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Saving Water and Money Through Toilet Leak Detection

A LOS ANGELES CASE STUDY IN AFFORDABLE MULTIFAMILY HOUSING

Executive Summary

APRIL 2024

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SUGGESTED CITATION

Snyder, Cora, Sonali Abraham, Christine Curtis. 2024. “Saving Water and Money Through Toilet Leak Detection: A Los Angeles Case Study in Affordable Multifamily Housing” Oakland, Calif.: Pacific Institute.

ABOUT THE PACIFIC INSTITUTE

The Pacific Institute is a global water think tank that combines science-based thought leadership with active outreach and engagement to influence local, national, and international efforts in water sustainability and resilience. Our vision is to create a world in which society, the economy, and the environment have the water they need to thrive now and in the future. Since 1987, we have worked with diverse groups ranging from major corporations to frontline communities with a mission of creating and advancing solutions to the world's most pressing water challenges. Our work is routinely featured in national and global top-tier media, and we engage more than 270 partners, including NGOs, utilities, policymakers, businesses, and others. For more about the Pacific Institute, please visit pacinst.org.

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ACKNOWLEDGEMENTS

This research was supported by the Cummins Foundation and the Ecolab Foundation. We thank them for their generosity. Thank you to our reviewers for providing valuable input on the draft report: Nicholas Benz, Heather Cooley, Maureen Erbeznik, Liesel Hans, Sara Hoversten, Morgan Shimabuku, and Robert Wilkinson.

We acknowledge the partnership of the Pacific Institute's Strategic Communications and Outreach team to launch this work and ensure it reaches key audiences toward the goal of building a more water resilient world. We specifically acknowledge Amanda Bielawski, Sumbul Mashhadi, Tiffany Khoury, Robert Jensen, Dana Beigel, and Brendan McLaughlin.

All conclusions and recommendations expressed herein, and any errors or omissions, are those of the authors.

Executive Summary

This report discusses a cross-sector pilot project that deployed toilet leak detection technology in eight affordable multifamily properties in Los Angeles, California in 2023. Periodic droughts, and prolonged drying trends driven by climate change, are reducing the reliability of Los Angeles' water supplies. Water efficiency and conservation are key strategies to ensure water resilience in the face of these changes.

The pilot project relied on a unique collaboration between nonprofit organizations, a private technology company, and public water utilities, and leveraged water stewardship funding from Fortune 500 corporations. The ultimate goal of the project is to help accelerate private-public partnerships on water efficiency projects that support water affordability and water resilience for affordable multifamily housing.

The goal of this report is to explore the water savings and other impacts of a specific toilet leak detection technology, based on results from the pilot project. It covers the project background and overview, shares the pilot results, outlines lessons learned, and provides recommendations for scaling.

This executive summary provides a high-level overview of the report's key findings.

PROJECT OVERVIEW

Housing in Los Angeles includes many large multifamily properties, most of which are occupied by renters. Multifamily properties built before 2017 in California are typically master metered for water, meaning that the entire property has one meter and receives a single bill for all water used; it is not disaggregated by dwelling unit. This presents a challenge for understanding water use and reducing water waste in multifamily housing. The US Environmental Protection Agency estimates that every year, household leaks waste nearly 1 trillion gallons of water nationally (US Environmental Protection Agency, 2024). Leaky toilets are a leading source of indoor water waste, and toilet leaks in master-metered multifamily properties are notoriously hard to detect. Renters have little financial incentive to respond to non-damaging leaks and property managers have no easy way to identify leaks. The outcome is that water costs are folded into the residents' rent, and opportunities to save money and water go untapped.

This pilot project deployed leak detection sensors on 1,198 toilets across eight large multifamily properties in Los Angeles, all owned by the Housing Authority of the City of Los Angeles (HACLA) and located within the Los Angeles Department of Water and Power (LADWP) water service area (Figure ES 1). Table ES 1 provides a list of the properties, the cities they are located in, and the number of sensors installed. All properties serve qualified low-income residents.

