City of Aurora, Colorado, United States

UTILITY JUSTIFIES AN INCREASE IN THEIR CAPITAL SPENDING BUDGET WITH ADVANCED RISK ANALYSIS

Aurora is Colorado's third largest city. Located in a semi-arid climate without a major water source nearby, the city must find innovative ways to manage their water supplies and infrastructure. Aurora Water operates about 1,500 miles of distribution and transmission mains that deliver clean drinking water to the city's 385,000 residents and hundreds of businesses.

Recognizing the challenges posed by aging infrastructure, Aurora Water undertook a comprehensive risk assessment of their pipeline network in 2022. The assessment helped the utility estimate the level of investment needed to meet customer service goals. The assessment also served as the foundation for a system-wide strategic plan targeting the most vulnerable pipes across their network.

Challenge

Over approximately five years, Aurora Water observed a notable increase in water main breaks. With limited resources to renew aging infrastructure, the utility's pipeline replacement program was struggling to keep pace.

The consequences of main breaks extend beyond utility operations, affecting customer level of service and the broader community. Even so, it can be difficult for utilities to secure funding and community support for investments in water infrastructure. Aurora Water needed a defensible plan to persuade the City Council to increase their capital budget for pipeline replacement.

In the past, pipeline replacement decisions were often based on limited information, such as pipe material, age, and historic failure data. Aurora Water sought to identify high-risk areas more effectively by integrating a wide range of system information. The resulting model needed to be easily interpreted by the City Council to support informed budgeting decisions.

Solution

Aurora Water partnered with Xylem to develop a comprehensive risk assessment of its active water distribution and transmission system. The assessment included three key components: a machine learning

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PROGRAM HIGHLIGHTS

- Performed a risk assessment of Aurora Water's water distribution and transmission system
- Provided data-driven recommendations for capital planning
- Findings supported Aurora Water's decision to increase their capital improvement budget for pipe repair and rehabilitation from $5 million to $28 million

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SERVICES PROVIDED

- Probability of failure analysis
- Consequence of failure analysis
- Valve criticality analysis
- Long-term budget estimation

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probability of failure model, a quantified consequence of failure analysis, and a valve criticality analysis.

The probability of failure model is designed to accurately predict which pipe segments are most likely to fail in the future. The model combined 16 years of historical break records with surrounding environmental factors, hydraulic data, and pipe features. Xylem established clusters of contiguous high-risk pipes based on location to support targeted capital planning. Clustering enables Aurora Water to efficiently prioritize and address at-risk pipes within a broad area to reduce mobilization costs and minimize community disruptions.

Assessing the consequence of failure provides another layer of risk that helps utilities prioritize their investments. For this study, Xylem quantified the direct costs associated with replacing failed pipes and revenue losses stemming from treated water outages.

Utilities can mitigate the consequences of a failure by regularly maintaining their valves. Operable isolation valves enable utilities to confine outages to a smaller part of their system and minimize impacts on customer service.

As part of its risk assessment, Xylem identified and prioritized Aurora Water's approximately 21,000 active isolation valves. The valve criticality analysis accounted for maximum flows, total number of water meters, and critical customers affected by each valve in the event of a shutdown. With this valuable information, Aurora Water can enhance its valve assessment and exercising program – ensuring the right valves are operable to minimize the consequences of potential failures.

Outcome

Aurora Water now has comprehensive data on probability and consequence of failure for every pipe in their network. This data establishes a solid foundation for identifying and prioritizing pipes in need of immediate action. The risk assessment – along with a high-level estimate of budget requirements – informed the utility's strategic plans and provided a robust decision-making framework for proactive pipeline management.

Based on the risk assessment results, Aurora Water has recommended the replacement of nearly 11 miles of pipe with the highest probability of failure to prevent potential water main breaks over the next 1 to 3 years. Equipped with data-driven recommendations, the utility justified an increase in their three-year capital improvement budget from $5 million to $28 million.

By systematically assessing risk, Aurora Water has gained a better understanding of the level of investment needed to maintain their aging infrastructure. Additionally, this knowledge has enabled the utility to target vulnerable assets and allocate limited funds for maximum efficiency.

Xylem mapped risk assessment results over the utility's distribution and transmission network.

"Identifying and proactively replacing high-risk distribution mains prevents us from spending valuable time and money on emergency repairs. This risk assessment helped Aurora Water justify an increase in capital improvement funding, enabling us to reduce water main breaks and boost our service levels in the most cost-effective way possible."

Shiva Sapkota
Engineer, City of Aurora