Uncovering Hidden Value in Pipe Risk Prioritization and Replacement Optimization

DSaaS™
DATA SCIENCE-AS-A-SERVICE

Golden State
Water Company
A Subsidiary of American States Water Company

CLIENT

Golden State Water Company

LOCATION

Rancho Cordova, CA

> *"We're very happy with Trinnex's DSaaS solution. It's even more data-driven than our previous approach and gives us confidence in our decisions. The optimization often uncovers strong candidate pipes – or combinations – we had not previously prioritized, adding real value to our pipe replacement planning process."*
>
> *Mark Insco*
> *Engineering Planning Manager, GWSC*

Background

Golden State Water Company (Golden State Water) is an investor-owned regulated utility operating 41 water systems, serving over 1 million customers across 81 communities in California, and managing approximately 2,900 miles of water main. The utility has relied for many years on their in-house engineering planning staff to develop pipe replacement projects using components such as GIS, break and leak history, hydraulic and statistical models, and risk analysis.
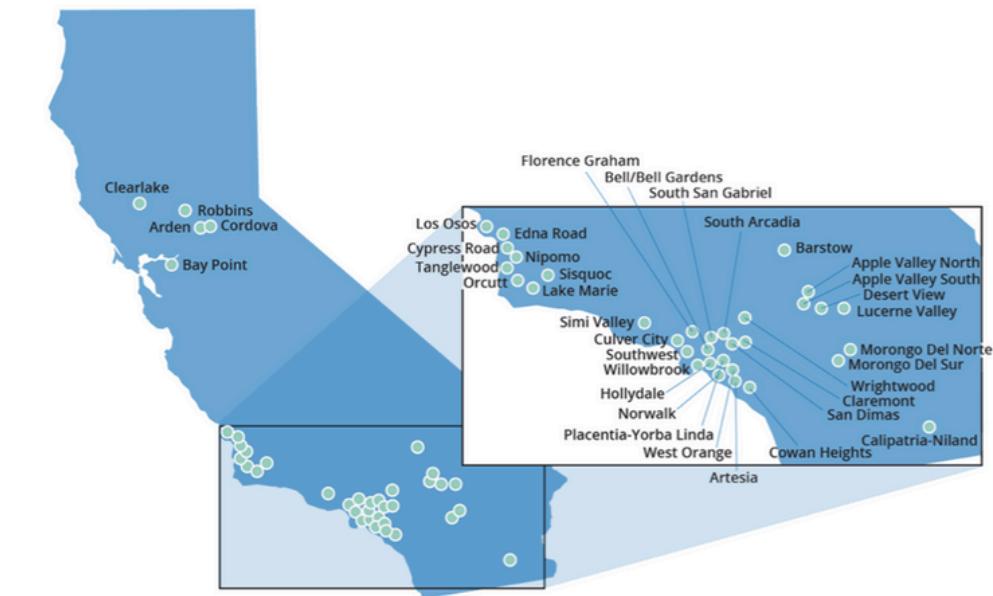
The Challenge

Golden State Water was challenged with a time-consuming process for creating pipe replacement construction packages. The output from the "traditional" risk model required a complex manual review process for grouping and prioritization. Their continuous pursuit of best practices led to a desire for an even more streamlined, data-driven methodology for identifying high-risk pipe segments for replacement – one that strikes the best balance among multiple competing objectives. The new solution needed to ensure that the most efficient replacement projects are selected for each community to ensure premium water quality and reliability.

Solution

Golden State Water decided to implement an enhanced pipe risk model and a multi-objective optimization approach to balance crucial factors like risk reduction, cost, and community impact. The team partnered with Trinnex to develop a data-driven, defensible approach to pipeline replacement planning.

Trinnex provided digital consulting services as well as **Data Science-as-a-Service (DSaaS)** for this project, including developing a risk prioritization model and an optimized project packaging tool. The tool uses advanced analytics to help water utility managers convert multiple existing risk assessments to streamlined, compact, construction-ready projects.

- **GIS-based Risk Modeling:** Trinnex updated the risk approach to a more robust model that analyzes the Likelihood of Failure (LoF) using factors like age, material, and break history, and the Consequence of Failure (CoF) based on parameters such as pipe diameter and flow rates.

- **Spatial Grouping/Clustering:** A spatial clustering algorithm was applied to high-risk pipes to group them into clusters, considering criteria like size differential, connectivity, compactness, and total length.

- **Multi-Objective Optimization (MOO):** This automated, algorithm-based search combines clusters to find the optimal solution to multiple project objectives, allowing Golden State Water to customize the solution by establishing benefits (e.g., replace pipes that have high LoF/CoF scores to reduce main breaks) and penalties (e.g., construction impacts such as traffic and community distruption).
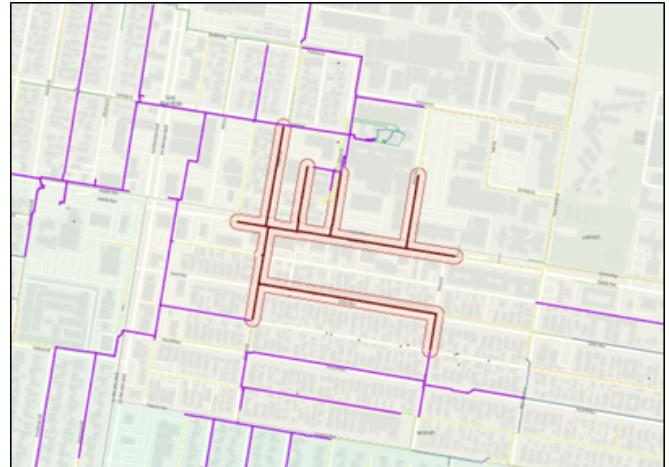
Results and Outcomes

Trinnex delivered a repeatable and defensible process for selecting replacement packages to ensure that utility goals, including budget and customer community needs, are met.

