WATER UTILITY CLIMATE ALLIANCE
ENGINEERING CASE STUDIES

SEATTLE PUBLIC UTILITIES & KING COUNTY

SHIP CANAL WATER QUALITY PROJECT

Seattle, Washington

PREPARING FOR EXTREME RAINFALL

Seattle Public Utilities' (SPU's) Ship Canal Water Quality Project was motivated by projected increases in extreme rainfall and growing demands on Seattle's stormwater and sewer infrastructure. This project includes construction of a 2.7-mile long tunnel to manage sewage and polluted stormwater overflows (combined sewer overflows or "CSOs"). The tunnel size was increased from the original design to account for future climate change-driven extreme precipitation events. The project will be operational in 2025 and will prevent an average of 95 million gallons of stormwater and sewage from entering Seattle's waterways each year.

CLIMATE CHANGE CHALLENGES

Overflows into Seattle's waterways are already occurring under current storm events, and local residents experience back-ups of sewage into their homes. Also, the capacity of King County's West Point wastewater treatment plants is already taxed during storms. SPU and King County recognized that future heavy storms, expected to be more intense with climate change, would only exacerbate these existing issues. As a result, the Ship Canal Water Quality Project storage tunnel size was increased in diameter from its original design of 14-feet to over 18-feet to capture more stormwater and runoff.

CLIMATE-READY DESIGN

Before deciding on a tunnel for the Ship Canal Water Quality Project, different stormwater management strategies were explored including green infrastructure and local detention facilities. SPU and King County decided on a storage tunnel because costs were similar, it would be less impact to nearby communities, and it would provide greater operational flexibility. The original 14-foot diameter design had sufficient capacity to cope with historical rainfall. However, given performance issues with other CSO reduction infrastructure as a result of increased rainfall in recent years, SPU updated its precipitation scaling factors. This resulted in upsizing the tunnel to over 18-feet in diameter. The larger diameter design will increase tunnel storage volume from ~15-million gallons to 29-million gallons.

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SPOTLIGHT ON THE SCIENCE

The initial 14-foot tunnel diameter design decision was made during a period of growing awareness that Seattle's rainfall was becoming more extreme than originally projected. During the tunnel design phase, SPU was in the process of updating its rainfall statistics using historical and future projected precipitation data, and preliminary results were indicating that Seattle had already experienced a shift in extreme rainfall. While SPU did not have final results, engineers running SPU's precipitation models raised concerns that existing infrastructure upsized using a 6% scaling factor was inadequate and that preliminary model results showed rainfall had already increased more than the assumed 6%. As a result, it became clear that the 14-foot diameter tunnel design would likely be inadequate to accommodate future changes in extreme rainfall. Confidence in the decision to upsize the design to over 18-feet was high because the engineers; observations were well-matched with the model output, so the apparent uncertainty was low.

THE ROLE OF LEADERSHIP

SPU has a culture of looking to the future and considering climate change impacts on its operations. With a commitment to consider future climate extremes, SPU's in-house engineers quickly flagged the potential issue with the tunnel design, even when their final modeled precipitation analyses were not yet complete. The engineers' in-depth knowledge of existing performance issues paired with these initial model results were sufficient evidence to flag the issue to leadership. SPU's General Manager and King County then made the decision to upsize the tunnel. With leadership on board, community support for the larger project, the project moved forward with the larger storage volume design. The 2.7-mile long storage tunnel and four other projects that are part of the system will be operational in 2025.

KEY TAKE-AWAYS

Once completed, the storage tunnel will prevent an average of 95 million gallons of polluted stormwater and sewage from entering Seattle's waterways each year. In choosing a storage tunnel design, SPU was able to decrease impacts to local communities and provide more operational flexibility. This helped to make the Ship Canal Water Quality Project a reality. While SPU's scaling factors were still being updated to incorporate new climate change projections during the design phase of Ship Canal Water Quality Project, a culture of concern around climate impacts, paired with knowledge of existing system performance issues, empowered engineers to flag the issue of the 14-foot tunnel diameter design. With support from leadership, the design was changed to a larger diameter, ultimately increasing the resilience of this long-term infrastructure investment.

LEARN MORE

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