FIGURE ES 1: Map of Pilot Properties

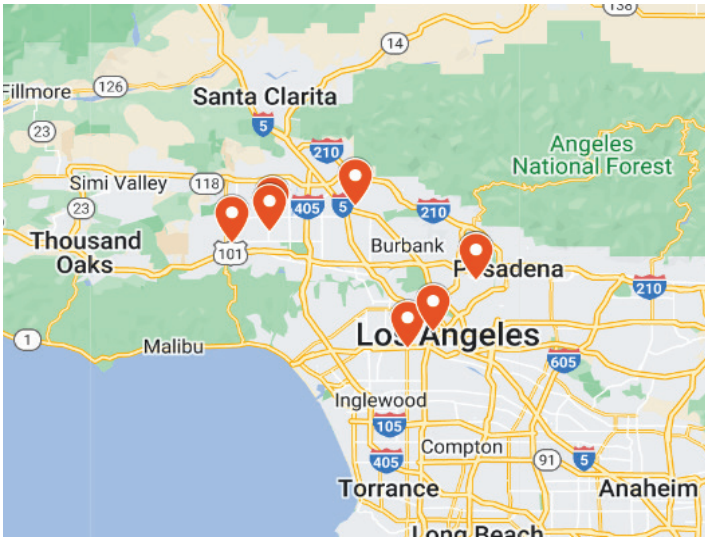


TABLE ES 1: List of Pilot Properties with Number of Sensors Installed

Property ID	City	Number of Sensors Installed
A	Eagle Rock	82
B	Sun Valley	199
C	Los Angeles	211
D	Reseda	73
E	Reseda	42
F	Woodland Hills	287
G	Los Angeles	202
H	Eagle Rock	102
Total sensors installed		**1,198**

The technology used in this project was provided by Sensor Industries. In March 2023, Sensor Industries equipped every toilet in the eight properties with sensors. The sensors are connected to an online dashboard that allows for real-time leak monitoring and alerts. Staff at each property were trained on how to use the online dashboard and alert system for identifying, tracking, and fixing leaks.

This project was made possible due to unique multi-sector partnerships. The Pacific Institute, Bonneville Environmental Foundation (BEF), Sensor Industries, and HACLA comprised the core project team. Seven Fortune 500 corporations provided funding for this project as part of their commitments to corporate water stewardship. BEF facilitated the corporate funding. Many of the corporations are members of the California Water Action Collaborative (CWAC), a network of nonprofits and corporations who work together to address water challenges in the state. Additional partners, including the Los Angeles Better Buildings Challenge (LABBC) and the Metropolitan Water District of Southern California (MWD), helped guide and advance the project along the way. Both MWD and LADWP also provided rebates to co-fund the installations.

PROJECT RESULTS

A multifaceted assessment of the project's impact was performed for this report, drawing on a broad array of quantitative and qualitative data sources.

Two data sources were used to assess changes to toilet leaks, water use, and costs: the sensor dashboard and property water and wastewater bills. The sensor dashboard provided data for each property on toilet water use and leak alerts generated and addressed, starting after sensor installation. Bill data from LADWP were used to assess changes in water and wastewater use and associated cost savings, with May–November 2023 as the pilot period and May–November 2022 as the baseline period. Water bill-related data errors required exclusion of four properties from the water and cost savings analysis. For the remaining four properties included in the analysis, the project team assumed (1) billed water use represents indoor water use, and (2) changes in billed water use can be approximately attributed to the toilet leak detection technology.

Table ES 2 below highlights the key findings about toilet leaks and water and cost savings. The full results are summarized below.

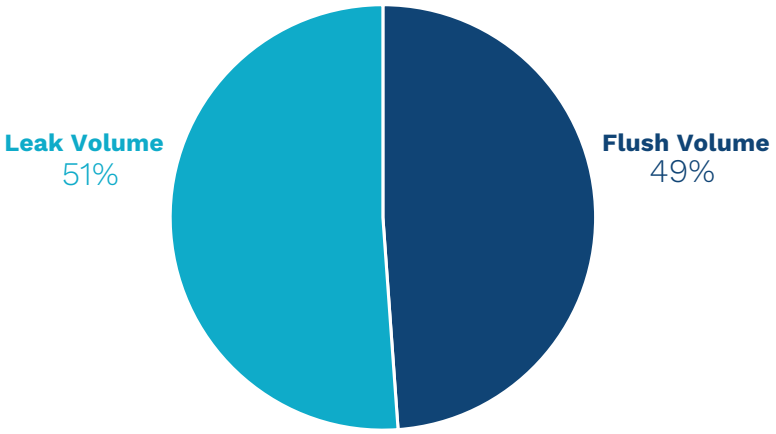
TABLE ES 2: Summary of Key Findings on Toilet Leaks, Water Savings, and Cost Savings

