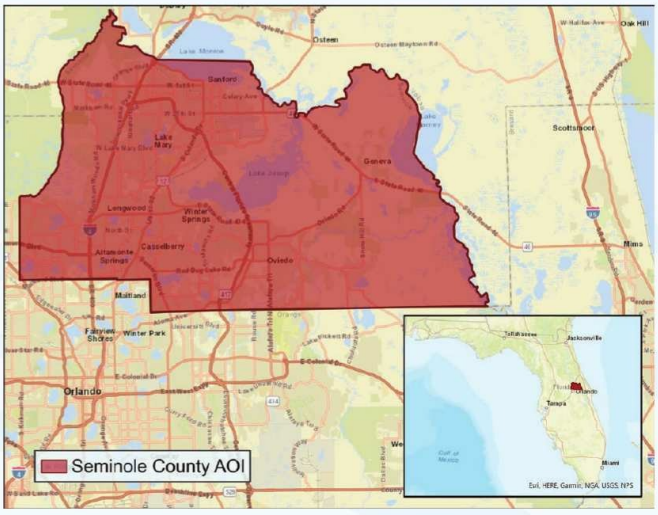


Figure 1



MORE THAN 98% OF THE LEAKS FOUND BY FIELD INSPECTIONS (200 OF 204) RESULTING IN REAL WATER LOSS ARE DUE TO LEAKS THAT HAVE NOT YET SURFACED.

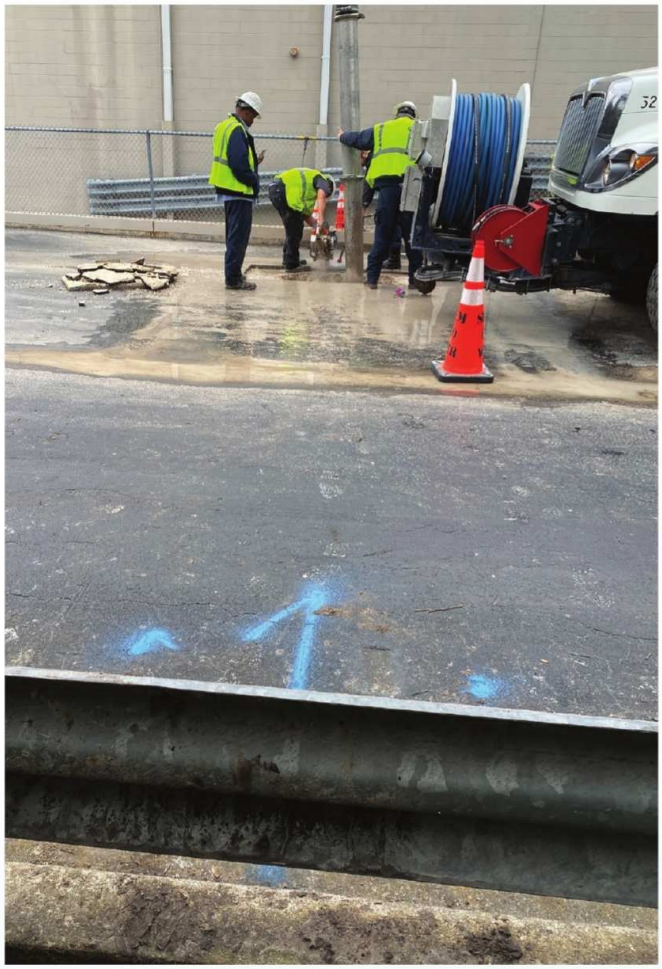


Table 1

REAL WATER LOSS IDENTIFIED BY LEAK TYPE – GPM			
Leak Type	Number	Flow Rate (GPM)	Total Flow (GPM)
Main Pipe	2	10.4	20.8
Service Pipe	20	6.9	138.0
Service Connection	6	6.9	41.4
Valve	6	6.9	41.4
Hydrant	6	3.5	21.0
Meter	1	0.4	0.4
Backflow Preventer	1	1.0	1.0
Curb Stop	1	0.7	0.7
	43		264.7

Recover utilizes specialized RADAR signals from satellites to illuminate an area of interest and subsequently collects the resulting reflected signals. These signals are analyzed to identify specific indicators of wet soil saturated with potable water. The result is a GIS-based map showing Likely Leaking Locations (LLL). These results typically encompass 5-10% of the entire system length, leading to lower time and resource costs for inspection compared to traditional walk-the-line random inspections.

The satellite leak pre-location program is very successful at identifying non-surfacing leaks. More than 70% of the utility side leaks that contribute to non-revenue water identified by Recover are non-surfacing leaks. It has been shown in the *Journal AWWA*, December 2021 article titled "Managing Non-Surfacing Leaks: The Key to Real Water Loss Reduction" that eliminating non-surfacing leaks directly affects NRW levels and can reverse an increasing trend.

RESULTS

A Recover satellite survey was performed for Seminole County in the winter of 2021, and the field inspection program was conducted in 2022. A total of 204 leaks were found in twenty-five crew days inspecting 52.2 miles of pipe. This equates to a performance metric of 8.2 leaks found per day and 3.9 leaks found per mile physically inspected. Of the 204 leaks found, 43 were on the utility side of the meter and thus are non-revenue water leaks; 161 were on the customer side of the meter. This is an exceedingly high percentage of leaks to be found on the customer side of the meter. It may be due to the relatively low non-revenue water percent in Seminole County and the fact that over 90% of the distribution pipe is PVC. The performance of the Recover service, focusing only on utility side leaks, is 1.7 leaks found per day and 0.82 leaks found per mile. This performance is better than the average achieved in other mostly PVC pipe systems, where 1.2 leaks were found per day, and 0.8 leaks were found per mile.

The breakdown of the 43 utility side leaks found by subtype is listed in Table 1, along with the AWWA Manual M36, Water Audits and Loss Control Programs estimated leak flow rates.

The table calculates the real water loss identified by the Recover satellite-directed field work using the utility side leaks and the leak flow rates. Real water losses found by this program are 0.381 million gallons per day or 139.1 million gallons per year.

CONCLUSION

This one Recover service reduced the non-revenue water levels by 56%, from 0.67 MGD to 0.29 MGD. This reduced the overall system NRW from 11.9% to 6.0%. More than 98% of the leaks found by field inspections (200 of 204) resulting in real water loss are due to leaks that have not yet surfaced.

The amortized cost of this new supply averages $890 per million gallons. This cost can be compared directly to the cost of water production, which is estimated to be $2,866 per million gallons. This marginal cost of the newly recovered water supply is an attractive investment as it is significantly lower than the marginal cost of production.

Even in a system where NRW is low, and the pipe asset base is primarily PVC, the ASTERRA Recover leak pre-location service can successfully and cost-effectively find non-surfacing leaks and reduce real water loss.