

Co-Creating a Combined Sewer Plan – A Tool that Reports Infrastructure Costs and Benefits in Real Time to Facilitate Community Based Planning

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Highlights

- Calculator reports cost and performance of user-defined infrastructure scenarios in real time so that community and city stakeholders can collaborate with project team to “co-create” the project
- User can select a suite of CSO reduction and stormwater treatment strategies to improve water quality in the project basin
- CSO reduction, water quality and hydraulic benefits are reported based on a series of relationships developed using SWMM, MGSFlood, and Excel modeling

Introduction

Seattle Public Utilities (SPU) is reimagining the planning process for combined sewer overflows (CSO) and stormwater improvements through the Longfellow Starts Here (LSH) project by endeavoring to make planning accessible and meaningful to the community served by this project. Whereas traditional options analysis has centered on technical feasibility and cost minimization approaches with sparse community engagement on leading options, the LSH team is shifting the planning approach to begin with community and co-create an infrastructure vision through simplified planning tools that demystify drainage and wastewater infrastructure. This approach is aligned with SPU’s equity strategy and mission as a community-centered utility to invite historically uninvited people to participate and empower them to help shape real infrastructure outcomes.

To support this vision, Herrera partnered with SPU to develop the Drainage and Wastewater System Benefits Calculator, a Microsoft Excel based tool that reports the cost and water quality performance of various user defined infrastructure scenarios in real time. The calculator can be used to iteratively optimize water quality improvements while ensuring the infrastructure scenario meets the state regulatory target for CSO control in combined portions of the basin and the city requirements for flow control in separated portions of the basin. The intent of this calculator is to facilitate simple, iterative planning so that community and internal stakeholders can collaborate with the project team to “co-create” the project and engage in dialogue around trade-offs and benefits of various options.

This paper provides a summary of the modeling conducted to develop the System Benefits Calculator, the curve relationships that serve as its engine, an assessment of the calculator’s value as a planning tool, and key preliminary results for infrastructure options in the LSH project basin.

Methodology

System Benefit Calculator Design

The dashboard for the System Benefits Calculator is shown in Figure 1. The user selects a suite of CSO reduction and water quality treatment options and the calculator reports the planning-level cost and

performance, including CSO volume reduction, pollutant load reduction, and peak flow reduction to the creek. Options include various configurations of roadside bioretention, floodable stormwater parks, treatment wetlands, sewer infiltration and inflow reduction, stormwater separation, and wastewater storage. Planning-level performance estimates are based on modeled relationships for each strategy.