Number of sensors installed	1,198
Cost per sensor	$292
Project lifetime	7 years
Toilet Leaks (based on sensor dashboard data for all eight pilot properties)	
Total number of toilet leaks detected during seven-month monitoring period	483
Percent of toilet water use lost to leaks during seven-month monitoring period	51%
Average volume of water lost per leak event	8,284 gallons
Water and Cost Savings (based on water bill data for four pilot properties)	
Average percent water use reduction	11%
Estimated annual water savings per sensor	3,469 gallons
Average percent reduction in water and wastewater bill costs	12%
Estimated annual water and wastewater bill savings per sensor	$81
Net present value per sensor	$150
Payback period	3 years, 8 months

Toilet Leaks

Between May and November 2023, the sensors measured almost 9.5 million gallons of water used by the 1,198 toilets across the eight HACLA properties. Of the total toilet water use, 49% (4.7 million gallons) was due to flushes and 51% (4.8 million gallons) was lost to leaks (Figure ES 2). This indicates that, while some leaks were fixed and water savings were realized during the monitoring period, there are significant additional water savings opportunities available by fixing toilet leaks at these properties. It also highlights the high water savings potential in other multifamily properties that are not yet equipped with toilet leak detection systems.

FIGURE ES 2: Toilet Water Use Across Eight HACLA Buildings After Sensor Installation, May–November 2023

