City of Vacaville, California

Real-Time Sewer Monitoring & Data Help Overcome Challenges Managing Aging Sewer System

Case Study

Overview

The City of Vacaville sewer collection system is maintained by the Vacaville Utilities Department (VUD). Vacaville's service area also includes the Town of Elmira. The collection system includes 284 miles of gravity sewer pipes, 2 miles of force mains, 8 lift stations, 5,859 manholes, and the Easterly Wastewater Treatment Plant that handles nearly 8 million gallons (MGD) a day before it is discharged into the Old Alamo Creek. The treatment plant operates under a National Pollutant Discharge Elimination System (NPDES) permit. VUD also has 41,686 sewer connections and serves a combined population of more than 102,000.

The Challenge

VUD faced persistent challenges managing its aging sewer and stormwater infrastructures. Frequent surcharges led to sanitary sewer overflows (SSO) that posed environmental risks and resulted in hefty regulatory fines. The city's capital improvement plan (CIP) efforts were sometimes hindered by unreliable data on system performance and maintenance needs. Additionally, elevated levels of Hydrogen Sulfide (H2S) gas emanated from the lift stations, increasing the potential for corrosion within the system's reinforced concrete pipes. The H2S gas triggered complaints from residents about the smell and internal concerns about high concentrations of H2S at the wastewater plant.

Things came to a head during several 2017 storms that dropped about 17 inches of rain on the Vacaville area between January 7 and February 22. A sewershed flooded, causing a Category 1 overflow into local waterways. To clean up the spill required 50 tanker trucks with pumping capability, which cost the City of Vacaville $25,000 in unplanned emergency funds.

The Solution

To address the recurring issues and avoid the kind of overflows that happened in 2017, VUD installed satellite-based remote sewer-monitoring technology to have 24/7 real-time visibility into the sewer collection and stormwater systems. Initially two SmartLevel™ ultra-sonic monitors were mounted underneath existing manhole covers without confined space entry and integrated with the Iridium Satellite Network to provide comprehensive remote monitoring and data collection.

Once VUD's wastewater staff was assured the technology would elevate operations, 20 additional SmartLevel™ monitors were deployed across critical points in the systems. Then, VUD added other SmartCover solutions to further optimize system performance. Three H2Scents™ sensors were introduced to measure H2S gas levels over extended periods of time and SmartRain™ software was added to integrate rain data using the Doppler radar and local rain gauges to provide comprehensive reports to better understand how rain affects the entire sewer system.

Highlights

- Prevented SSOs and reduced fines with real-time alarms
- Utilized data to identify high-risk locations to monitor more closely
- H2S sensors improved odor and corrosion control methods
- Improved community relations
- Able to make informed decisions; realize cost savings

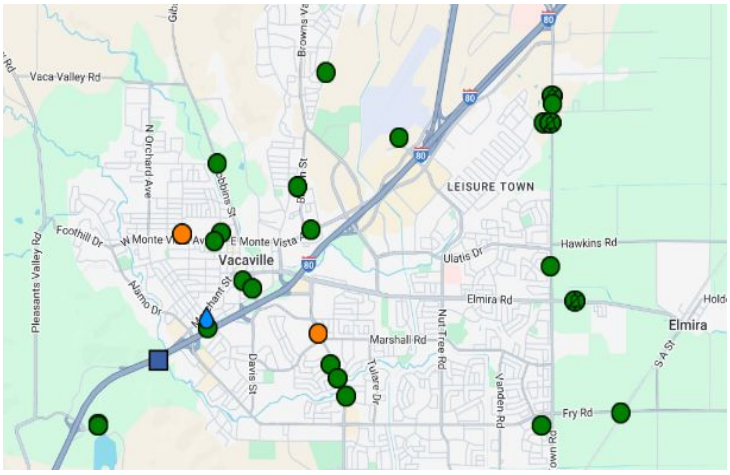

Figure 1: Vacaville's Network of Smart Sewer Monitors

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The Results

The integration of sewer-monitoring technology into Vacaville's collection system has led to significant improvements in system reliability and operations efficiency. The monitors enable proactive maintenance and timely interventions when issues arise. The monitors also are mobile and can be easily moved around as needed to assess various potential risk areas. The uninterrupted real-time data is transmitted to a dashboard on a secure website and sounds alarms and alerts to operations staff through mobile communications devices, using a mobile application. During surcharges alarms occur and monitors still have full dynamic range of the manholes.

The city achieved a notable reduction in SSOs, from 24 in 2017 to 10 events in 2023. From January through July 2024, VUD experienced 4 SSO events. The technology also improved VUD's regulatory compliance, enhanced the effectiveness of its CIP efforts, and created a safer working environment, all while protecting the environment and improving service.

Using real-time sewer monitoring devices has enabled VUD to identify system deficiencies, such as areas with insufficient capacity that could potentially overflow, sections that require expansion to handle increased flow; low points that can lead to backups or blockages. They also can collect data using H2Scent to optimize Ferric Chloride dosing for H2S and to address odor-related complaints.

With early warnings and the ability to collect data about level and flow, rain affects and H2S volume, VUD has been able to strategically leverage insights. The data has been used for stakeholder engagement and internal communications and planning, including to demonstrate the value of monitoring and gain buy-in for adding 3 more monitors in 2025 upstream of the Easterly Wastewater Treatment Plant to assist with plant shutdowns and ongoing maintenance. The data helped establish a process to ensure effective preventive maintenance with cross-departmental efforts. Data informed the use of siphon monitoring in residential subdivisions to identify and prevent overflows and to provide a secondary containment process to allow enough time for crews to respond to backups.

High School TikTok Toilet Paper Challenge

Several system backups near Will C. Wood High School in 2023 led to the discovery of students participating in a TikTok Toilet Paper Challenge in which they flushed excessive amounts of toilet paper, creating blockages. VUD used data-based monitoring reports to explain the severity of students' actions to school officials and worked with the school's maintenance staff to address the issue. The school warned the students and began purchasing perforated toilet paper to lessen the impact. Perforations break the toilet paper into smaller, more manageable sheets, which dissolve faster and are less likely to clog pipes.

Figure 2: Disruptive Result of TikTok Challenge

Conclusion

VUD gained the real-time sewer monitoring it needed for visibility into its sewer collection and stormwater systems and the data analytics for trending and comparisons for informed decisions about daily operations and capital improvement planning. The H2S sensors improved odor and corrosion control, enabling precise chemical dosing to reduce costs and extend the life of its sewer assets. VUD has saved time and money using real-time sewer-monitoring technology by reducing SSOs, improving response times and optimizing cleaning schedules. The department also has improved community relations and reduced fines by better protecting the environment.