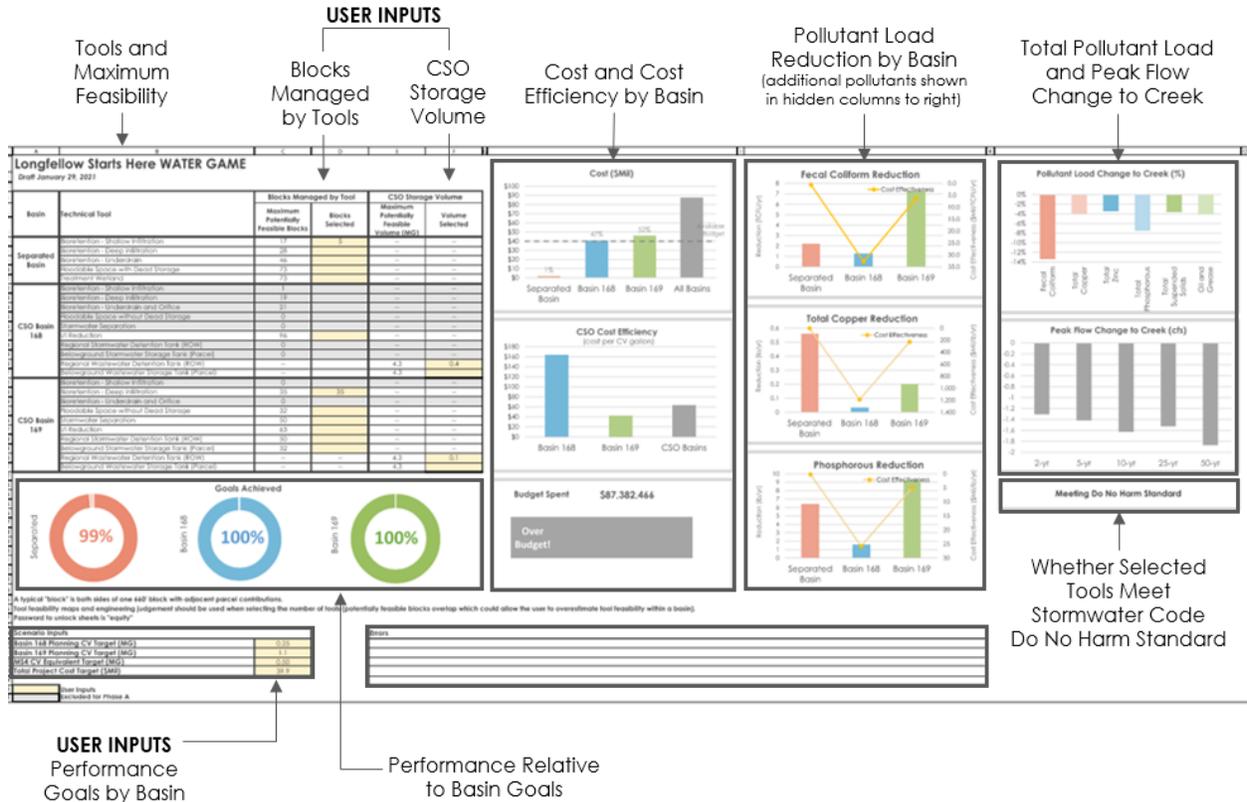


Figure 1. System Benefit Calculator Dashboard

Modeling Approach

To support dynamic performance estimates, modeling was conducted in SWMM, MGSFlood, and Excel to develop a series of relationships, including the following:

- Facility sizing as a function of contributing effective impervious area (quantified as the number of “typical blocks” to be more readily understood by the community)
- Average annual pollutant load reduction as a function of effective impervious area treated
- Peak flow reduction as a function of effective impervious area managed
- Control volume reduction as a function of wastewater storage volume or effective impervious area managed to a peak reduction standard
- Control volume reduction as a function of the degree of I&I reduction in the basin
- CSO volume reduction as a function of control volume reduction

These relationships are used in the Excel-based calculator to estimate facility size, cost, and performance based on simple user inputs to support high level project planning and prioritization prior to options analysis. With this simplified approach results are known to be uncertain and leading infrastructure strategies will be technically vetted in follow-on analysis.

Results and discussion

SPU has found the calculator to be a valuable tool in the high-level infrastructure planning process. Key takeaways are listed below.

- **Reduces cost and schedule for early planning:** The calculator eliminates the need for early detailed modeling and cost analysis of options. It also reduces the risk of carrying an option forward that does not meet key performance criteria which could require re-work and cause delays.
- **Allows consideration of broader strategy palette:** By eliminating the need for early detailed modeling and costing, the tool supports teams in exploring a wider array of scenarios. The assumed result is that teams will be more comprehensive and innovative in the planning process because they won't be limited to the "up to x options" specified in a consulting scope of work.
- **Serves as valuable communication tool:** The calculator is proving to be an effective tool to communicate regulatory strategy to management and internal stakeholders due to its visual nature and ability to show the consequences of each decision in real time.

Preliminary technical results for the LSH project are provided below:

- **Green infrastructure is cost effective:** Given the hydrologic and hydraulic dynamics of the project basins, green infrastructure is cost effective alongside grey options because the grey options are expensive at the scale needed. This early finding allows the project team to focus on green solutions during the next phase of analysis.
- **Stormwater treatment provides water quality co-benefits:** The calculator highlights the value of pairing stormwater work with measures to meet CSO obligations for a holistic water quality solution. In addition to reducing fecal coliform bacteria loads, stormwater treatment practices remove other pollutants (such as nutrients, metals, and toxics) at much higher efficiencies than CSO reduction solutions.

Conclusions and future work

The System Benefits Calculator is removing the historical bottlenecks of infrastructure planning associated with modeling and cost analysis by providing a simplified planning platform that provides real-time results. The calculator will be used in the next phase of the LSH project to "co-create" project options and engage in dialogue around trade-offs and benefits of various options. The team is currently working to expand the functionality of the calculator for use in Seattle's Urban Village planning with a broader suite of strategies and a new performance targets that focus on peak flow reduction in the drainage and sewer systems.

References

None