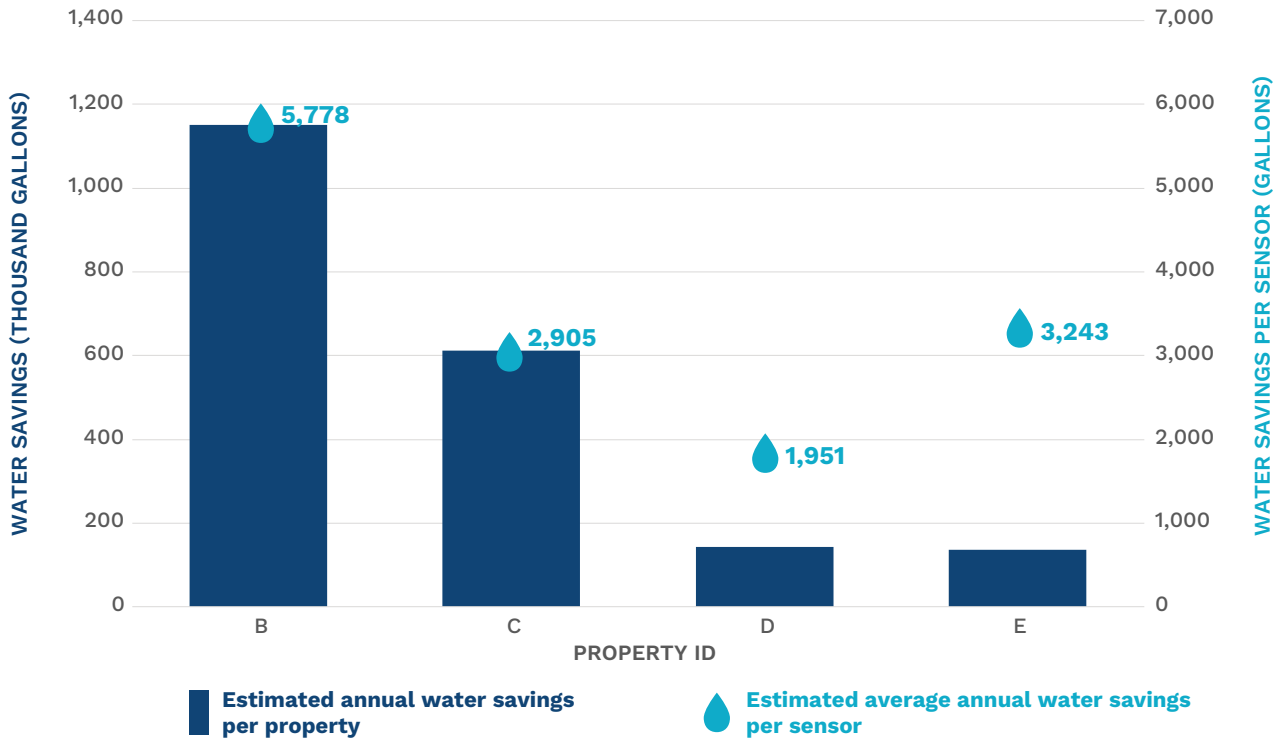


Over the monitoring period, there were a total of 483 leak alerts across the eight properties. On average each leak resulted in 8,284 gallons of water loss before it was stopped, and it took an average of 10 days for the leak alert to close.

Changes in Water Use

Changes in water use were analyzed using water bill data for Properties B, C, D, and E (Figure ES 3).[1] On average, the toilet leak detection system resulted in an 11% reduction in property water use. Annually, we estimate that 2.04 million gallons, or 6.2 acre-feet, of water will be saved across the four properties evaluated, translating to an average of 3,469 gallons (0.01 acre-feet) saved per sensor per year.

FIGURE ES 3: Estimated Annual Average Water Savings per Property and per Sensor After Installation of Toilet Leak Sensors