- The key deliverables included the comprehensive risk model and GIS layers, as well as ranked pipe replacement clusters.
- The solution revealed new ways of considering replacements and increased construction efficiency (buildability).

Future Steps

- Provide comprehensive training and a final report, equipping staff to independently manage and adapt the prioritization framework moving forward.
- Enhance data with additional inputs for future analyses to help reveal patterns of pipe failures.
- Explore potential technology integration with work management and metering systems.

Key Takeaways

- **Automated Efficiency:** Automation of the methodology transformed a difficult and time-consuming manual review process into a repeatable, optimized framework.
- **Data-Driven Defensibility:** The process provides built-in justification for construction package selection, producing defensible results that meet regulatory requirements.
- **Multi-Dimensional Insight:** Optimization enables utilities to strike the best balance among numerous competing objectives, and execute the best possible plan to achieve the best possible outcomes.
- **Anticipating Future Needs**: The project included detailed reviews that enhanced the quality and completeness of the data, expanding its usability for future predictive analytics to help forecast pipe failures and guide replacement planning.

About DSaaS — DATA SCIENCE-AS-A-SERVICE
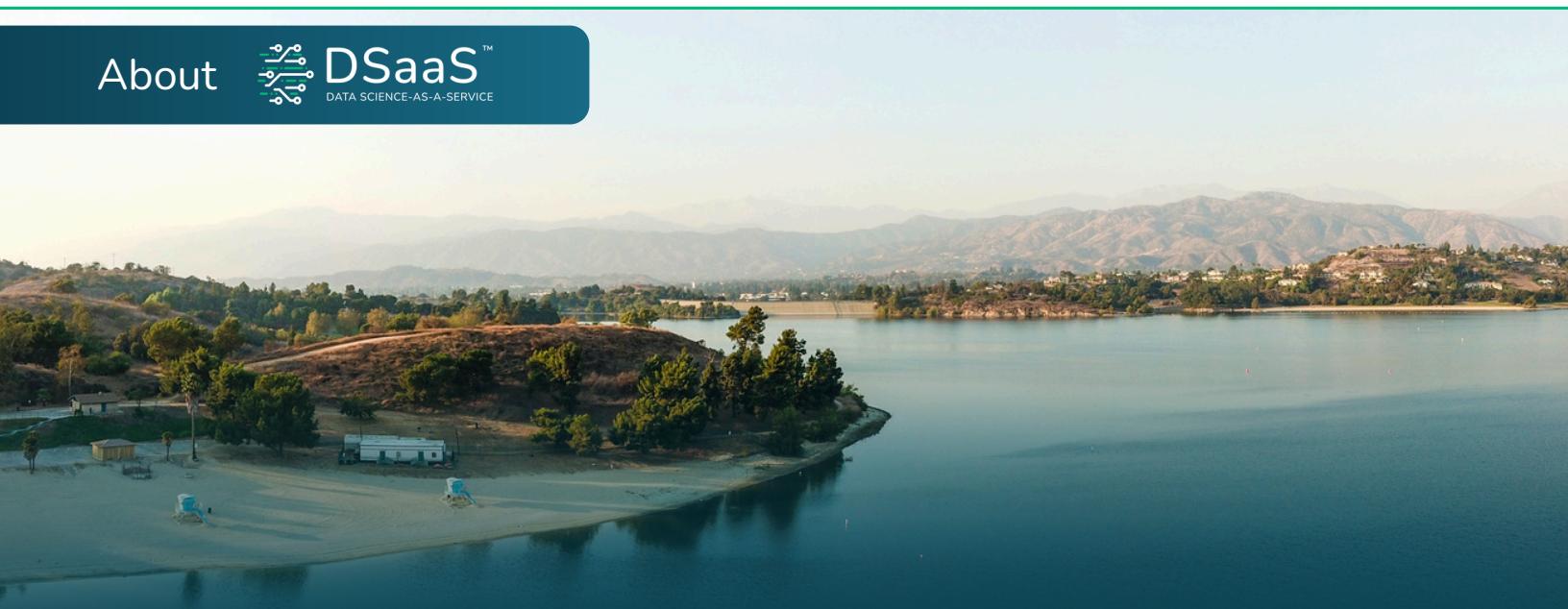
Trinnex DSaaS offers a range of customized solutions using the latest techniques in data analysis, artificial intelligence, and machine learning to meet the unique needs of each utility and improve operations, efficiency and decision-making.