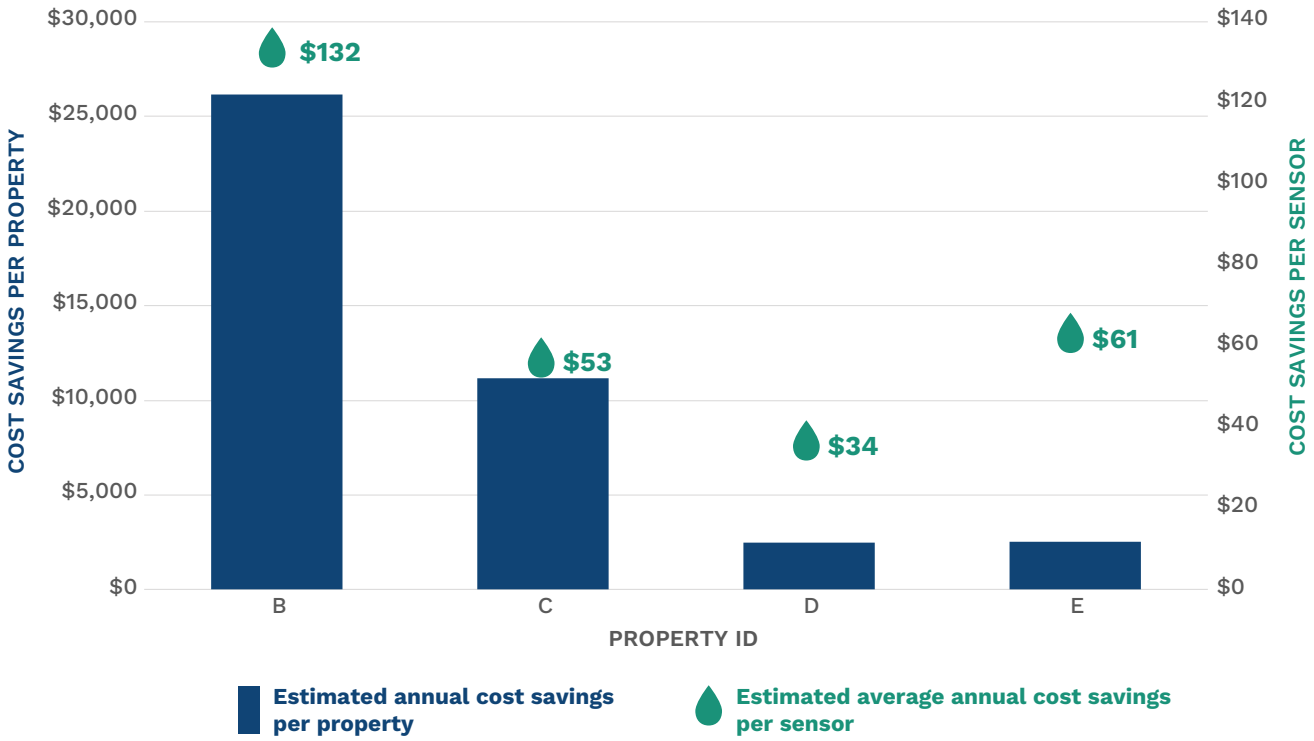


1 Four properties were removed from the water and cost savings analysis due to water bill data errors.

Changes in Water and Wastewater Costs

During the monitoring period, HACLA realized an average 12% reduction in water and wastewater costs across the four properties, equivalent to an estimated annual cost savings of $42,380 or $81 per sensor per year. Estimated annual savings per property range between $2,500 and $26,000 total, and between $34 and $132 per sensor (Figure ES 4).

FIGURE ES 4: Estimated Annual Average Cost Savings per Property and per Sensor After Installation of Toilet Leak Sensors



Stakeholder Perspectives

The qualitative analysis that informed the stakeholder perspectives results included eight semi-structured video conference interviews with 11 project partners, eight structured videoconference interviews with property managers and maintenance workers (one for each property), and 100 in-person surveys with residents from three of the properties. The stakeholder perspectives results are based primarily on a thematic analysis done on the transcripts of semi-structured interviews with project partners. In the interviews, we asked questions about the following four topics: what drove interest in participating in the project, barriers to and enablers of project implementation, the benefits associated with advancing water efficiency in affordable housing, and how this project might be scaled.

Across the interviews, it was evident that project partners shared a mission to innovate in water conservation. Each stakeholder brought their unique perspective, yet all were united by a common goal: to make a meaningful contribution to addressing California's water challenges. The general sentiment from the interviews centered around the power of partnership and innovation in driving sustainable change. The project's strong partnership model and financial support helped overcome traditional limitations associated with improving water efficiency in affordable multifamily housing.

Project partners identified various challenges, primarily centering on the variable effectiveness of the technology depending on the existing building infrastructure and property staff responsiveness. Despite the challenges, the project partners emphasized that the project has had numerous benefits beyond water conservation, including financial savings and social impacts. They expressed a desire for wider implementation through sustainable financial models and integration into incentive programs.

LESSONS LEARNED

We drew four lessons learned from the pilot project and offer recommendations for future projects based on these learnings.

1	**Lesson:** Direct and consistent engagement with onsite property management staff is essential to maximize long-term water savings. **Recommendation:** Implement a structured, ongoing engagement strategy for property staff to ensure consistent, effective use of the technology.
2	**Lesson:** Data limitations associated with master-metered multifamily properties make pilot project evaluation challenging. **Recommendation:** Include a baseline data period with leak sensors installed without generating leak alerts, allowing for more precise measurement of water savings.
3	**Lesson:** Corporate water stewardship investments can catalyze innovative solutions through collaborative projects. These projects greatly benefit from facilitation by a third-party organization. **Recommendation:** Corporate water stewardship co-funding should be explored by organizations seeking funds for projects with measurable water benefits.
4	**Lesson:** Residents in multifamily housing lack opportunities to inform, engage in, and benefit from water projects. **Recommendation:** Involve residents proactively and systematically in the project, including offering education and participation opportunities, and explore ways to ensure that residents share in the project benefits.

RECOMMENDATIONS FOR SCALING

We explored how water efficiency solutions—including toilet leak detection—could be expanded in multifamily housing and provided two recommendations for scaling, with specific strategies and examples supporting each.

1. Expand existing water and energy conservation incentive programs

- Incorporate water into energy efficiency programs for multifamily housing
- Incorporate solutions for multifamily properties into water conservation incentive programs
- Incorporate performance-based incentives into water conservation incentive programs

2. Develop innovative financing solutions

- Offer on-bill financing for water efficiency projects
- Set up revolving funds to a sustainable source of capital for water efficiency projects

As water scarcity worsens and water costs rise in Southern California, and many other places around the United States and globally, it is critical to invest in and explore innovative opportunities to reduce water waste and improve water resilience. Moving forward, we see significant opportunities to expand implementation of this solution and leverage the partnerships built through this pilot project to invest in additional water-saving solutions in Los Angeles and beyond.

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